

## Crown rust of oats in Canada in 1978'

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Oat crown rust (*Puccinia coronata* f. sp. *avenae*) caused moderate damage to late-sown fields of oats in the Red River Valley region of Manitoba. Outside this region throughout Manitoba and eastern Saskatchewan, crown rust infections were light. Virulence combinations in the crown rust population were determined using a set of 12 oat lines carrying substituted single genes (Pc) for crown rust resistance. The 49 isolates from eastern Canada (Nova Scotia, Quebec and Ontario) and the 247 isolates from Manitoba and Saskatchewan comprised 20 and 31 virulence combinations respectively. In eastern Canada there were no major changes in the physiologic races of crown rust in 1978. Insufficient crown rust collections were obtained from eastern Canada to provide meaningful data on the distribution of virulence on the individual Pc genes. In Manitoba and Saskatchewan there were also no major changes in the physiologic races of crown rust. Virulence on genes Pc 35 and Pc 40 predominated, and there were moderate levels of virulence on genes Pc 46 and Pc 50. There was little change from previous years in the level of virulence on the commercial cultivar Hudson, and no virulence was found on the gene combinations Pc 38-39 and Pc 55-56.

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La rouille couronnée de l'avoine (*Puccinia coronata* f. sp. *avenae*) a cause des dégâts modérés aux semis tardifs dans la vallée de la rivière Rouge au Manitoba. Dans le reste de la province et dans l'est de la Saskatchewan, l'infection a été bénigne. Les combinaisons de virulence observées dans l'inoculum de rouille ont été établies à partir d'un groupe de 12 lignées d'avoine possédant des gènes uniques substitués (Pc) de résistance à la maladie. Les 49 isolats de l'est du Canada (Nouvelle-Écosse, Québec et Ontario) et les 247 du Manitoba et de la Saskatchewan constituaient, respectivement, 20 et 31 combinaisons de virulence. Dans l'Est, on ne relève pas de grand changement au tableau des races physiologiques et, par ailleurs, les prélèvements ont été trop peu abondants pour apporter des renseignements valables sur la distribution des formes de virulence envers chaque gène Pc. Au Manitoba et en Saskatchewan non plus, il n'y a eu de changement marqué au tableau des races. Les formes dominantes de virulence étaient celles qui concernaient les gènes Pc35 et Pc40, les gènes Pc 46 et 50 ne subissant qu'une virulence modérée. Le degré de virulence sur le cultivar du commerce Hudson n'a guère bougé par rapport aux années précédentes et on n'a constaté aucune virulence envers les combinaisons de gènes Pc 38-39 et Pc 55-56.

### Occurrence in western Canada

Oat crown rust caused by *Puccinia coronata* Cda. f. sp. *avenae* Eriks. was more prevalent in 1978 than it was in 1977 (1). The first infections were observed by mid July, and the weather was generally favorable for continued rust spread. However, moderately-severe damage occurred only in late-sown fields, and the heavier infections were generally confined to the Red River Valley of Manitoba. Only traces of crown rust were found west of the Manitoba-Saskatchewan boundary.

### Physiologic specialization

Isolates of crown rust were obtained from nurseries in Kentville, Nova Scotia; Lennoxville and Ste. Anne de la Pocatière, Quebec; Elora, Ailsa Craig, Guelph, Kemptville, and Appleton, Ontario; and from field surveys in Manitoba and eastern Saskatchewan. Isolates were also obtained from a trap nursery consisting of selected oat lines grown at Portage la Prairie and Glenlea, Manitoba.

In 1978 all crown rust collections were identified using a series of backcross lines of *Avena sativa* L. cv. Pendek

containing single genes (Pc) for crown rust resistance derived from *A. sterilis* L.

From eastern Canada, including Nova Scotia, Quebec, and Ontario, 49 isolates, comprising 20 physiologic variants, were identified. The variants are given as virulence combinations on lines with the Pc genes (Table 1). Compared to 1977, there was an increase in the number of isolates avirulent on the twelve Pc-gene lines. The percent of isolates virulent on genes Pc 35, 40, and 56 was relatively similar to 1977 (1), while the percent of isolates decreased somewhat on gene Pc 45 and increased on gene Pc 50 (Table 2). Also, the frequency of virulence on Hudson, currently the most rust resistant cultivar in Canada, remained relatively constant (Table 2). Although the number of isolates obtained from eastern Canada were insufficient to provide reliable data on the frequency of virulence on the individual Pc genes, the results indicate that there were no major changes in the physiologic race composition of crown rust in eastern Canada in 1978.

From western Canada, including Manitoba and eastern Saskatchewan, 247 isolates, comprising 31 virulence combinations, were identified (Table 1). There were no major changes in virulence of crown rust in 1978. Of some concern is the apparent occurrence of the 35, 38, -

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Table 1. Virulence combinations of *Puccinia coronata* on backcross lines of *Avena sativa* cv. Pendek containing single (Pc) genes for crown rust resistance

Virulence formula effective/ineffective Pc genes	Nova Scotia		Quebec		Ontario		Manitoba		Saskatchewan	
	No. of isol.	% of isol.	No. of isol.	% of isol.	No. of isol.	% of isol.	No. of isol.	% of isol.	No. of isol.	% of isol.
35, 38, 39, 40, 45, 46, 47, 48, 50, 54, 55, 56	3	27.3	6	50.0	7	26.9	48	22.0	8	27.6
38, 39, 40, 45, 46, 47, 48, 50, 54, 55, 56/35	3	27.3	0		3	11.5	23	10.5	5	17.2
35, 38, 39, 45, 46, 47, 48, 50, 54, 55, 56/40	0		0		2	7.7	39	17.9	6	20.7
35, 38, 39, 40, 46, 47, 48, 50, 54, 55, 56/45	0		0		2	7.7	0		1	3.4
35, 38, 39, 40, 45, 47, 48, 50, 54, 55, 56/46	0		1	8.3	0		9	4.1	3	10.3
35, 38, 39, 40, 45, 46, 47, 48, 54, 55, 56/50	0		0		1	3.8	17	7.8	2	6.9
35, 38, 39, 40, 45, 46, 47, 48, 50, 55, 56/54	0		0		0		5	2.3	0	
35, 38, 39, 40, 45, 46, 47, 48, 50, 54, 55, 56	0		0		3	11.5	1	0.5	0	
39, 40, 45, 46, 47, 48, 50, 54, 55, 56/35, 38	0		0		0		1	0.5	1	3.4
38, 39, 45, 46, 47, 48, 50, 54, 55, 56/35, 40	1	9.1	0		0		24	11.0	3	10.3
38, 39, 40, 46, 47, 48, 50, 54, 55, 56/35, 45	0		0		1	3.8	0		0	
38, 39, 40, 45, 47, 48, 50, 54, 55, 56/35, 46	0		0		0		4	1.8	0	
38, 39, 40, 45, 46, 47, 48, 54, 55, 56/35, 50	1	9.1	0		3	11.5	2	0.9	0	
38, 39, 40, 45, 46, 47, 48, 50, 55, 56/35, 54	0		0		0		1	0.5	0	
38, 39, 40, 45, 46, 47, 48, 50, 54, 55/35, 56	0		1	8.3	2	7.7	1	0.5	0	
35, 38, 39, 45, 47, 48, 50, 54, 55, 56/40, 46	0		0		0		5	2.3	0	
35, 38, 39, 45, 46, 47, 48, 54, 55, 56/40, 50	1	9.1	0		0		5	2.3	0	
35, 38, 39, 45, 46, 47, 48, 50, 55, 56/40, 54	0		0		0		1	0.5	0	
35, 38, 39, 45, 46, 47, 48, 50, 54, 55/40, 56	0		0		0		2	0.9	0	
35, 38, 39, 40, 46, 47, 48, 50, 54, 55/45, 56	0		1	8.3	0		0		0	
35, 38, 39, 40, 45, 47, 48, 54, 55, 56/46, 50	0		0		0		3	1.4	0	
35, 38, 39, 40, 45, 47, 48, 50, 54, 55/46, 56	0		1	8.3	0		1	0.5	0	
35, 38, 39, 40, 45, 46, 47, 48, 54, 55/50, 56	0		0		0		2	0.9	0	
38, 39, 45, 47, 48, 50, 54, 55, 56/35, 40, 46	0		0		0		8	3.7	0	
38, 39, 45, 46, 47, 48, 54, 55, 56/35, 40, 50	0		1	8.3	0		3	1.4	0	
38, 39, 45, 46, 47, 48, 50, 54, 55/35, 40, 56	1	9.1	0		0		2	0.9	0	
38, 39, 40, 46, 47, 48, 50, 54, 55/35, 45, 56	0		0		1	3.8	0		0	
38, 39, 40, 45, 47, 48, 54, 55, 56/35, 46, 50	1	9.1	0		0		1	0.5	0	
38, 39, 40, 45, 47, 48, 50, 54, 55/35, 46, 56	0		0		0		1	0.5	0	
38, 39, 40, 45, 46, 47, 48, 55, 56/35, 50, 54	0		0		1	3.8	0		0	
35, 39, 45, 47, 48, 49, 50, 54, 55/38, 40, 56	0		0		0		1	0.5	0	
35, 38, 39, 45, 47, 48, 54, 55, 56/40, 46, 50	0		0		0		2	0.9	0	
35, 38, 39, 45, 47, 48, 50, 54, 55/40, 46, 56	0		1	8.3	0		2	0.9	0	
35, 38, 39, 40, 45, 47, 48, 50, 55/46, 54, 56	0		0		0		2	0.9	0	
35, 38, 50, 56/39, 40, 45, 46, 47, 48, 54, 55	0		0		0		2	0.9	0	
Total	11		12		26		218		29	

Table 2. Frequency of virulence of isolates of *Puccinia coronata* on backcross lines of Pendek carrying single crown rust resistance (Pc) genes, and on Hudson

Resistance gene or variety	Nova Scotia		Quebec		Ontario		Manitoba		Saskatchewan		Trap nursery	
	No. of viru- lent isol.	% of isol.	No. of viru- lent isol.	% of isol.	No. of viru- lent isol.	% of isol.	No. of viru- lent isol.	% of isol.	No. of viru- lent isol.	% of isol.	No. of viru- lent isol.	% of isol.
Pc 35	7	63.6	2	16.7	11	42.3	71	32.6	9	31.0	7	14.0
Pc 38	0	0.0	0	0.0	0	0.0	2	0.9	1	3.4	1	2.0
Pc 39	0	0.0	0	0.0	0	0.0	2	0.9	0	0.0	0	0.0
Pc 40	3	27.3	2	16.7	2	7.7	96	44.0	9	31.0	22	44.0
Pc 45	0	0.0	1	8.3	3	11.5	2	0.9	1	3.4	1	2.0
Pc 46	1	9.1	3	25.0	0	0.0	40	18.3	3	10.3	6	12.0
Pc 47	0	0.0	0	0.0	0	0.0	2	0.9	0	0.0	0	0.0
Pc 48	0	0.0	0	0.0	0	0.0	2	0.9	0	0.0	0	0.0
Pc 50	3	27.3	1	8.3	5	19.2	35	16.1	2	6.9	7	14.0
Pc 54	0	0.0	0	0.0	1	3.8	11	5.0	0	0.0	1	2.0
Pc 55	0	0.0	0	0.0	0	0.0	2	0.9	0	0.0	0	0.0
Pc 56	1	9.1	4	33.3	6	23.1	15	6.9	0	0.0	4	8.0
Hudson	2	18.2	1	8.3	2	7.7	18	8.3	0	0.0	2	4.0

50,56/39,40,45,46,47,48,54,55 virulence combination (Table 1). These isolates were collected from near McCreary, Manitoba, and although this race has been used in greenhouse studies, the isolates did not appear to be greenhouse contaminants. Crown rust is not known to overwinter on the prairies except where European buckthorn occurs, thus this may remain as an isolated occurrence of this potentially serious race. The incidence of virulence on the individual Pc genes and on the cultivar Hudson (Table 2) was relatively unchanged from 1977 (1) except for a moderate increase in virulence on genes Pc 35 and Pc 46, and a decrease on gene Pc 40. None of the latter 3 genes are of importance to the rust resistance breeding program in western

Canada. The gene combinations presently being employed to provide crown rust resistance are genes Pc 38-Pc 39 and genes Pc 55-Pc 56. To date both these gene combinations have remained highly effective against all isolates tested.

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#### **Acknowledgements**

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#### **Literature cited**

1. Harder, D.E. 1978. Crown rust of oats in Canada in 1977. Can. Plant Dis. Survey 58:39-43.