CROWN RUST OF OATS IN CANADA IN 1970[1]

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Disease development and crop losses in Western Canada

Oat crown rust caused by Puccinia coronata Cda. f. sp. avenae Eriks. was first found near Holland, Manitoba, on July 20th. Crown rust increased rapidly throughout the province and in adjacent areas of south-eastern Saskatchewan. By mid August the disease had reached epidemic proportions throughout most of this area. The intensity of the epidemic in fields in the vicinity of Stonewall, Manitoba, was more severe than in any naturally occurring field epidemic observed by the author since 1962.

Preliminary estimates of yield reductions due to the combined crown and stem rust epidemics on oats in Manitoba in 1970 are in excess of 10 million bushels. While it is difficult to determine the extent to which each rust contributed to the loss, crown rust was more damaging than in 1969 when it was responsible for losses of about 3.5 million bushels (1). Yield loss estimates were calculated in a previously described manner (2), and only late maturing fields were included in these calculations. The overall loss from oat rusts in Manitoba in 1970 is in excess of $5 million, at a price of $0.50 per bushel oats. Losses in Manitoba during 1969 and 1970 from rust epidemics highlight the need for the development of rust resistant oat varieties.

Rating of crown rust intensity on 12 oat (Avena sativa L.) varieties grown in nurseries in Saskatchewan, Manitoba Ontario, Quebec, and Nova Scotia are presented in Table 1. Omitted from this table are nurseries in which no crown rust was found on any of the 12 oat varieties, as well as nurseries from which rust intensity could not be estimated because of the mildewed or shrivelled condition of the leaves.

The lines containing crown rust resistance genes Pc 3% (R.L. 2924) and Pc 39 (R.L. 2925) were not attacked by crown rust at any of the locations across Canada, and appear to afford effective protection to this disease.

Saia oats, a diploid species, also provided effective resistance in crown rust nurseries across Canada, but this resistance is more difficult to incorporate in commercial hexaploid oats because the intercrosses are often sterile.

Distribution of physiologic races

The frequency of occurrence and distribution of 25 physiologic races of crown

Table 1. Percentage infection of crown rust on 12 oat varieties at 18 localities in Canada in 1970

Location	Bond	Trispernia	Landhafer	CI 4023	Saia	Rodney ABDH	CI 3034	Rodney	Harmon	RL 2924	RL 2925	RL 2926
Indian Head, Sask.	1	0	0	0	0	tr*	0	tr	0	0	0	0
Melfort, Sask.	tr	0	tr	tr	0	0	0	tr		0	0	tr
Brandon, Man.	80	0	20	80	0	60	40	60	40	0	0	50
The Pas, Man.	tr	0	tr	tr	0	0	0	tr	tr	0	0	0
Morden, Man.	90	80	80	80	tr	80	80	100	80	0	0	70
Williamstown, Ont.	10	0	tr	tr	0	10	0	10	tr	0	0	tr
Apple Hill, Ont.	5	0	5	tr	0	tr	tr	5	5	0	0	tr
Thunder Bay, Ont.	10	0	0	10	0	5	5	5	5	0	0	1 0
Kemptville, Ont.	30			10	0	10	10	5	5	0	0	1 0
Guelph, Ont.	tr	0	tr	1	0	tr	2	1	tr	0	0	tr
Ottawa, Ont.	90	tr	tr	70	0	30	80	80	80	0	0	tr
Appleton, Ont.	80	10	10	30	0	10	20	60	60	0	0	10
New Liskeard, Ont.	90	5	10	80	0	80	50	80	90	0	0	50
Vineland, Ont.	80	20	30	80	tr	50		80	60	0	0	10
La Pocatière, Qué.	20	0	0	10	0	5	10	10	20	0	0	tr
Macdonald College, Qué.	30	0	0	20	0	5	10	20	tr	0	0	tr
Normandin, Qué.	10	0	0	tr	0	tr	tr	tr	tr	0	0	0
Kentville, N.S.	20	0	0	10	0	5	5	20	10	0	0	5

* tr = trace infection, less than 1%

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Table 2. Distribution of physiologic races of crown rust in Canada in 1970

Physiologic race	West		East		W & E Totals	
	No. of isolates	% of all isolates	NO. of isolates	% of all isolates	No. of isolates	% of all isolates
202	1	0.6	1	2.0	2	0.9
203	1	0.6	6	12.0	7	3.1
210	1	0.6	3	6.0	4	1.8
216	4	2.3	12	24.0	16	7.2
226	1	0.6	1	2.0	2	0.9
236	1	0.6	0	0.0	1	0.5
239	0	0.0	1	2.0	1	0.5
241	1	0.6	0	0.0	1	0.5
259	0	0.0	2	4.0	2	0.9
264	56	33.0	6	12.0	62	27.9
274	0	0	1	2.0	1	0.5
276	5	3.0	0	0.0	5	2.2
290	1	0.6	0	0.0	1	0.9
295	15	9.0	3	6.0	18	8.1
325	29	17.0	3	6.0	32	14.4
326	44	26.0	7	14.0	51	22.9
327	3	1.7	0	0.0	3	1.3
341	1	0.6	2	4.0	3	1.3
394	1	0.6	0	0.0	1	0.5
409	1	0.6	0	0.0	1	0.5
415	1	0.6	1	2.0	2	0.9
446	1	0.6	0	0.0	1	0.5
451	0	0.0	1	2.0	1	0.5
2, 10	1	0.6	0	0.0	1	0.5
1, 3, 7, 10	1	0.6	0	0.0	1	0.5
Total races	21		15		25	
Total isolates	170		50		220	
Race: Isolate ratio	1:8		1:3.3			

Table 3. Percentage Of Canadian crown rust isolates virulent on differential host varieties, 1966 to 1970

Location and year	Anthony	Victoria	Appler	Bond	Landhafer	Santa Fe	Ukraine	Trispernia	Bondvic	Saia
Western Canada										
1970	96	86	97	99	93	92	75	55	55	2
1969	92	62	93	94	82	82	87	30	30	5
1968	90	48	90	95	82	81	95	10	10	3
1967	72	59	72	89	68	68	80	24	31	13
1966	66	58	62	82	24	23	83	2	2	4
Eastern Canada										
1970	82	66	84	92	42	42	84	18	18	0
1969	50	44	50	93	21	24	97	7	7	10
1968	79	40	83	87	8	9	96	2	2	7
1967	47	54	50	86	10	11	95	2	1	13
1966	51	45	30	77	9	9	85	0	0	9

rust identified from 220 Canadian isolates is presented in Table 2. Although 21 physiologic races were identified in the west, four of these, 264, 295, 325, and 326, comprised 85% of the isolates. These races, as well as most of the others isolated, attacked almost all of the standard differential varieties of crown rust.

Fifteen physiologic races were identified from 50 isolates obtained from Eastern Canada. The 'Victoria–Virulent' races 203, 210, 216, 264, and 326 comprised 68% of the population. Though virulence on 'Landhafer', 'Santa Fe', Trispernia', and 'Bondvic' in the east increased markedly from previous years, it did not reach the very high levels observed in the west.

Despite some differences in the race populations of Eastern and Western Canada, the major virulent races 264 and 326, occurred in abundance in both regions. There was also a marked reduction in the occurrence of relatively avirulent biotypes of the 220 to 239 race group in both areas.

Virulence on the differential varieties

The percentage of crown rust isolates virulent on each differential variety is shown in Table 3. The situation in Eastern Canada indicates greatly increased virulence on 'Landhafer' and 'Santa Fe' which, prior to 1969, had never been attacked by more than 10% of eastern ,isolates. Record levels of virulence also occurred on 'Anthony', 'Victoria', 'Appler', and 'Bond', in the east.

In Western Canada, the virulence on all the differential varieties except 'Saia' was so high in 1970 that the future use of this set of varieties as crown rust differentials in Canada is no longer feasible. It is anticipated that a new set of crown rust resistance genes, each incorporated singly in isogenic lines of the variety 'Pendek', will be used to differentiate crown rust races in Canada in the future.

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Literature cited

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