

Distribution of virulent blackleg on standing rapeseed/canola crops in Saskatchewan, 1982-1991

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Surveys of standing crops of rapeseed/canola were conducted during July and August between 1982 and 1991. The virulent strain of *Leptosphaeria maculans* (blackleg) consistently was less prevalent and its average incidence was lower in the northern growing areas of Saskatchewan crop districts 8a, 9a, and 9b, than in areas farther south. Disease severity on infected plants also was often less in the north. Crops of both *Brassica rapa* and *B. napus* had less blackleg in northern areas. Blackleg incidences in *B. rapa* crops were consistently lower than those in crops of *B. napus*.

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Entre 1982 et 1991, pendant les mois de juillet et d'août, des études ont été effectuées sur des cultures sur pied de colza/canola. La souche virulente de *Leptosphaeria maculans* (jambe noire) était moins répandue et son incidence moyenne a été moindre dans les régions nordiques de croissance des districts agricoles 8a, 9a, et 9b de la Saskatchewan que dans les régions plus éloignées au sud. Au nord la maladie était souvent moins virulente sur des plants infectés. Les cultures de *Brassica rapa* et de *B. napus* ont été moins touchées par la jambe noire dans les régions nordiques. Les incidences de la jambe noire dans les cultures de *B. rapa* ont été moins prononcées que celles des cultures de *B. napus*.

Introduction

After 1961, putative strains of *Leptosphaeria maculans* (Desm.) Ces. & De Not. (blackleg) weakly virulent on adult rape (*Brassica napus* L.) and turnip rape (*B. rapa* L.) plants were found intermittently on Cruciferae in crop district(s) (C.D.) 6 and 8b in central Saskatchewan (9,15). A virulent strain of *L. maculans* (LM-VIR) initially was found on stubble of the 1975 rapeseed crop in three widely separated Saskatchewan fields near Melfort (C.D. 8a), Humboldt (C.D. 8b), and Rosthern (C.D. 6b) (7,10). By 1980, infestations of LM-VIR had been found near Cutknife (C.D. 9b) and near the Manitoba border in crop district 5a (14). Spread of the pathogen was predominantly northwest and southeast from the original centers of infestation. In 1982, crops with high incidences of basal stem canker were widespread in crop districts 6 and 8b for the first time, with yield losses ranging up to 50% (11). Subsequently, blackleg prevalence, incidence and severity continued to increase along a northwest-southeast line from the southern part of crop district 9b to crop district 5. The disease spread into eastern Alberta Census Divisions 7 and 10 from crop district 9b (5,6), and into western Manitoba from crop district 5 (16).

The spread of LM-VIR into northern rapeseed/canola growing areas was not as rapid as its east-west movement. Since 1984, LM-VIR has been more widespread in crop district 8b than farther north and east in crop districts 8a and 9a (2,3,4,13). There are no published data which permit a comparison of levels of LM-VIR in southern and northern parts of crop district 9b, but LM-VIR only recently has been found in the Meadow Lake area in the extreme northern part of crop district 9b (R. Gugel, pers. comm.). The pathogen also has been slow to become established in north-central growing areas north and east of Prince Albert (C.D. 9a). The purpose of this paper is to further examine the distribution of LM-VIR in three paired areas: (1) southern and central parts of crop district 9b; (2) crop districts 6 and 9a; and (3) southern and northern parts of crop district 8.

Materials and methods

The methods used in surveys conducted between 1982 and 1985 have been described (11,12,13). In 1991, 100 Saskatchewan canola fields were surveyed for blackleg between July 22 and August 31. Areas surveyed were similar to those done in 1971 (8, Fig. 2) except that crop districts 5b and 7b were not surveyed in 1991. All but a few crops were standing when sampled. Fifteen fields were sampled in crop district 6a, 20 in 6b, 11 in 9a, 23 in 9b, and 31 in crop district 8. Crop district 9b was subdivided into central (C) and southern (S) sectors, with about equal numbers of fields in each. In crop district 9b(C), the survey route was along highways 26 and 3, from north of North Battleford to

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the Alberta border. In crop district 9b(S), the route was along highway 16 to Maidstone, south on highway 21 to highway 40, and east on no. 40 to North Battleford. Crop district 8 was divided into northern and southern sectors and these were further subdivided into eastern (E) and western (W) sectors. The route travelled in crop district 8(NW) was along highways 25 and 3 from St. Louis to Melfort. In crop district 8(NE) the route was along grid 681 and highways 335, 35, 55, 23, and 3, linking Star City, Nipawin, Carrot River and Tisdale. In crop district 8(SW) the route was along grid 756 from Prud'homme to Annaheim, and in crop district 8(SE) it was along highways 35 and 349 from Sylvania to Naicam. Crop district 9a was surveyed between Prince Albert and Choiceland. Surveys in crop district 6 centred around Saskatoon. A three year comparison (1989-91) of blackleg on stubble of harvested crops around Prince Albert and Saskatoon will be the subject of another paper.

Two individuals going in different directions each walked an inverted V about 100 meters into and back out of a field, each randomly collecting 25 plants along the way. Plants were removed to the laboratory and stored at 1°C for 2 to 3 days until disease ratings were complete. Basal stem canker severity was assessed as "clean" (0), "slight" (1 = up to 33% of stem circumference girdled), "moderate" (2 = 34 - 66% of stem circumference girdled), or "severe" (3 = 67 - 100% girdling), and the presence of upper stem and leaf lesions recorded. Basal stem ratings (0 - 3) were converted to a percentage scale or disease severity index (8).

Results and discussion

Virulent blackleg was very prevalent in Saskatchewan in 1991, occurring in 96% of the fields surveyed; basal stem cankers occurred in 93% of these fields. Reports were received early in the summer of severe stem canker developing in fields around Saskatoon. In August, many fields west of the city (C.D. 6b) had stem canker incidences of 100%. Crop district 9a had noticeably lower blackleg levels than crop district 6b (Table 1). The mean incidence of basal stem canker for all fields examined in crop districts 9a and 6b was 26% and 75.1%, respectively. Average severity ratings for infected plants (all fields) also were much lower in crop district 9a (Table 1). Although much of crop district 6 was surveyed 10 days later than district 9a, this probably did not have a large effect on the prevalence and incidence data. However, it may have influenced severity ratings somewhat.

In each of the four years crop district 9b was surveyed, LM-VIR was consistently more prevalent, and its overall incidence higher, in 9b(S) than in 9b(C), although the differences often were not large. The incidence of basal stem canker was higher in 9b(S) in three of the four years (Tables 1 and 2); this was also true of severity ratings. Only the 1991 severity data have been reported.

In 1991, the incidence of blackleg was considerably lower in fields in the northern part of crop district 8 than in those in the southern portion (Table 1). When the northern and southern parts were further subdivided, disease levels declined in the following order: crop districts 8(SW), 8(SE), 8(NW), and 8(NE) (Table 3). Very low blackleg incidences were found in crop district 8(NE), one of the areas where LM-VIR was found from 1975-1977 (7, 10). The average incidence of basal stem canker in seven *B. napus* fields there was only 2.9%. A comparison of data for southern and northern portions of crop district 8 for the years 1982 to 1985 also revealed consistently higher blackleg levels in the south, with one exception. In 1983, upper stem and leaf infections were more numerous in northern fields, but the reverse was true of basal stem cankers (Table 4).

In crop district 8(S), plant samples were collected from 11 fields of *B. napus* and from five fields of *B. rapa* in 1991; in crop district 8(N), 10 fields of *B. napus* and five of *B. rapa* were sampled. Each Brassica species had higher levels of basal stem infection in the southern part of crop district 8 (Table 5). The *B. napus* fields had a higher mean incidence of basal stem canker, in both the north and south, than the *B. rapa* fields. In crop district 9b, the frequency of basal stem infection on *B. napus* was slightly higher in 9b(C) than farther south, but only two fields were sampled in 9b(C). Stem canker incidence on *B. rapa* was higher in the south than in 9b(C) (Table 5).

An important consideration is whether blackleg incidence and severity in the north "catch up" to incidence and severity farther south by autumn. Reports of surveys conducted after swathing (4), and the author's post-harvest survey data indicate that the same general relationships observed in July are still apparent in October. In 1986, more than 90% of canola producers were using a combination seed treatment for seedling blight, blackleg, and flea beetle control (1). This likely slowed the spread of LM-VIR into more remote areas such as the Meadow Lake region of Saskatchewan and the Peace River region of Alberta. However, before seed treatment for blackleg became commonplace, LM-VIR may have entered northern areas repeatedly in infected seed. Higher rainfall levels and lower evaporation rates in the north probably adversely influenced blackleg levels by causing depletion of stubble-borne ascospore inoculum. The more favorable moisture regime in the north also permits more frequent field cultivation and more thorough burial of infected stubble.

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Table 1. Results of 1991 surveys of standing canola crops for virulent blackleg in three parts of Saskatchewan.

Crop district	No. fields	Prevalence%		Incidence%		Av. severity rating %	
		any infection	basal cankers	any infection	basal cankers	all plants	infected plants
9a	11	100.0	90.9	36.2	26.0	11.1	35.5
6a	15	100.0	100.0	75.5	65.7	52.1	62.3
6b	20	100.0	100.0	85.5	82.2	66.7	75.2
6	35	100.0	100.0	81.3	75.1	60.4	69.7
9b(C) ¹	11	81.8	81.8	24.2	16.2	5.9	26.5
9b(S)	12	100.0	91.7	30.2	20.8	9.6	32.3
9b	23	91.3	87.0	27.3	18.6	7.8	29.5
8 (N) ²	16	93.8	87.5	16.9	11.8	4.7	23.5
8 (S)	15	100.0	93.3	45.0	32.0	15.7	41.8
8	31	96.8	90.3	30.5	22.6	10.0	32.4

¹ Subdivisions of crop district 9b: (C) = central part, (S) = southern part (see text).

² Subdivisions of crop district 8: (N) = northern part, (S) = southern part (see text).

Table 2. Results of surveys of Saskatchewan rapeseed/canola crops for virulent blackleg, central and southern parts of crop district 9b, July, 1983-1985.

Year and sector ¹	No. of fields	% fields with plants infected		Mean % plants per field infected		
		on any part	at stem base	on any part	at stem base	at stem base
				all fields	infested fields	infested fields
1983 (C)	12	58	8	3	5	4
1983 (S)	12	92	50	27	30	11
1984 (C)	13	39	15	10	25	10
1984 (S)	15	60	20	16	27	27
1985 (C)	12	25	25	4	16	13
1985 (S)	18	50	39	7	14	11

¹ See text for descriptions of routes travelled.

Table 3. A comparison of the prevalence, incidence, and severity of virulent blackleg in four sectors of Saskatchewan crop district 8, July, 1991.

Sector ¹	No. of fields	% fields with plants infected		Mean % of plants per field infected		Basal stem canker severity (0 - 100)	
		on any part	at stem base	on any part	at stem base	all fields all plants	all fields infested plants
8(NE)	9	89	78	6	4	1	18
8(NW)	7	100	100	32	27	9	31
8(SE)	7	100	86	40	31	13	32
8(SW)	8	100	100	50	33	18	51

¹ See text for descriptions of routes travelled.

Table 4. Results of surveys of Saskatchewan rapeseed/canola crops for virulent blackleg, northern and southern parts of crop district 8, July, 1982-1985.

Year and sector ¹	No. of fields	% fields with plants infected		Mean % of plants per field infected		
		on any part	at stem base	on any part	infected fields	at stem base
				all fields	infected fields	infested fields
1982 (N)	11	82	0	12	15	0
1982 (S)	15	93	87	19	21	3
1983 (N)	16	56	0	15	27	0
1983 (S)	15	67	20	9	14	7
1984 (N)	17	59	6	7	12	16
1984 (S)	9	78	44	16	21	23
1985 (N)	19	58	21	5	8	7
1985 (S)	12	92	67	14	15	10

¹ See text for sector description.

Table 5. Incidence of basal stem infections of blackleg in standing crops of *Brassica rapa* and *B. napus* in northern and southern parts of crop district 8 and in central and southern parts of crop district 9b in 1991.

C.D. and sector ¹	Species ²	No. fields	Mean incidence of basal stem canker (%)
8 (N)	<i>B. rapa</i>	5	12.1
8 (N)	<i>B. napus</i>	11	14.4
8 (S)	<i>B. rapa</i>	5	24.7
8 (S)	<i>B. napus</i>	10	35.7
9b (C)	<i>B. rapa</i>	9	13.9
9b (C)	<i>B. napus</i>	2	26.7
9b (S)	<i>B. rapa</i>	6	17.3
9b (S)	<i>B. napus</i>	6	24.3

¹ See text for descriptions of sectors.

² *B. rapa* = *B. campestris*.

