DISEASES OF BRASSICA SPECIES IN SASKATCHEWAN, 1970-72

II. STEM, POD, AND LEAF SPOTS[1]

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Abstract

Alternaria black spot [Alternaria brassicae and A. raphani] was the principal stem and pod spot of Brassica species from 1970 to 1972. Average severity indices for the disease increased by a factor of four during the 3-year period in both rape (Brassica napus) and turnip rape (B. campestris). The average severity ratings for B. campestris were almost double those for B. napus each year. Ringspot [Mycosphaerella brassicicola] and pod drop (a pedicel rot) were not diseases of major importance. However, pod drop was considered potentially serious, as it caused entire pods to be lost or fail to fill normally; Alternaria alternata and Cladosporium sp. were isolated from infected pedicels.

Introduction

The diseases to be dealt with in this paper are alternaria black spot, ringspot, and "pod drop". Alternaria black spot is caused by Alternaria brassicae (Berk.) Sacc. and A. raphani Groves & Skolko. Mycosphaerella brassicicola (Duby) Lind. is responsible for ringspot. The cause of pod drop has now been identified with certainty.

Methods

Procedures employed, including the method of calculation of the disease severity index (DSI) have been described in an earlier paper (3). Locations of fields inspected appeared in Figures 1 and 2 of that publication. Severity classes used for alternaria black spot and ringspot have been defined in Tables 1 and 2, respectively, of this paper. In 1972, percentages of pods exhibiting pod drop symptoms were determined on plants from certain fields to indicate potential yield reductions attributable to infections of the severity usually encountered. Meaningful estimates of reductions in yield caused by Alternaria and Mycosphaerella cannot be made at present.

Results and discussion

Alternaria black spot.

In many fields, infection of high percentages of plants was coupled with very low severity indices (Tables 3 and 4).

Table 1. Disease severity classes used for alternaria black spot

Severity class	Percentage of surface area of plant covered by lesions
0	0
TR*	<1
1	1 - 10
2	11 - 30
3	>30

* Plants in this class were considered healthy for purposes of calculating the disease severity index.

However, in 1971 and 1972, the mean DSI values for black spot were double those of the preceding year in both Brassica napus L. and B. campestris L. (Table 3). A DSI rating of 17 for a field represents the equivalent

Table 2. Disease severity classes used for ringspot

Severity class	Percentage of surface area of plant covered by lesions
0	0
1	1 - 20
2	21 - 40
3	41 - 60
4	61 - 80
5	81 - 100

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Table 3. Prevalence, incidence, and severity of alternaria black spot and ringspot in Saskatchewan from 1970 to 1972

	Disease	*Brassica napus* 1970	1971	1972	*Brassica campestris* 1970	1971	1972
No. of fields sampled		16	18	19	24	51	19
% of fields having the disease	black spot	100	100	100	100	100	100
	ringspot	94	94	50	88	96	94
% of plants per field diseased (avg)	black spot	90	94	93	82	97	99
	ringspot	56	27		43	79	
Avg DSI* (%)	black spot	5	10	18	8	18	32
	ringspot	7	2		9	9	

* DSI = disease severity index.

Table 4. Percentages of fields with alternaria black spot in each of a number of disease severity categories

Mean DSI	*Brassica napus* 1970	1971	1972	*Brassica campestris* 1970	1971	1972
0 - 5	75	33	28	58	28	0
6 - 10	13	22	11	17	8	0
11 - 20	13	28	22	8	20	11
21 - 30	0	16	16	4	20	28
31 - 40	0	0	16	13	24	39
41 - 50	0	0	6	0	2	22

of up to 10% of the surface area of 50% of the plants covered with lesions. Arbitrarily, all fields of B. campestris and B. napus with DSI values of 17 or more have been listed in Tables 5 and 6, respectively, along with their locations.

The uniformity and severity of infection in many fields examined in 1971 and 1972 was striking. The abundance of spores on plants at harvest time in northern Saskatchewan was vividly demonstrated in 1972. In August a 12.5-g sample of a dark powder scraped from a swather was received from the Meadow Lake area. Upon examination, it was found to consist almost entirely of conidia of A. brassicae. Those working in fields around the northern community attributed cases of skin and eye irrigation to this source. The prevalence of black spot in crop districts 5B, 8, and 9 has also been reflected in high levels of seed-borne Alternaria (unpublished data).

It would appear from the data in Tables 3 and 4 that Brassica napus and B. campestris differ considerably in susceptibility to black spot. Reports in the literature have indicated that B. hirta Moench and B. napus are considerably more resistant to Alternaria brassicae than is B. campestris (1, 2). Observations of leaf infections on plants in varietal tests in the field lend support to these reports, as do infection studies (unpublished data). Nevertheless, factors other than inherent resistance or susceptibility may offer a partial explanation for the discrepancies in DSI values between species in Tables 3 and 4. These include differences in geographical area of cultivation. There is a great preponderance of B. campestris acreage in northern districts due to the earlier maturation of this species.

Ringspot

The 1970 and 1971 data for this disease are summarized in Tables 3, 7, and 8. Average severity indices were low for both Brassica species. In 1972, ringspot was generally inconspicous and only abbreviated notes were taken. In B. napus, infections rated "trace" occurred at one to a few out of 10 sampling sites per field. In fields of B. campestris, the disease was recorded at almost all sampling sites but still rated "trace" or "trace to slight". No ringspot was seen on B. hirta. The severity index of the only field of B. juncea (L.) Coss examined (field 7, 1971) was 5, with 57% of the plants infected.

Often during the 3-year period, young infections on lower parts of stems were the only indications of the presence of ringspot. These linear, tan-colored lesions were unlike typical older lesions caused by the fungus and could easily go unnoticed.

Table 5. *Brassica campestris* fields most heavily affected by alternaria black spot

Field no.	DSI	Crop District	Locality
	1970		
17	32	8A	Nipawin
23	18	9A	Meath Park
30	32	9B	St. Walburg
33 - 35	19 - 33 (avg 27)	9B	Meadow Lake
	1971		
11	24	9B	Maidstone
19, 59, 67	27 - 33 (avg 31)	8B	
20, 22, 31, 32, 33, 36	19 - 35 (avg 26)	5B	
24, 26, 27, 28	17 - 36 (avg 26)	9B	North Battleford to St. Walburg
39, 40, 41, 43, 44	29 - 37 (avg 33)	9A	Prince Albert to White Fox
52, 55	24, 35	8A	Melfort, Tisdale
61, 63, 64, 65, 66	23 - 43 (avg 33)	9A	West of Prince Albert
	1972		
13 - 15, 19 - 24	22 - 48 (avg 33)	5B	
30 - 35	30 - 45 (avg 38)	9B	Meadow Lake

Table 6. *Brassica napus* fields most heavily affected by alternaria black spot

Field no.	DSI	Crop District	Locality
	1970		
18	20	8A	Nipawin
	1971		
47	24	8A	Nipawin
48	20	8A	Nipawin
68	23	8B	St. Benedict
71	22	8B	Humboldt
	1972		
10	22	8B	Annaheim
17	17	5B	Preeceville
18	26	5B	Stenen
25	28	9A	Fielding
26 - 29	20 - 43 (avg 33)	9B	North Battleford to St. Walburg
43	34	9A	Shellbrook
44	20	9A	MacDowall

In July, 1972, the white leaf spot (Cercospora) stage of Mycosphaerella, first observed by Vanterpool (4, and personal communication), was seen frequently on Brassica breeding lines at Saskatoon. The spots were usually 1-2 cm in diameter. Large numbers of 0- to 3-septate Cercospora spores were washed free in water mounts. Colonies identical to those isolated from Mycosphaerella stem lesions developed in spore dilution plates.

Pod drop

Pod drop was first observed by the author in July 1970 on turnip rape from the Rosetown area of Saskatchewan. Symptoms consisted of unusual black lesioning of the pedicel just at and below the point of attachment to the

Table 7. Percentages of fields with ringspot in each of a number of disease severity categories

Mean DSI	*Brassica napus*		*Brassica campestris*	
	1970	1971	1970	1971
0 - 5	38	94	54	24
6 - 10	31	0	17	43
11 - 20	31	6	17	29
21 - 30	0	0	8	4
31 - 40	0	0	4	0

pod. The infections probably started from diseased petals. In instances in which the blackening extended for several mm down the pedicels, the pods often had failed to fill normally. Pods were frequently missing. Gaps in the inflorescence may result from 2,4-D-induced flower drop or from lack of pollination on calm days. However, loss of pods due to the pod drop disease may be distinguished by the characteristic blackening at the tips of the pedicels.

Pod drop was recorded in 13% of the 1970 fields, 9% of the 1971 fields, and 18% of those sampled in 1972. Infections were plentiful in 1971, but in each of the other 2 years the disease was abundant only in one field. All of the fields affected were of Brassica napus, with the exception of one of B. juncea. Taking this into consideration, the disease was detected in 31%, 28%, and 42% of the B. napus fields examined in 1970, 1971, and 1972, respectively.

In 1970, several Brassica introductions at Saskatoon had many examples of this type of infection. Alternaria alternata (Fries) Keissler and a species of Cladosporium were isolated. In 1971, many platings of material with pod drop symptoms were made. Cladosporium and A. alternata were the only fungi obtained consistently. Only the

Table 8. Fields of *Brassica napus* and *Brassica campestris* most heavily infected with ringspot*

Field no.	DSI	Crop District	Locality
	Brassica napus		
	1970		
4	11	9A	Albertville
5	11	9A	Spruce Home
13	16	8A	Zenon Park
20	14	8A	Valparaiso
27	11	9B	Cavalier
	1971		
68	14	8B	St. Benedict
	Brassica campestris		
	1970		
16	29	8A	Carrot River
17	18	8A	Nipawin
23	19	9A	Meath Park
29	26	9B	Turtleford
32	14	9B	Makwa
33	36	9B	Meadow Lake
34	11	9B	Meadow Lake
	1971		
4	10	7B	Landis
11, 13, 27, 28, 30	10 - 15 (avg 13)	9B	
17, 20, 21, 32, 36	10 - 16 (avg 12)	5B	
19, 59, 67	12 - 23 (avg 18)	8B	
45	10	8A	Nipawin
39, 41, 42, 43, 44, 61, 66	13 - 29 (avg 17)	9A	

* Only fields having DSI values of 10 or more have been listed. A value of 10 is the equivalent of up to 20% of the surface area of 50% of the plants covered with lesions.

latter grew from 1972 collections. In all these attempts, A. brassicae was never isolated and A. raphani was found only rarely.

Percentages of infected pods were determined on plants from a number of representative sampling sites from several fields. On an average, from 5% to 13% infected pods per plant were found. The highest percentage was 33. There were up to 67% infected pods per branch, and an average of from 50% to 75% of the branches per plant had diseased pods.

Of the three diseases considered, only alternaria black spot was of major significance. Pod drop, however, is thought to be potentially the most devastating of any new disease problem to appear on this crop in recent years.

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