ALTERNARIA BRASSICICOIA ON IMPORTED GARDEN CRUCIFER SEED, A POTENTIAL THREAT TO RAPESEED PRODUCTION IN WESTERN CANADA[1]

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Abstract

Alternaria brassicicola, a serious pathogen of crucifers which apparently does not occur normally in Canada's Prairie Provinces, was detected in 21 of 63 samples of garden crucifer seed obtained through commercial channels in Saskatoon, Saskatchewan. It was most common in samples of Brassica oleracea var. capitata, occurring in 50% of these. In each of four samples of 'Houston Evergreen' cabbage, 50% or more of the seeds carried the fungus. Following surface disinfestation of this seed, a considerable amount of infection remained. Commonly grown varieties of rape, turnip rape, and mustards were highly susceptible to A. brassicicola, both as seedlings and mature plants. Attention is drawn to the potential threat posed to Canada's rapeseed crop.

Resume

Alternaria brassicicola pathogene dangereux des crucifères apparemment étranger aux provinces des Prairies a été décelé dans 21 des 63 échantillons de semence de cruciférées maraîchères obtenues dans le commerce à Saskatoon. La fréquence la plus forte a été relevée chez Brassica oleracea var. capitata oh elle a été décelée dans 50% des echantillons. Sur chacun des quatre échantillons du chou "Houston Evergreen", au moins 50% des semences étaient porteuses du champiqnon. L'infection est demeurée importante, même après un traitement superficiel des semences. Au stade de plantule, et à maturité, les variétés courantes de colza, de navette et de moutarde se sont montrées très sensibles à A. brassicicola. On souligne le danger éventuel de ce pathogene pour la culture de colza au Canada.

species of Alternaria of significance in Canada as pathogens of cultivated Cruciferae are A. brassicae (Berk.) Sacc., A. raphani Groves & Skolko, and A. brassicicola (Schw.) Wiltshire (2). In western Canada the first two of these, alone or in combination, cause alternaria black spot on rape (Brassica napus L.), turnip rape (B. campestris L.) and cultivated mustards (B. hirta Moench and B. juncea (L.) Coss). Although the highly virulent A. brassicicola is relatively common in eastern Canada and British Columbia (2), it apparently occurs only sporadically in the three Prairie Provinces. It was found on cauliflower in Manitoba in 1934 (1) and cabbage in Alberta in 1944 (3), and Groves and Skolko in 1944 reported the isolation of Alternaria oleracea Milbr. (A. brassicicola) from seeds from Manitoba (5).

A recently completed 5-year seed health study, in which platings were made of over 1,000 seed samples of rape and turnip rape produced in Alberta, Saskatchewan and Manitoba, failed to yield a single colony of A. brassicicola (unpublished data). In conjunction with this study, enquiries were made of the Plant Products Division of Agriculture Canada regarding the availability of seed of cabbage and closely related plants produced in this country. It was learned that, with few exceptions, all such seed sold in Canada is imported from Holland, Britain or California. One sample of pedigreed 'Houston Evergreen' cabbage seed produced in British Columbia was obtained. This sample was heavily contaminated with A. brassicicola. In the spring of 1973, 'Houston Evergreen' cabbage seed was observed for the first time in two stores in Saskatoon. This prompted an investigation of the extent to which the serious pathogen, A. brassicicola, was entering the rape-growing area on crucifer seed from other parts of Canada and from abroad.

Methods

Seed samples of garden crucifers were obtained from various local commercial suppliers and a minimum of 100 seeds per sample plated without pretreatment on V8 juice agar containing 40 ppm rose bengal and 100 ppm streptomycin sulfate. Plates were examined 7 to 10 days after being seeded. Fresh subsamples from heavily contaminated

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samples were surface disinfested by immersion in 10% Javex (0.6% available chlorine) for 20 min and plated as before to determine the level of internal infection.

The characteristic sooty black colonies, typical conidia (5) and high virulence on emerged seedlings enabled relatively certain identification of A. brassicicola on the original plates. Transfers were made to tubes of V8 juice agar and, later, pathogenicity tests on seedlings of eight crucifer species (Table 5) were conducted using a method similar to that of Davis (4). A disease severity index (%) was calculated as previously described (7). other seedlings were similarly inoculated with representative isolates of A. raphani and A. brassicae for comparison of virulence. Plants with 3 to 5 leaves were sprayed with suspensions of conidia of A. brassicicola and incubated under plastic bags in a growth room held at 21 C during the 18-h light period and 15.5 C during the 6-h dark period. Those inoculated were Brassica campestris L. cv. Span, B. juncea cv. Ekla, B. hirta, B. napus cv. Zephyr, B. oleracea var. capitata cv. Early Golden Acre, B. oleracea var. acephala DC., Raphanus sativus cv. Scarlet Globe and Crambe abyssinica Hochst. ex R. E. Fries. Final notes were taken on the extent of infection 10 to 14 days after inoculation.

Table 1. Garden crucifer seed samples plated for detection of *Alternaria brassicicola*

Species and variety	Common name	NO. samples plated
Brassica caulorapa Pasq.	Kohlrabi	3
B. oleracea L. var. *acephala* DC.	Kale	1
B. oleracea var. *botrytis* L.	Cauliflower	6
B. oleracea var. *capitata* L.	Cabbage	30
B. oleracea var. *gemmifera* Zenker	Brussels sprouts	7
B. oleracea var. *italica* Plenck	Broccoli	2
B. napobrassica (L.) Mill	Rutabaga	3
B. rapa L.	Turnip	1
B. pekinensis Rupr.	Chinese cabbage	3
Cheiranthus cheiri L.	Wallflower	2
Iberis umbellata L.	Candytuft	1
Matthiola incana R. Br.	Stocks	1
Raphanus sativus L.	Radish	5
Total samples		63

Results

Brassica oleracea samples comprised almost 15% of the 63 crucifer seed lots plated. Thirty of the samples were cabbage cultivars (Table 1). In 50% of the latter and 29% of the remaining B. oleracea samples, Alternaria brassicicola was detected (Table 2). The only other species from which the pathogen was isolated were Brassica caulorapa Pasq. and Cheiranthus cheiri L. In the former, 1 of 3 samples had 1%, and in the latter, 1 of 2 samples had less than 1% of the seeds affected. The number of B. oleracea samples in each of 7 infestation severity categories may be seen in Table 3. In all 4 samples of "Houston Evergreen" cabbaqe 50% or more of the untreated seeds carried the pathogen. In some of these samples, considerable amounts of infection remained following treatment with Javex (Table 4).

Alternaria raphani occurred in a sample of brussels sprouts and in the only sample of Matthiola incana R. Br. The infestation levels were 8% and 2%, respectively. A. brassicae was isolated from two cabbage samples. In both, 1% of the seeds carried the pathogen.

Alternaria brassicicola isolates from Brassica oleracea seed were highly virulent to seedlings of 7 of the 8 crucifers tested, including currently grown rape and turnip rape varieties and three common weeds (Table 5). Its virulence exceeded that of A. brassicae, the most prevalent pathogenic Alternaria found on Brassica species in western Canada. Following spray inoculation with conidia of A. brassicicola numerous small leaf spots developed on all the crucifers tested with the exception of radish and zephyr rape which were somewhat more lightly infected.

Discussion

The effects of fungicidal treatment of A. brassicicola contaminated seed did not form a part of this study. However, Richardson (8) reported that, following treatment of Brassica seed, a considerable amount of A. brassicicola still could be detected.

McDonald (6) has pointed out that temperature optima reported in the European literature for growth, spore germination, and disease development for A. brassicicola were higher than those for A. brassicae and that moisture and temperature requirements of the former for infection appeared to be more exacting. This is a possible explanation for the absence of A. brassicicola from the Canadian prairies. However, it has by no means been demonstrated experimentally that the fungus is unable to survive, or indeed, to develop to epidemic proportions, in this area. Therefore, at the present time, we are confronted with an apparent yearly importation of a potentially serious pathogen into the Prairie Provinces, an area from which it is virtually absent and in which there are large acreages of a highly vulnerable crop.

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Table 2. Samples of garden crucifer seed contaminated with pathogenic Alternaria species*

Crucifer and no. samples plated	Samples having A. brassicicola No.	%	A. raphani No.	%	A. brassicae No.	%
Brassica oleracea var. capitata (30)	15	50	0	0	2	7
Remaining samples of B. oleracea (14)	4	29	1	7	0	0
Total B. oleracea (44)	19	43	1	2	2	5
Other Brassica spp. (10)	1	10	0	0	0	0
Other genera (9)	1	11	1	11	0	0
All samples (63)	21	33	2	3	2	3

* Seed plated without pretreatment.

Table 3. Categorization of Brassica oleracea seed samples by the prevalence of Alternaria brassicicola infestation

Crucifer and no. samples plated	Categories (% of seeds per sample infested) 0	<1	1–4.9	5–9.9	10–19.9	20–49.9	50–100
Brassica oleracea var. capitata (30)	15	1	3	3	4	0	4
Remaining B. oleracea samples (14)	10	1	2	0	1	0	0
Total B. oleracea samples (44)	25	2	5	3	5	0	4

* Seed plated without pretreatment.

Table 4. Effect of surface disinfestation of 4 samples of "Houston Evergreen" cabbage seed heavily contaminated with Alternaria brassicicola

Sample no.	% of seeds per sample having the pathogen Untreated seed	Surface disinfested*
12	>50.0	17.0
43	57.0	6.7
54	50.0	3.3
94	>50.0	16.0
Average	>50.0	10.8

* A 10% solution of Javex (0.6% available chlorine) was used for 20 min.

Table 5. Relative susceptibility of the seedlings of 8 crucifers to infection by *Alternaria brassicicola*, *A. raphani* and *A. brassicae*

Crucifer species	Disease severity index (%)		
	Alternaria species		
	A. brassicicola *	*A. raphani* **	*A. brassicae* **
Brassica campestris cv. Span	99	91	85
Brassica napus cv. Zephyr	94	95	73
B. juncea cv. Ekla	91	78	76
B. oleracea var. *capitata* cv. Early Copenhagen Market	100	100	95
Camelina sativa	6	12	1
Descurainia sophia	95	91	76
Sisymbrium loeselii	99	98	90
Thlaspi arvense	97	100	57

* The data for 6 isolates were averaged.

** Data for one representative isolate.

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