Occurrence and Characterization of the Epsilon Race of Bean Anthracnose in Ontario

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ABSTRACT

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Several isolates of *Colletotrichum lindemuthianum* were obtained from diseased pods collected from a field of pedigreed field beans (*Phaseolus vulgaris*), cultivar Ex Rico 23, in 1982. Pure cultures of the isolates were inoculated to Ex Rico 23 bean plants to satisfy Koch's postulates. Based on their pathogenicity to a series of differential hosts, these isolates were determined to be the epsilon race of the pathogen. This is the first report of this race in Canada.

Bean anthracnose (*Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cav.) is an important disease of white beans (*Phaseolus vulgaris* L.). Bean anthracnose became epidemic in southern Ontario in 1976 (5) and was caused largely by race delta (6) and to a lesser extent by race lambda (7). Because all recommended Ontario bean cultivars are susceptible to both races, a backcross program was instituted to transfer a resistant gene (ARE) from PI 326418 (Cornell 49-242) to the recommended cultivars.

Following a strict program of seed treatment with benzimidazoles (2) and a field inspection for all pedigreed seed plots for a zero anthracnose tolerance, the disease was not found in 1981.

In 1982, plants of Ex Rico 23 in a single foundation field near Kerwood, Ontario, were found to be affected by anthracnose. The 1982 crop had been sown on stubble of a previous crop of Dark Red Kidney and Cranberry beans (*P. vulgaris*). This paper reports the occurrence in that field and the characterization of a new race of bean anthracnose, which is believed to be a new record for Canada.

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MATERIALS AND METHODS

Isolation. Several anthracnose lesions were excised from dried pods of Ex Rico 23. Lesions were washed in 10 ml of sterile water with vigorous agitation. A loopful of the store suspension was streaked onto a plate containing Mathur's agar (1) amended with 40 μg/ml of novobiocin to retard bacterial growth. Two days later, colonies resembling *C. lindemuthianum* were transferred to new plates containing Mathur's agar.

Inoculation. A spore suspension of 10^7 spores per milliliter was prepared from a 2-wk-old pure culture by flooding the plate with 5 ml of sterile water and

Table 1. Disease reaction of a new isolate of *Colletotrichum lindemuthianum* on a series of differential bean hosts compared with known races of the pathogen[a]

Bean cultivar	New isolate	Race delta (ATCC 18987)	Races						
			Epsilon	Alpha	Beta	Gamma	Delta	Kappa	Lambda
Dark Red Kidney	R[b](0)[c]	S (9)	R	R	S	S	S	S	S
Widusa	R (0)	S (9)	R	S	R	R	S	S	S
Kaboon	R (0)	R (0)	R	R	R	S	R	R	S
Michelite	S (1)	S (7)	S	S	R	R	S	S	S
Sanilac	R (0)	S (9)	R	R	R	R	S	S	S
Prelude	S (6)	S (7)	S	S	R	R	S	S	S
Cornell 49-242	R (0)	R (0)	R	R	R	R	R	S	R

[a] Race delta (ATCC 18987) was used for reference purposes.
[b] Differential host reactions based on Hubbeling (3) and Kruger et al (4); R = resistant and S = susceptible.
[c] Numbers in parentheses indicate severity rating based on a scale of 0–9, where 0 = no symptoms, 1 = 10% or less of leaf area with disease symptoms, 2 = 10–20%, 3 = 20–30%, 4 = 30–40%, 5 = 40–50%, 6 = 50–60%, 7 = 60–70%, 8 = 70–80%, and 9 = 80–90%.

scraping the surface of the colony with a curved transfer needle. Seedlings of Ex Rico 23 were inoculated with the spore suspension at the primary leaf stage according to the method of Tu and Aylesworth (5). Inoculated plants were examined 7 days later for symptoms and the fungus was reisolated.

Assay on differential cultivars. Race characterization followed the differential schemes of Hubbeling (3) and Kruger et al (4). The differential hosts used are listed in Table 1. The method of inoculation was the same as described previously. For comparative purposes, a differential series was similarly inoculated with spores of race delta.

Disease reaction was rated on a scale of 0–9, where 0 = no symptoms, 1 = 10% or less of the leaf area diseased, 2 = 10–20%, 3 = 20–30%, 4 = 30–40%, 5 = 40–50%, 6 = 50–60%, 7 = 60–70%, 8 = 70–80%, and 9 = 80–90%.

RESULTS AND DISCUSSION

Reactions of the series of differential cultivars are summarized in Table 1. Based on the differential host reactions described by Kruger et al (4) and Hubbeling (3), the new isolate was determined to be race epsilon of *C. lindemuthianum*.

Other cultivars frequently used as a differential series were also tested; their disease reactions are summarized in Table 2. A known isolate of the race delta of *C. lindemuthianum* (ATCC 18987) was employed to indicate the adequacy of the testing method; results are presented in Tables 1 and 2.

C. lindemuthianum was not found on the seeds from the "select" plot used as seed for the "foundation" field, and there were no symptoms of anthracnose observed during the field inspection in August 1981. The disease occurred in a foundation field planted with select seed on the stubble of the previous year's crop of Dark Red Kidney and Cranberry beans. Because both California Light Red Kidney and Dark Red Kidney (Tables 1 and 2) are resistant to race epsilon but Cranberry is not and all select seeds of Ex Rico 23 in 1981 were free of anthracnose, the imported Cranberry bean seed sown in 1981 may have been responsible for the introduction of this new race of *C. lindemuthianum* into Ontario. This limited introduction and subsequent elimination of yet another previously unrecognized strain of a potentially dangerous plant pathogen on seed into Canada again emphasizes the need for greater monitoring of imported seed lots for diseases.

Table 2. Disease reactions of other cultivars to a new isolate of *Colletotrichum lindemuthianum* and to race delta (ATCC 18987) of the pathogen

Cultivar	Disease reaction	
	New isolate	Race delta (ATCC 18987)
California Light Red Kidney	R[a] (0)[b]	R (0)
Charlevoix	R (0)	S (9)
Coco a la creme	R (0)	R (0)
Cranberry	S (8)	S (7)
Dark Red Kidney	R (0)	S (4)
Ex Rico 23	S (9)	S (8)
Imuna	R (0)	S (8)
Seaway	S (4)	S (9)

[a] Differential host reactions based on Hubbeling (3) and Kruger et al (4); R = resistant and S = susceptible.
[b] Numbers in parentheses indicate severity rating based on a scale of 0–9, where 0 = no symptoms, 1 = 10% or less of leaf area with disease symptoms, 2 = 10–20%, 3 = 20–30%, 4 = 30–40%, 5 = 40–50%, 6 = 50–60%, 7 = 60–70%, 8 = 70–80%, and 9 = 80–90%.

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