Occurrence of anthracnose fruit rot caused by *Colletotrichum acutatum* on day-neutral strawberries in Manitoba

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Anthracnose fruit rot of strawberry, caused by *Colletotrichum acutatum*, was observed in August, 1994 in a strawberry cultivar yield trial at Morden, Manitoba. The disease was found on five day-neutral cultivars. Incidence of fruit rot ranged from 11% on cv. Seascape to 82% on Fern. The pathogen may have been introduced via transplants imported from California as this disease has not been previously detected in commercial strawberry fields in Manitoba. This is the first official report of *C. acutatum* on strawberry in Canada.

L'anthracnose de la pourriture de la fraise, causée par *Colletotrichum acutatum*, a été observée en août 1994 dans un essai de rendement d'un cultivar de fraise à Morden, au Manitoba. Cinq cultivars insensibles à la photopériode étaient atteints de la maladie. L'incidence de la pourriture de la fraise va de 11 % chez cv. Seascape à 82 % chez Fern. Le pathogène aura pu être transmis par des plants importés de la Californie étant donné que cette maladie n'a pas été détectée préalablement dans les champs commerciaux de fraises au Manitoba. Il s'agit du premier rapport officiel sur *C. acutatum* des framboises du Canada.

Introduction

Strawberry (*Fragaria* X *ananassa* Duchesne) is an important horticultural crop in Manitoba with an annual farm gate value of $3 million (1). The majority of the strawberries grown in Manitoba are June-bearing cultivars harvested by farmers and growers for roadside stands and local fresh markets, or by individuals for home use. Growers are interested in the introduction of day-neutral strawberries which have the potential to increase the production acreage and to make fresh strawberries available throughout the growing season.

Anthracnose fruit rot, caused by *Colletotrichum acutatum* Simmonds, has been reported on strawberry in Australia and New Zealand (6), England (3) and the United States (4). The fungus may also cause lesions on petiole and runners, crown rot and wilt of strawberry plants (4,5). Anthracnose fruit rot was observed for the first time in Manitoba in cultivar evaluation trials at Morden, in August 1994. Severe fruit rot of day-neutral cultivars had occurred within 5 wk after it was first noted. This report shows the progression of anthracnose disease in the naturally infected strawberry field plots and the disease response of several day-neutral cultivars in yield trials.

Materials and methods

Five day-neutral strawberry cultivars were examined for their reactions to anthracnose caused by *C. acutatum* in two separate field trials at Morden during the 1994 growing season. The two trials were planted on a clay loam soil at the Morden Research Centre, Manitoba, Canada, using certified virus-free transplants imported from California. For trial 1 the cultivars Fern, Tristar, Tribute and Hecker were planted in May 1992, and for trial 2 the cultivars Fern, Tristar, Hecker and Seascape were planted in May 1993. The cultivars were planted in a matted-row system in 2.0 m rows with 2.0 m between rows. The single rows of each cultivar were randomized in each of five replicate blocks in trial 1 and four replicate blocks in trial 2. Ripe fruit were hand-picked and counted at 3 day intervals starting 17 June 1994. Diseased fruit were observed in August 1994 and were harvested from 13 September to 23 September, the end of fruiting season. At each of these harvests the ripe healthy fruit and diseased fruit were collected separately and the number in each category was recorded for each plot. Data were analyzed by analysis of variance using SAS statistical programs (2). Treatment means were separated by the least significant difference (LSD) test or by student's *t* test at a probability level of 0.05.

Results and discussion

Anthracnose rot symptoms were first observed on fruit during the 2 August 1994 harvest. These early infections appeared as small, irregular, tan or light brown, water-soaked lesions. By 7-10 August the lesions had become circular, dark brown and sunken (Fig. 1a). The symptoms

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Accepted for publication, July 15, 1995.

were observed on both green and ripe fruit. About three weeks after the early infections were observed the affected fruit were firm dry, and mummified (Fig. 1b).

Isolations from rotted fruit on potato-dextrose agar (PDA) consistently yielded *C. acutatum*. The fungus produced aseptate conidia in culture and on diseased fruit. The growth rate in culture at 30°C and characteristics of the colony (Fig. 2a), the lack of setae on PDA and fruit, and conidial shape and size (Fig 2b) were consistent with those described in systematics (5). The identity of *C. acutatum* was verified by Dr. B. J. Smith at the USDA, Small Fruit Research Station, Poplarville, Mississippi. Using the inoculation method described by Smith and Black (4) and identified cultures, *C. acutatum* was confirmed as the etiologic agent of the fruit rot by verifying Koch's postulates.

By 12 September the extent of fruit rot among the cultivars used in each trial was estimated to be 10 to 50%. The incidence increased from day to day after a heavy rainfall (76 mm) on 3 and 4 September. Significant differences were found in the incidence of anthracnose fruit rot among the four cultivars in each trial. Tristar fruit had the lowest incidence of rot in trial 1 (28.2%) and the second lowest in trial 2 (13.3%). Seascape was not used in trial 1, but its fruit showed the lowest incidence of rot in trial 2 (12.7%). The level of fruit rot infection of Tribute fruit (53.7%) was moderate compared to that of the other cultivars used in trial 1. Fern and Hecker were the most susceptible cultivars, with fruit rot in excess of 55% in both trials (Table 1).

For each of the three cultivars tested in both trials the disease incidence was significantly greater in trial 1 (Table 1). This may have been due to an increase in inoculum during the first year for plants in trial 1. The source of *C. acutatum* inoculum is uncertain. It may be an indigenous pathogen in the field plots or it may have been introduced on the day-neutral transplants from California.

In both trials, the incidence of fruit rot increased on all cultivars over the 11-day assessment period (Fig 3). The incidence of fruit rot, averaged for Fern, Hecker and Tristar, increased from 61% to 68% in trial 1 and from 36% to 62% in trial 2. The rapid increase in fruit rot incidence over the 11-day period in trial 2 suggests that the disease can be very destructive once infection is established or inoculum build up.

Anthracnose fruit rot, caused by *C. acutatum*, has not been detected previously in commercial strawberry fields in Manitoba, nor elsewhere in Canada. We suspect that the pathogen was introduced on imported transplants. Since *C. acutatum* likely will survive over winter on plant debris and mummified fruits in the field, the pathogen may become more widespread in the 1995 crop unless controls are put in place. Measures to prevent further spread and to eradicate the pathogen may become necessary in day-neutral plantings, including burning of plant debris, destroying older plantings by deep plowing, and rotating crops.

Acknowledgements

The authors thank Dr. B.J. Smith at the USDA, Small Fruit Research Station, Poplarville, Mississippi, for the identification and confirmation of *C. acutatum*. We also gratefully acknowledge Mr. M.P. Reimer for photographic assistance, J. Dyck and S. Gobin for their technical assistance. This work was funded by the Prairie Fruit Growers Association.

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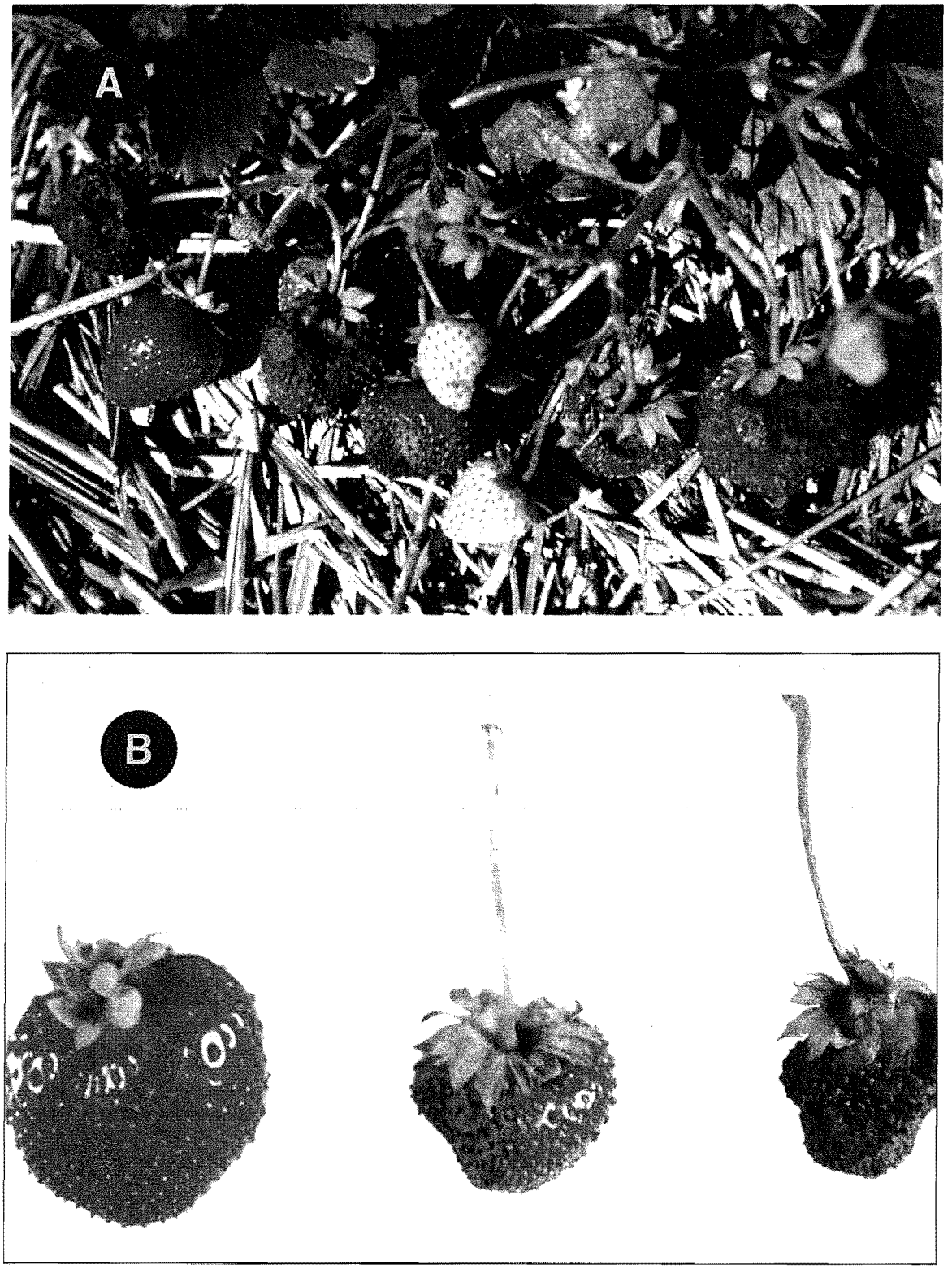
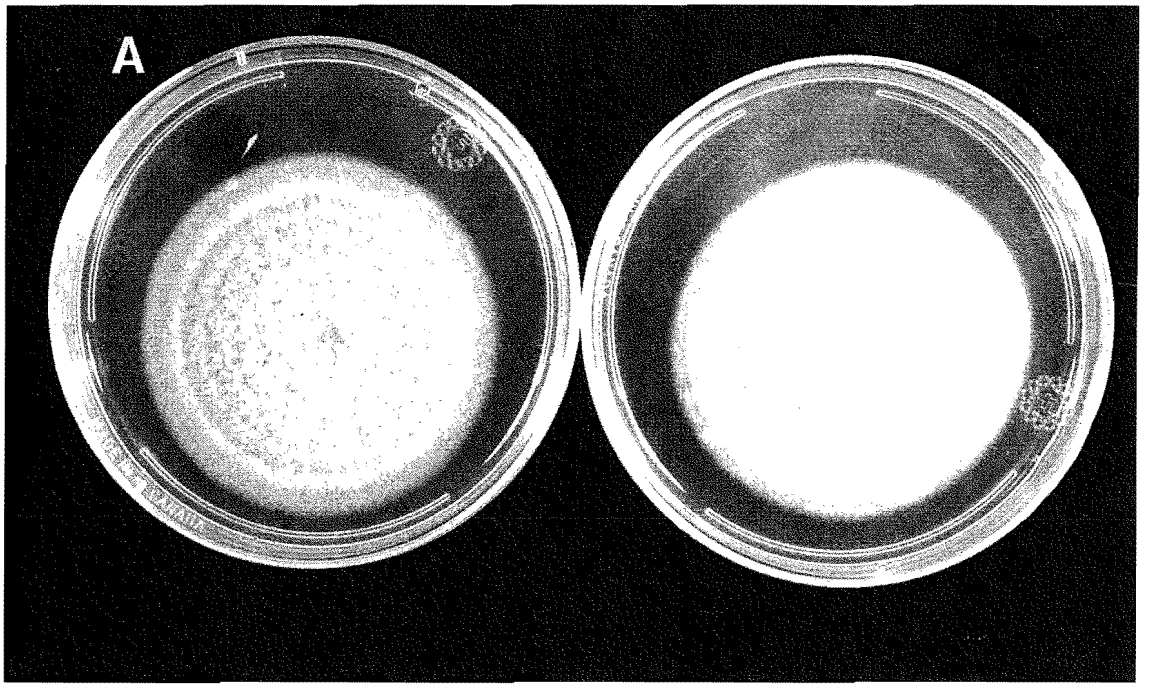


Fig. 1. Symptoms of anthracnose fruit rot of strawberry caused by *Colletotrichum acutatum*; (A) Infected fruits in the field. (B) Comparison of healthy berry (left) and infected berries (middle and right).



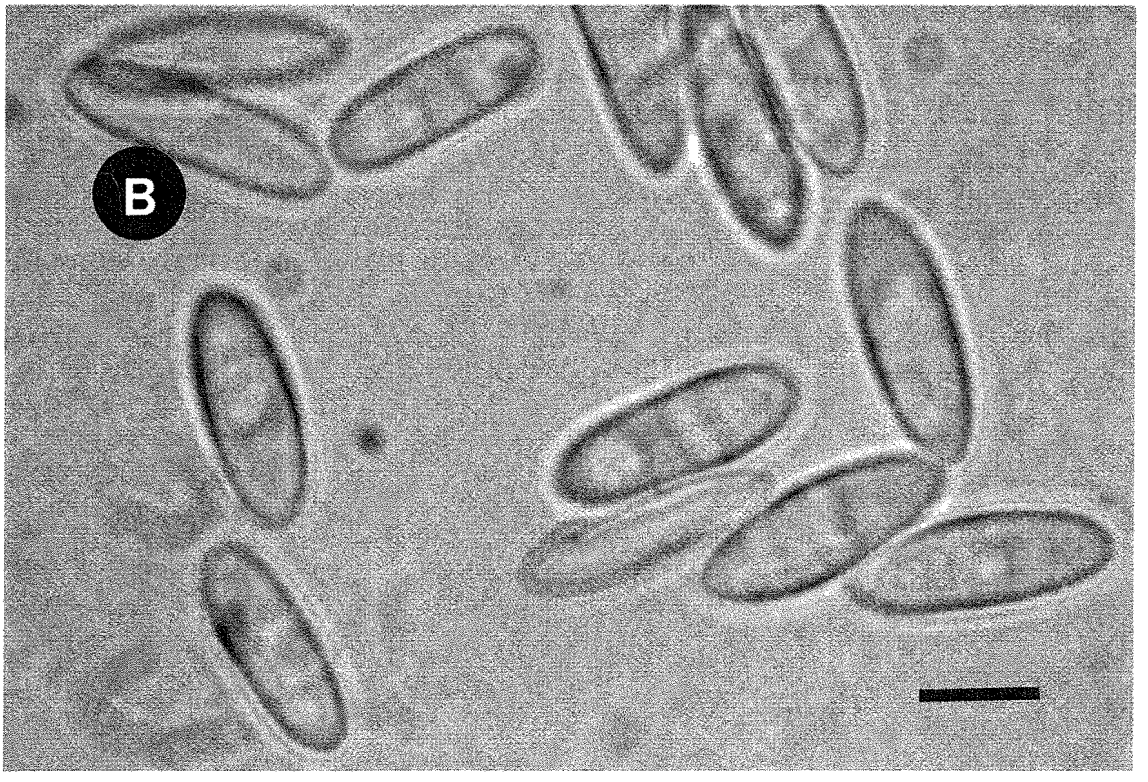


Fig. 2. *Colletotrichum acutatum* isolated from infected strawberry fruits; (A) Seven day old cultures on PDA under continuous fluorescent light following a 3-mm mycelial agar disc transfer; upper colony surface (left) and lower colony surface (right). (B) Conidia; scale bar = 10µm.

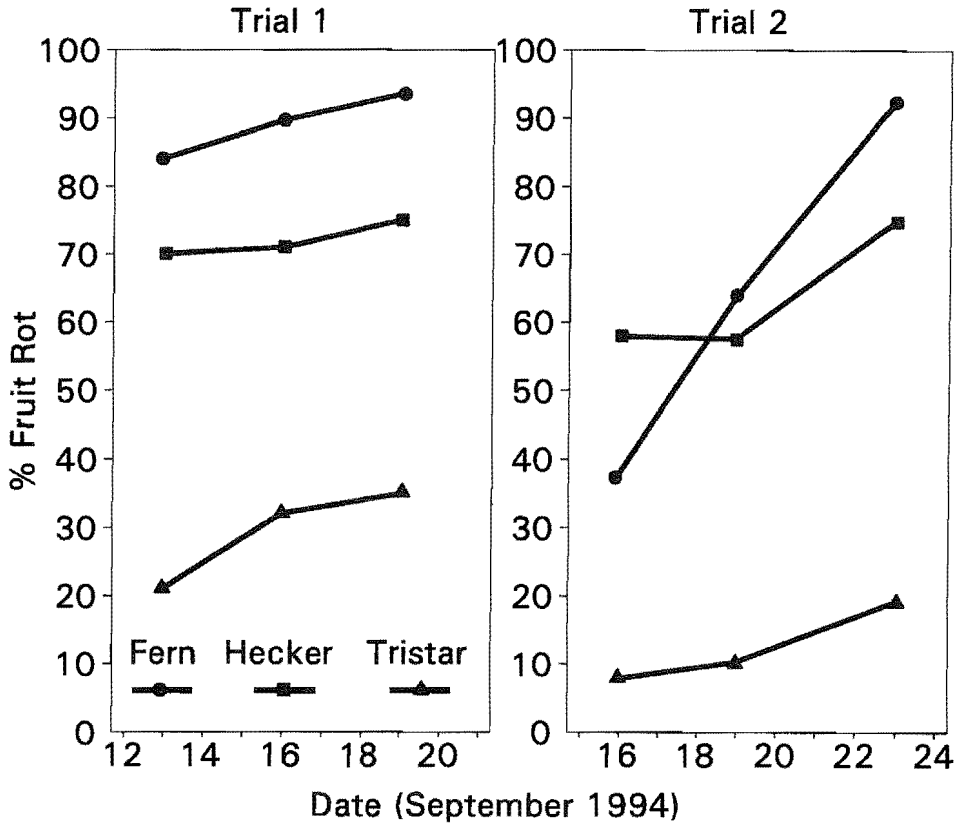


Fig. 3. Development of anthracnose fruit rot in strawberry caused by *Colletotrichum acutatum* during September 1994 at Morden, Manitoba. Each point represents the mean of five replicate plots in Trial 1 and four replicate plots in Trial 2.

Table 1. Mean incidence of anthracnose fruit rot caused by *Colletotrichum acutatum* on day-neutral strawberries at Morden, Manitoba in 1994.

	Trial 1H *		Trial 2**		Contrast in fruit rot Trial 1 vs. Trial 2		
Cultivar	No. fruits harvested	% rotted fruits	No. fruits harvested	% rotted fruits	Difference	t	P > t
Fern	693	88.6 a	131	69.6 a	19.0	8.8	0.02
Hecker	390	75.0 a	101	55.5 a	19.5	6.8	0.03
Tristar	611	28.2 c	117	13.3 b	14.9	11.4	0.01
Tribute	498	53.7 b	NA	NA			
Seascape	NA***	NA	71	12.7 b			

* Trial 1 with five reps and trial 2 with four reps were established in 1992 and 1993, respectively.
** Means in the same column followed by the same letter are not significantly different at P = 0.05 using LSD test.
*** Seascape was not used in trial 1, Tribute was not used in trial 2.