Eumartii wilt of potato in Alberta

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This paper deals with *Fusarium* species isolated from diseased potato tubers held in storage or from wilted plants growing under field conditions. It reports the first documented occurrence of Eumartii wilt of potatoes in Alberta.

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Cet article traite des espèces de *Fusarium* isolées à partir de tubercules de pommes de terre malades entreposées ou à partir de plants flétris poussant au champ. On y note le premier cas documenté en Alberta de flétrissure de la pomme de terre causée par *F.* solanivar. *eumartii*.

Introduction

Fusarium species cause a variety of potato diseases. About 20 species are pathogenic on potatoes. They can cause wilt, tuber rot, dry rot of tubers in storage, and seed-piece decay. According to *Fusarium* species, potato wilt can be classified as Eumartii wilt, Oxysporum wilt or Avenaceum wilt. Eumartii wilt is generally the most aggressive and results in the greatest damage to potatoes. Oxysporum wilt is usually milder than Eumartii wilt and the disease is typically a vascular wilt in contrast to the other Fusarium wilts described here, which are more nearly cortical rots. The mycelia of F. oxysporum are closely limited to the xylem vessels of the stem, while those of F. avenaceum occur abundantly in both the vascular and cortical tissues of the lower stem, while the mycelia of F. *solani* var. *eumartii* are most abundant in the stem cortex (McLean and Walker, 1941). Avenaceum wilt is comparable in severity to Oxysporum wilt.

The first symptoms of Eumartii wilt are light green areas between the veins of the top leaves. (Ohms et al., 1961). Later, the leaves develop reddish to purplish spots, giving infected plants a bronzed appearance (Fig. 1). If the epidermal tissue of the stolon is removed, a brown discoloration of the remaining tissue is evident, sometimes confined to the vascular elements. In severe cases, the entire stolon my be completely rotted (Fig. 4). Affected tubers show a vascular discolarationwhich originates at the point of stolon attachment and extends into the tuber. Eumartii wilt has been reported as widespread in the United States in Pennsylvania, New York, Ohio and Idaho (Haskell, 1916; Goss, 1924). The disease has been serious in Idaho causing severe losses in some growing areas, due to internal tuber damage (Ohms and Fenwick, 1961). This is not the case in Canada and as far as we are aware this is the first confirmed report of this disease in Alberta.

Materials and Methods

During 1984, isolations of *Fusarium* species were made from diseased tubers collected from storages and one commercial potato field in Alberta. Isolation of the causal fungus was made as follows: different portions of the diseased plant were cut into small pieces approximately 1 cm^2 and surface-sterilized in 95% ethyl alcohol for one minute, followed by immersion in 1:10 commercial bleach solution (1.2% sodium hypochlorite) for one minute. They were then transferred aseptically, through three rinses of sterile distilled water onto Nash and Snyder's pentachloronitrobenzene (PCNB) medium (Nash and Snyder, 1962) in order to isolate *Fusarium* sp. After making sure that the cultures were pure by the method of single-sporing described by Snyder and Smith (1962), inoculations were made on healthy plants. Inoculum concentrations of several selected isolates identified as *F.* solanivar. *eumartii* and F. avenaceum were washed from PDA tubes and spore numbers determined by hema-cytometer counts. The inoculum level was adjusted with sterile distilled water to approximately 2×10^5 spores/mL. In order to avoid significant changes of inoculum viability, they were refrigerated at 4°C after preparation and used within a 4 hour period.

On July 2nd, 1984, seed pieces of two potato plants cultivars, Russet Burbank and Warba, grown for one month in the greenhouse in pots, were inoculated by injecting a suspension (2×10^5 spores/mL) of spores into the stems just below soil level. Four plants were inoculated with each isolate. Comparable plants of each cultivar were injected in the same way, but no inoculum was introduced. Seed tuber pieces of Russet Burbank were also inoculated. Prior to inoculation, seed tubers were washed, dipped into 0.5% NaOCl and allowed to dry. The tubers were cut and dipped at once in the spore suspensions and planted immediately in steamed soil. Twenty seed pieces were used in each treatment. All the plants were kept in the greenhouse at 24°C. Data were recorded by measuring the length of stem discoloration one week after the stem inoculation test and by measuring the height of potato plants one month after inoculation test and by measuring the height of potato plants one month after inoculation of the seed-pieces.

Results and Discussion

Fusaria were successfully isolated form vascular discolored stem tissue below or close to the soil line and from discolored vascular tuber tissue. From 80% of the isolations there developed a species of *Fusarium* having a pale olive-buff color on the PDA medium. It was readily obtained from the potato roots and less readily from stem pieces (Fig. 3). This species was almost identical to F. *eumartii* described by Carpenter in 1915 (1). The isolate had sparse aerial mycelium, light brown

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sporodochia, macroconidia nearly straight in the lower half, slightly curved in the upper half, 3 to 4 septate, with occasional microconidia.

In the stem inoculation tests, F. solani var. eumartii produced complete disorganization of the stem at the point of inoculation (Fig. 5). The average lengths of stem discoloration by several isolates of F. solani var. eumartii and F. avenaceum are presented in Table 1. Three weeks after inoculation, the plants were dead and the below ground portions of the stems were found to be nearly rotted through while check plants remained healthy.

A reduction of shoot height was found to occur when seed-pieces were inoculated by *F.* solani var. eumartii and F. *avenaceum* prior to planting. The results in Table 2 indicate that

Table 1. The average length of stem discoloration of two varieties of potatoes one week after inoculation with strains of Fusarium *solani* var. *eumartii* and *F.* avenaceum.

Species and Strain No.	Stem Discoloration (mm) Russet Burbank	Warba
F. solani var. *eumartii*		
7	32	17
15	22	19
2	9	14
F. avenaceum		
3	6	4
6	6	4
Check	0	0

inoculation with F. solani var. eumartii could cause a 50% failure of seed-piece emergence. Even when the plants emerged, the average height of one-month-old inoculated plants were markedly lower (11.4 cm) compared to the control plant, (28.9 cm). *F.* avenaceum did not have an effect on seed-piece emergence; however, the height was reduced (22.4 cm).

Inoculation experiments show that F. solani var. *eumartii* is an extremely virulent parasite capable of causing seed piece emergence failure, severe growth reduction, stem-end rot and internal discoloration of tubers.. It is probable that there are other weak parasites, capable of causing similar host reactions when environmental conditions are favorable. Such weak pathogens might be *F. equiseti* and F. *trichothecioides* which were also isolated in this project from diseased plants and tubers.

Table 2. The emergence percentage and height of potato shoots (Russet Burbank) one month after seed-pieces were inoculated with *F. solani* var. *eumartii* and F. avenaceum.

Species and Strain No.	Emergence %	Green Height cm
F. solani var. eumartii		
7	50	17.1
24	50	16.6
2	70	11.4
28	80	18.1
F. avenaceum		
6	100	22.8
21	100	22.4
Check	100	28.9

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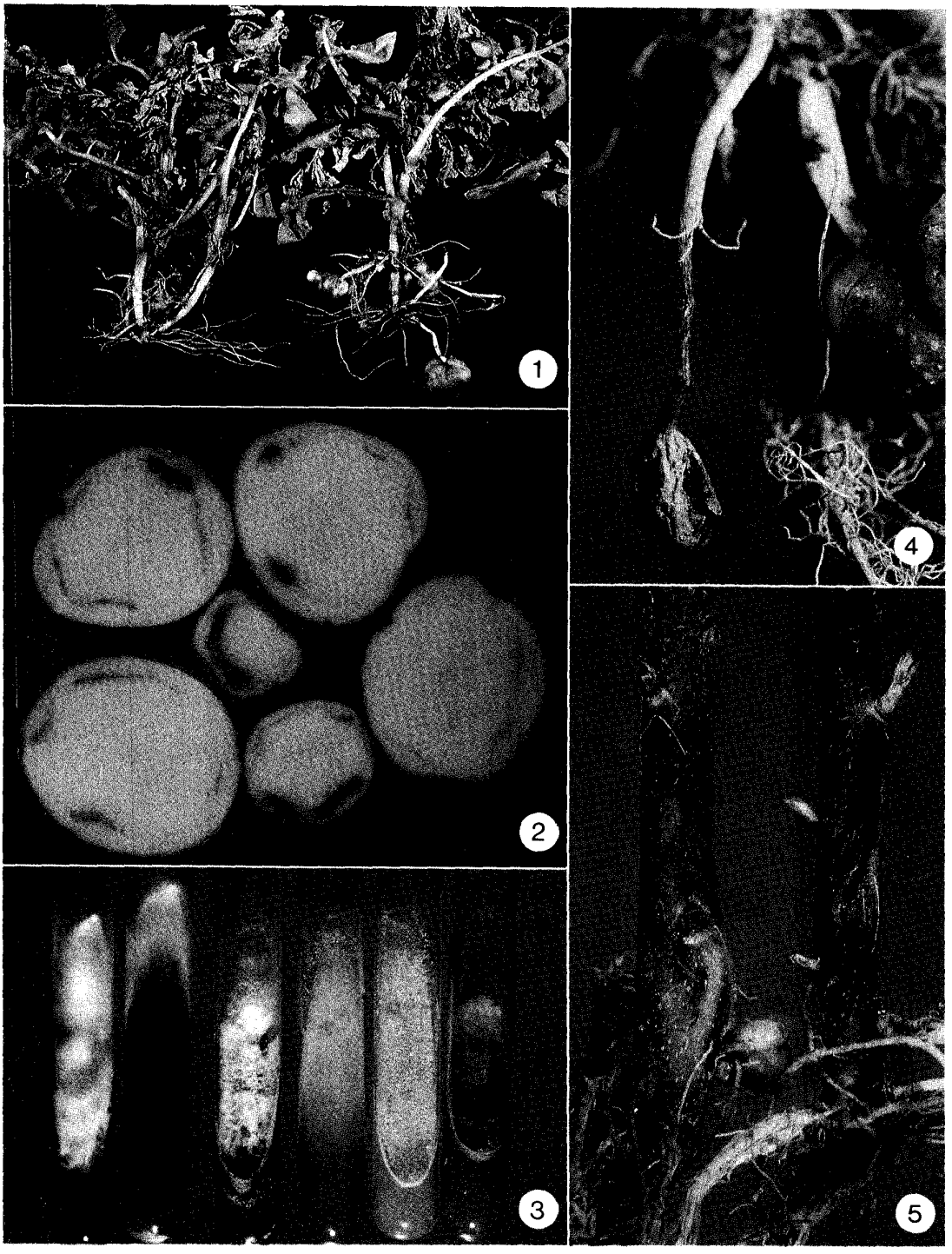

Figure 1. Symptoms of Eumartii wilt in Russet Burbank showing bronzed appearance.
Figure 2. Symptoms of Eumartii wilt in Norgold Russet potato tuber from storage – Note bacterial ring rot like symptoms.
Figure 3. Four cultures on the right side illustrated for F. ***solani*** var. ***eumartii*** and the left two cultures represented ***F. avenaceum.***
Figure 4. Symptoms of a severely infected stolon and small tubers in Russet Burbank.
Figure 5. Symptoms of Eumartii wilt showing the effect of inoculation with ***F. solani*** var. ***eumartii*** on Russet Burbank. Note the brown stem discoloration on the right, check on left.