

# Identification and Aggressiveness of *Erwinia carotovora* subsp. *betavasculorum* on Sugar Beet from Texas

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## ABSTRACT

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*Erwinia carotovora* subsp. *betavasculorum* was positively identified from cultivar HH 23 from the Hereford, TX, area by a microprecipitin test, growth on Miller-Schroth selective medium, and a pathogenicity test on a susceptible cultivar. The aggressiveness of strains varied from mild to moderately severe; however, none of the Texas strains was more aggressive than a California isolate and no resistance-breaking biotypes were detected. Known sources of resistance should provide disease control.

Bacterial vascular necrosis and rot of sugar beet incited by *Erwinia carotovora* (Jones) Bergey et al subsp. *betavasculorum* Thomson et al (*E. c.* subsp. *betavasculorum*) was first reported from California in 1972 (4) and has subsequently been reported from Washington (2), Idaho, and Arizona (5). The extension of the geographical distribution of the pathogen and its pathogenicity and aggressiveness are of economic importance to beet production because many of the cultivars grown in the United States are susceptible (6,7). This paper reports the identification and aggressiveness of the pathogen from the Hereford, TX, area.

## MATERIALS AND METHODS

The diseased sugar beets, cultivar HH 23, used in these studies were received from the Holly Sugar Company, Hereford. Cultivar HH 23 was moderately susceptible to the pathogen in injured-inoculated tests at Salinas, CA (15.7% rot per root and 24.1% infected plants).

**Identification of isolates.** Rotted tissue from suspect plants was mixed with sterile water (1/1, v/w) and the supernatant was further diluted 1/9. These rotted beet dilutions were then tested in a microprecipitin test on glass slides with antiserum prepared from injecting several dialyzed, glutaraldehyde-fixed bacterial strains of the pathogen into rabbit. Microprecipitin tests of *E. c.* subsp. *betavasculorum* strains CB-2, MR-1, SB-4, SB-6, SB-13, SP-5, UR-7, and WE-1 (3) were positive in contrast to negative results from *E. amylovora*, *E. chrysanthemi*, *E. carotovora* subsp. *carotovora*, and

normal rabbit serum. One drop of test material was mixed with one drop of antiserum. Checks were healthy beet juice, sterile water, or strain SB-13 of the pathogen similarly tested. The supernatants were also tested on Miller-Schroth selective medium (1) after further dilutions.

**Pathogenicity and aggressiveness of isolates.** Typical *Erwinia* colonies were isolated, increased, and tested for pathogenicity on the susceptible cultivar, C40 (10), as previously described (6,9). Nine colonies reisolated from sugar beet were tested for their aggressiveness on C40 and C36 (8), a highly resistant sugar beet, following the same inoculation procedure used for the pathogenicity test. Six 3-mo-old plants of each cultivar per strain were used to test the aggressiveness of the bacterial isolates. A highly aggressive strain, MR-1 from sugar beet, was used as a comparison of the aggressiveness of the Texas isolates. The plant roots were harvested 2 mo after inoculation, sectioned, and scored for rot (0 = free of rot, vn = vascular necrosis, 1 = soft rot, and 2 = dead).

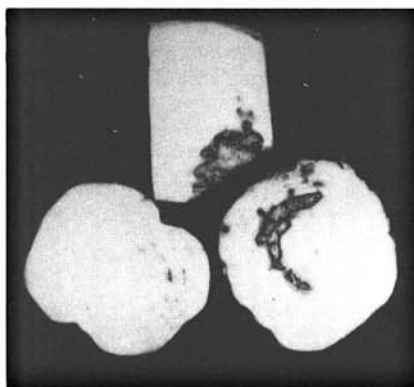


Fig. 1. Soft rot and vascular necrosis symptoms of sugar beet roots from Hereford, TX.

## RESULTS AND DISCUSSION

**Identification of isolates.** Symptoms were typical of bacterial vascular necrosis and rot of sugar beet (soft rot and vascular necrosis) (Fig. 1). Colonies of the bacterium on Miller-Schroth media were typical for the pathogen (fried-egg appearance). The bacterium was pathogenic on the susceptible cultivar, C40, but not on the resistant cultivar, C36.

The precipitin test was positive for the bacteria from the diseased tissue as well as the known isolate, SB-13. Neither water nor juice from healthy beets caused flocculation (Table 1).

This is the first report of bacterial vascular necrosis and rot from Texas. All of the evidence (symptoms, microprecipitin test, appearance of the colonies on Miller-Schroth media, and isolation of pathogenic types reinoculated to susceptible sugar beet) confirms the presence of the sugar beet *Erwinia* bacterium in beets from Texas. Because the microprecipitin test positively identified the bacterium, it proved to be a useful test in confirming the diagnosis of the disease from rotted sugar beet tissue.

**Pathogenicity and aggressiveness of the isolates.** The test to determine if the Texas strains of the bacterium differed from a known isolate in aggressiveness showed that none of the strains was more aggressive and there were no resistance-breaking biotypes that overcame the resistance of C36, the resistant tester. All C40 plants inoculated with the MR-1 isolate were dead at harvest.

Although some of the isolates from Texas were highly aggressive (disease

Table 1. Results of microprecipitin tests for *Erwinia carotovora* subsp. *betavasculorum* from infected Texas beets

Test	Relative values <sup>a</sup>
Juice plus antiserum <sup>b</sup>	-
Water plus antiserum	-
Beet juice <sup>c</sup> (1/1) plus antiserum	+++
Beet juice <sup>c</sup> (1/9) plus antiserum	++++
SB-13 <sup>d</sup> plus antiserum	++
SB-13 <sup>d</sup> (1.9) plus antiserum	+

<sup>a</sup>- = No flocculation and + = flocculation.

<sup>b</sup>Expressed juice from healthy beet root mixed 1/1 (v/w) in sterile deionized water.

<sup>c</sup>Rotted beet juice mixed 1/1 or diluted 1/9 (v/w) in sterile deionized water.

<sup>d</sup>Strain SB-13 of *E. carotovora* subsp. *betavasculorum* from water culture.

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**Table 2.** Relative aggressiveness of nine Texas strains of *Erwinia carotovora* subsp. *betavasculorum* compared with an aggressive isolate, MR-1, on a susceptible cultivar (C40) and a resistant cultivar (C36)

Sugar beet cultivar	Strain <sup>a</sup> (disease reaction) <sup>b</sup>									
	MR-1	1-1a	1-2a	1-4a	3-1a	3-4a	3-5b	4-1b	4-2a	4-2b
C40	2.0 <sup>c</sup>	1.8	1.2	1.0	0.3vn	0.5vn	1.2	0.2vn	1.0vn	1.0
C36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0vn	0.0vn

<sup>a</sup>MR-1 is a California strain; all others are from Texas.

<sup>b</sup>Disease rating: 0 = free of rot, vn = vascular necrosis, 1 = soft rot, and 2 = dead.

<sup>c</sup>Mean of six 3-mo-old beets per mean value.

ratings of 0.2–1.8) (Table 2), none was more aggressive than MR-1, a highly destructive isolate of the pathogen. This suggests that known sources of resistance should provide excellent control if introduced into adapted cultivars.

#### ACKNOWLEDGMENT

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