

Bacterial Top and Stalk Rot of Maize in Brazil

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ABSTRACT

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A population of sweet corn (*Zea mays*) grown during the 1979-1980 rainy seasons in Brasília was heavily attacked by a bacterium causing top and stalk rot. About 37% of the plants showed symptoms, and 24% died within 45 days of planting. The bacterium was identified as *Erwinia chrysanthemi* pv. *zeae*. This is believed to be the first report of this pathogen on corn in Brazil.

In March 1980, a population of sweet corn (*Zea mays* L.) derived from cultivars Nutrimaiz × Tropical and grown under furrow irrigation on our experimental station in Brasília suffered heavy losses (24% mortality, 37% infection) from a corn bacterial pathogen apparently new to Brazil. Similar bacterial top and stalk rots of corn were observed in 1973 in Brasília, in 1978 in extreme western Minas Gerais, and in 1979 in Sete Lagoas, Minas Gerais. However, the pathogen was not isolated or identified (7). In this study, we identified the causal agent of this new disease. A brief report of our findings has been published (7).

MATERIALS AND METHODS

Isolation and identification. Pieces of affected sweet corn pith tissue close to the

apical meristem were taken from five plants in the same field and placed in a drop of sterile, distilled water on a glass slide. After a few minutes, numerous bacteria were observed microscopically. Loopfuls of bacteria were streaked onto plates of V-8 juice agar, potato-dextrose agar (PDA), and tetrazolium chloride agar (TZCA) media (6). These plates were incubated at 26 ± 2 C for 2-3 days. The predominant bacteria on the plates were purified by restreaking three times on TZCA.

Because of the stalk soft rot symptom and some characteristics of the purified bacterium, we performed standard determinative tests for *Erwinia* spp. (4,8,9) on two strains obtained from the infected corn plants and on one strain each of *Erwinia carotovora* pv. *carotovora* (Jones 1901) Bergey, *E. carotovora* pv. *atroseptica* (Van Hall 1902) Dye, and *E. chrysanthemi* pv. *chrysanthemi* Burkholder, McFadden & Dimock 1953 (isolated from potato) provided by the International Potato Center (CIP) in Lima, Peru.

Pathogenicity test. To obtain inoculum, cultures of each strain isolated on TZCA were grown for 48 hr on the TZCA medium but without tetrazolium chloride. A concentration of 10^7 - 10^8 cells per milliliter in sterile, distilled water was

used for the inoculations. To test the pathogenicity of the five strains of *Erwinia*, we inoculated 4- to 8-wk-old plants of the sweet corn cultivar Cubano Doce (10 plants per strain) in the greenhouse (night-day temperatures of 20-30 C) and 6-wk-old plants (20 plants per strain) in the field in April (15-28 C). We injected bacterial suspensions (0.2 ml per plant) into the pith tissue of the stalk of the plants about 20 cm above the soil line with a standard 1-ml insulin syringe.

RESULTS AND DISCUSSION

Symptoms. Only the two test bacterial species produced symptoms in corn plants. The initial symptoms were water-soaked lesions in the leaf sheath; the lesions commonly extended into the leaf lamina as streaks. From these lesions, the decay progressed into the pith, causing its disintegration. The most characteristic symptom was the breaking or toppling of plants above the fourth or fifth node. These symptoms resembled those shown by naturally infected plants as well as those described by Hoppe and Kelman (5).

Characterization of the pathogen. The gram-negative bacterium consistently isolated from diseased tissues was a single rod measuring 1.7 - 2.4×0.7 - $1.0 \mu\text{m}$ (average $2.2 \times 0.8 \mu\text{m}$) with peritrichous flagella. It had the following characteristics: facultative anaerobe, potato slice soft rot (+), catalase (+), gelatin hydrolysis (+), H_2S production (+), indole (+), lecithinase (+), oxidase (-), phosphatase (+), utilization of lactose (-), arabinose (+), ethanol (+), glucose (+), mannitol (+), and sucrose (+). Neither dark blue insoluble pigment (1) nor fluorescein was produced. The

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pathogen was sensitive to erythromycin. Colonies on PDA (pH adjusted to 6.5) resembled fried eggs (umbonate with undulate margins).

Based on comparisons of our two unknown strains with the three known *Erwinia* species tested and on biochemical, cultural, and morphological characteristics, the bacterium was identified as *E. chrysanthemi* pv. *zeae* (Sabet 1954) Victoria, Arboleda & Muñoz (2,3). One of our isolates (E-20) has been deposited at the National Collection of Plant Pathogenic Bacteria, Harpenden, England, as strain no. 3144.

Locally, this top and stalk rot disease has been named *quebra cana* (Portuguese for stalk breaker). Although we are not sure of its distribution or severity, similar symptoms observed in previous years suggest that the pathogen is widespread in Brazil. Because of the prevailing climatic conditions (high humidity and

temperature and heavy rains) during the corn-growing season (November–March), the disease is considered potentially serious in localized cornfields, particularly fields of sweet corn, which is more susceptible than field corn lines.

We believe this is the first report of *E. chrysanthemi* pv. *zeae* virulent on corn in Brazil.

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