THE ROLE OF *ERWINIA CAROTOVORA* IN THE EPIDEMIOLOGY OF POTATO BLACKLEG.
II. THE EFFECT OF SOIL TEMPERATURE ON DISEASE SEVERITY

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Abstract

Relative disease severity (seedpiece decay or post emergence blackleg) incited by *Erwinia carotovora* var. *carotovora* (*Ecc*) and *Erwinia carotovora* var. *atroseptica* (*Eca*) was studied in the field and the greenhouse. When inoculated tubers were planted in cool soils in the field or greenhouse (7.0–18.5°C average minimum and 16–26°C average maximum temperature during the first 30 days after planting) *Eca* caused significantly more disease than *Ecc*. Under these experimental conditions *Ecc* did not cause significantly more disease than that found in non-inoculated controls. When soil temperatures were high at planting time (21.4–24.0°C average minimum and 29.6–35.0°C average maximum temperature for the first 30 days after planting), inoculation with *Ecc* resulted in severe disease while *Eca* produced no more infection than that found in uninoculated controls. At intermediate soil temperatures both were infective.

Seedpiece decay by both organisms was correlated with soil temperatures during the first 30 days after planting. As the soil temperature increased, inoculation with *Ecc* resulted in more disease than inoculation with *Eca*. At lower soil temperatures the opposite result was obtained.

Field and greenhouse studies showed that both *Eca* and *Ecc* were able to cause typical post emergence blackleg infection, the former at low soil temperature and the latter at high temperature conditions.

The data suggest that both *Ecc* and *Eca* are components of the potato blackleg and soft rot disease complex. Environmental conditions, especially soil temperature, determine which organism is causative under a particular set of conditions.

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Resumen

Severidad relativa de la enfermedad (pudrición de semilla de papa o pierna negra de post-emergencia) causada por *Erwinia carotovora* var. *carotovora* (Ecc) y *Erwinia carotovora* var. *atroseptica* (Eca) fue estudiada en el campo y en invernadero. Cuando tubérculos inoculados fueron sembrados en suelos fríos del campo o invernadero (7-18.5 °C promedio mínimo y 16-26 °C promedio máximo de temperatura durante los primeros 30 días después de la siembra) Eca causó significativamente más daño que Ecc. Bajo estas condiciones experimentales Ecc no causó significativamente más enfermedad que la que se encontró en los controles no inoculados. Cuando las temperaturas del suelo fueron altas en la siembra (21.4-24.0 °C de promedio mínimo y 29.6-35.0 °C de promedio máximo durante los primeros 30 días después de la siembra) la inoculación con Eca produjo una severa enfermedad mientras Ecc no produjo mayor infección que la encontrada en controles no inoculados. A temperaturas intermedias del suelo ambas fueron infectivas.

La pudrición de semilla de papa causada por los dos organismos estuvo correlacionada con las temperaturas del suelo durante los primeros 30 días después de la siembra. A medida que la temperatura del suelo aumenta, la inoculación con Ecc produce mayor enfermedad que la inoculación con Eca. A temperaturas bajas del suelo el resultado opuesto fue obtenido.

Estudios de campo e invernadero mostraron que tanto Eca como Ecc podían causar una típica pierna negra de post-emergencia, la primera a temperaturas bajas del suelo y la última a temperaturas altas.

La información sugiere que Ecc y Eca son componentes del complejo pierna negra de la papa y pudrición de planta. Las condiciones ambientales, especialmente la temperatura del suelo, determinan cual organismo es el causante bajo un conjunto particular de condiciones.

Introduction

The epidemiology of potato blackleg has been a subject of considerable speculation since the disease was discovered in the 19th century. Recent reports which suggest that not only *Erwinia carotovora* var. *atroseptica* (*E. atroseptica*) but also *E. carotovora* var. *carotovora* (*E. carotovora*), are involved in this disease have complicated the understanding of the etiology of blackleg. In Scotland, for example, it was reported that although both organisms are found contaminating seed stocks, only *E. atroseptica* appears to predominate in stem infections (16). However, in Arizona, Stanghellini and Menely (20) reported that *E. carotovora* was the predominant organism found in stem infections under Arizona conditions while Molina and Harrison (14) demonstrated that both organisms cause stem infections in Colorado. Tanii and Abai (21) recently reported that a serologically distinct