THE PRESENCE AND LOCATION OF *ERWINIA CAROTOVORA* SUBSP. *CAROTOVORA* (JONES) BERGEY ET AL. IN THE GUT OF ADULT *DROSOPHILA MELANOGASTER* (MEIGEN)¹

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**Abstract**

The potato blackleg bacterium *Erwinia carotovora* subsp. *carotovora* (Jones) Bergey et al. was found in feces and regurgitated material obtained from surface sterilized adult fruit flies, *Drosophila melanogaster* (Meigen), that had fed for five hours on nutrient agar cultures of the bacterium. The highest levels of bacteria were obtained from fecal material and it is likely that this is the source of most of the inoculum carried by these vectors. The bacteria were found to be present in the foregut, midgut, and hindgut of *D. melanogaster*. The largest number of bacteria were in the foregut with the population level decreasing as distance down the digestive tract increased. It is probable that the association between the vector and the bacterium is accidental. The probability that the insect aids survival of the bacterium by protecting it from adverse environmental conditions is suggested.

**Resumen**

La bacteria que causa la pierna negra de la papa *Erwinia carotovora* subsp. *carotovora* (Jones) Bergey et al. fue encontrada en las heces fecales y material regurgitado obtenido de moscas adultas de frutas, *Drosophila melanogaster*, (Meigen) que habian sido superficialmente esterilizadas y que se habian alimentado por cinco horas en nutriente agar contaminado con la bacteria. Los mas altos niveles de bacteria fueron obtenidos del material fecal y es probable que este es el origen de la mayor parte del inoculo transportado por esos vectors. *Drosophila melanogaster* transporta la bacteria internamente en la parte anterior, media y posterior del tubo digestivo. El mas alto numero de bacteria fue encontrado en las partes anterior del tracto digestivo con el nivel de poblacion bacteriana decreciendo a medida que se iba avarrazando hacia el final del tracto. Es probable que la asociacion entre el vector y la bacteria sea accidental. La probabilidad de que el insecto ayude en la sobrevivencia de la bacteria protegiendola de adversas condiciones ambientales es sugerida.

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Introduction

Potato blackleg caused by *Erwinia carotovora* subsp. *carotovora* (Jones) Bergey et al. and *E. carotovora* subsp. *atroseptica* (van Hall) Dye (11) is an important bacterial disease wherever potatoes are grown (2). In Colorado it is estimated that it is responsible for losses of five to ten percent of the potato crop in most years (2). Early investigations by Leach (10) indicated that the pathogen was commonly present in cultivated soil and needed only favorable conditions to invade through potato seed pieces and cause disease. However, strong evidence now suggests that the bacterium does not survive well alone in the soil (3) but rather lives from season to season in stored seed potatoes (13), in plant residues that remain in the soil after harvest (3, 14) or in culled potatoes dumped in open areas (7). The bacterium also may survive in association with volunteer plants or in certain weeds, especially in tropical regions (3, 14).

Several studies suggest that insects play an important role in survival and dissemination of the bacterium (1, 2, 7, 8, 9, 12). For example, *Drosophila melanogaster* has been shown to acquire *Erwinia* from infected plants and transmit it to healthy ones (12). Also, several insect species, particularly in the order Diptera, collected near refuse cull piles were found to be contaminated with *Erwinia carotovora* subsp. *carotovora* and/or *Erwinia carotovora* subsp. *atroseptica* (7, 8). The pathogen may be carried both externally and internally by the insect and survives inside the vector for 48 to 72 hours (2). Previous workers (6) have reported little survival of unprotected *Erwinia* cells after two hours, at humidities ranging from 43 to 90 percent. This suggests that insects play an important role in extending the survival time of these bacteria, particularly in regions such as Colorado.

Insects could also extend the distances that the bacteria are disseminated from inoculum sources; for example, insects associated with potato cull piles transmitted *Erwinia carotovora* subsp. *carotovora* and/or *Erwinia carotovora* subsp. *atroseptica* to injured field plants at distances as great as 183 m from the source of inoculum (8). Thus it appears that, as vectors, insects may be important in increasing *Erwinia*-incited diseases in the field. This, plus the fact that *Erwinia* spp. can be present in aerosols (5, 6), indicates that the epidemiology of potato blackleg is very complex.

We conducted this study to gather additional information on the association between *Drosophila melanogaster* and *Erwinia* spp. We wanted to determine the pathway of the bacterial inoculum from insect vectors to plant hosts. The alternative hypotheses tested were that the bacteria carried to healthy plants were either regurgitated or deposited with fecal material. We also wanted to determine if bacteria carried internally in insects were associated with any particular portion of the digestive system.