MULTIPLICATION OF *PSEUDOMONAS SOLANACEARUM* IN RESISTANT POTATO PLANTS AND THE ESTABLISHMENT OF LATENT INFECTIONS

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Abstract

When 1-mo-old plants of a wilt-resistant clone of *Solanum phureja* (1386.15) were stem-inoculated with three strains of *Pseudomonas solanacearum* (K60, S123, and S206), the bacteria multiplied rapidly at the point of inoculation and then moved in the vascular system to other parts of the stem. Resistant plants showed a remarkable ability to support relatively high populations of the bacterium in the absence of disease symptoms. Although multiplication in this resistant clone was substantially less than in susceptible Russet Burbank potato plants, large numbers of bacteria (up to $624 \times 10^4$ cells of K60 per 5-cm stem segment) reached the base of the stem of plants maintained at high temperature ($28^\circ$C) for 20 days after stem inoculation. From the base of the stem, the bacteria moved rapidly into the roots and tubers. Strains of *P. solanacearum* differed in their ability to cause latent tuber infection in different resistant potato clones. When 11 *S. phureja* x *S. tuberosum* hybrids were stem-inoculated, maintained at $28^\circ$C for 3 wk and then grown to maturity at $20^\circ$C, most of the clones yielded tubers infected by one or more strains. The race 1 strain (K60) was the most infectious; 53.8% of all tubers harvested from all plants inoculated with this isolate carried latent infections. Because one clone (BR 53.1) never yielded infected tubers, there appear to be genetic factors which may be useful in breeding programs aimed at eliminating latent tuber infection.

Resumen

Cuando se inocularon plantas de 1 mes de edad del clon de *Solanum phureja*, 1886.15 (resistente) con tres cepas de *Pseudomonas solanacearum* (K60, S123 y S206) las bacterias se multiplicaron rápidamente en el lugar de la inoculación y se esparcieron en el tallo por medio de los haces vasculares. Aunque la multiplicación en este clon resistente fue mucho menor que en una planta de papa susceptible, como Russet Burbank, la población de bacterias alcanzó $624 \times 10^4$ células por segmento de 5 cm de largo de tallo en la base de plantas mantenidas a una temperatura alta

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(28°C) por 20 días. De la base del tallo, la bacteria se esparció rápidamente a las raíces y tubérculos. Diferentes cepas de \textit{P. solanacearum} difirieron en su habilidad de causar infecciones latentes en los tubérculos de clones resistentes. Cuando se inocularon 11 híbridos de \textit{S. phureja x S. tuberosum} en los tallos y las plantas se mantuvieron a 28°C por 3 semanas y luego se dejaron madurar a 20°C, casi todos los clones produjeron tubérculos infectados por una o más cepas. La cepa de raza 1, K60 fue la más infecciosa; 53.8% de todos los tubérculos producidos por todas las plantas inoculadas resultaron infectados por esta bacteria. Como uno de los clones resistentes (BR 53.1) nunca produjo tubérculos infectados, se sugiere que esta es una característica genética que puede ser muy útil en programas de mejoramiento en que se intente eliminar el problema de infecciones latentes en los tubérculos.

**Introduction**

There are numerous reports that \textit{Pseudomonas solanacearum} E.F. Smith, the agent of bacterial wilt of potatoes, persists in infected tubers in the interim between harvest and subsequent planting (see review by Kelman, 11). Many tubers remain symptomless, particularly when susceptible potato clones are infected late in their growth cycle. The problem of latent infection of potato tubers is particularly severe in developing countries, where certified seed is not readily available.

Infected tubers are important sheltered sites for long-term survival of \textit{P. solanacearum} in the field; approximately 10% of tubers infected with race 3 strains of the pathogen, when grown in noninfested soil, give rise to diseased plants (5). Furthermore, when seed potato tubers from an infested field were assessed for infection by \textit{P. solanacearum}, both visually and by direct isolation, the visual method failed to detect two-thirds of the infected tubers after 6 wk of storage at 28°C (3). As resistant cultivars become more widely used, movement of virulent strains may be a significant problem because these cultivars may remain symptomless after inoculation with virulent strains of the pathogen (15), and thus would not be rogued out in the field or after the tubers are harvested.

Latent infection is also an important problem in breeding programs in which progenies are screened at the seedling stage by root inoculation (4). The tubers that are produced months later by the resistant plants may carry the bacterium (Ciampi \textit{et al}, unpublished data).

Bacterial cells reach potato tubers via the vascular system after initial multiplication in roots or stems. Although there is a considerable amount of information on the multiplication and movement of \textit{P. solanacearum} in susceptible potato (7), tomato (7, 17), and tobacco (1) plants, there is no information as to the rate of movement, or the populations of the bacterium that can occur in resistant potato clones. It is known that resistance