

Brown Rot of Potato and Southern Wilt of Geranium *Ralstonia solanacearum* Race 3 Biovar 2 and Race 1

Hosts: For *Ralstonia solanacearum* race 3 biovar 2 (R3bv2): Potato (*Solanum tuberosum*), tomato (*Solanum lycopersicum*), eggplant (*Solanum melongena*), garden pepper (*Capsicum* spp.), geranium (*Pelargonium zonale*), pelargonium (*Pelargonium × hortorum*), and solanaceous weeds, such as nightshade (*Solanum nigrum*) and bittersweet (*Solanum dulcamara*). For *Ralstonia solanacearum* race 1 (R1): Very broad host range infecting potato, geranium, and hundreds of species in many plant families.

Disease common names: Brown rot of potato and bacterial wilt of potato; southern wilt of geranium and bacterial wilt of geranium.

Pathogens: *Ralstonia solanacearum* R3bv2; R1. Syn.: *Pseudomonas solanacearum* and *Burkholderia solanacearum*.

Disease Cycle

Inoculum: *Ralstonia solanacearum* (R3bv2): Infected potato tubers used as seed pieces and infected geranium cuttings used for propagation are major sources of primary inoculum. Symptomless weeds may harbor high bacterial populations that are released into streams and ditches. *Ralstonia solanacearum* (R1): R1 is endemic in the southeastern United States and inoculum sources are similar to R3bv2 but with a much larger host range.

Transmission: Potato: R3bv2 is spread by contaminated farming equipment, soil transfer, planting of infected seed pieces, insects, footwear, and irrigation water. Geranium: R3bv2 and R1 are both transmitted by propagation material, soil transfer, pruning, watering of plants, and handling in the field and production facilities.

Infection: Infection of both potato and geranium occurs through small wounds or natural openings in roots. The pathogen then colonizes the vascular tissue, causing plugging of the xylem and water stress. Aerial infection of geranium is caused by pruning and handling by workers.

Symptoms and signs: Initial symptoms on potato plants are flaccid leaves, which curl downward at the margins, followed by marginal chlorosis, necrosis, and wilt (Fig. 1). This usually is seen on young leaves on hot days and may be on one side of a leaflet or on one branch. Later, the entire plant may wilt with a general yellowing of foliage. Vascular tissues darken, leaves become necrotic, and the wilted plant collapses and dies. Rotted tubers show blackened, crusty areas (Fig. 2) and exude abundant bacterial ooze (Fig. 3). On geranium, both R1 and R3bv2 cause southern wilt with identical symptoms. Plants infected with R3bv2 are shown in Figures 4–7. Typical symptoms are wilting and yellowing of the lower leaves. As the disease progresses upward, characteristic symptoms are curled leaf margins and wilted leaves that may develop wedge-shaped chlorotic areas that become necrotic. Finally, the entire plant may become desiccated and die. Southern wilt may be difficult to detect during winter months. Higher temperatures of 85–95°F (29.4–35°C) favor disease development. The symptoms are somewhat similar to those caused by *Xanthomonas pelargonii*, but *Xanthomonas pelargonii* causes small, round leaf spots and wilt.

Survival: R3bv2 strains are tolerant to low temperatures in the highland tropics and temperate zones where potatoes are commonly grown. The pathogen survives in soil and on roots of symptomless weeds, enabling it to survive between cropping seasons. Survival of R1 strains with a wide host range is similar to information presented for *Ralstonia* diseases of solanaceous hosts and banana.

Disease Management

Potato: Planting with certified pathogen-free potato seed pieces is recommended whenever possible. When not available, principal control measures involve selection of pathogen-free tubers for seed pieces and storage under dry, cool conditions, followed by planting in fields where the disease has not previously been observed. Other cultural practices include careful use of irrigation water to avoid contamination from diseased fields and disinfestation of workers' shoes and machinery. Rotation with nonsolanaceous crops may reduce disease incidence but the required duration of rotation periods has not been established. Chemical control of bacterial brown rot is generally not feasible in contaminated soils, and disease resistance has failed at warm temperatures. R3bv2 does not occur in the United States and Canada and is regulated by a federal quarantine. It is potentially a very destructive strain because of tolerance to cool weather. It is common in the southeastern United States and is well adapted to tropical and warm weather regions.

Geranium: In areas where R3bv2 occurs, management practices are similar to those for potato. Using disease-free propagation and roguing diseased plants material are essential. There is no resistance. In the United States, quarantine regulations and eradication practices are used to prevent introduction and establishment of R3bv2. It has been detected in a few greenhouses and has been eradicated in these cases. It is a serious disease of potato and tomato in temperate regions throughout the world where it occurs.

References

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- Bradbury, J. F. 1986. Guide to Plant Pathogenic Bacteria. CAB International, Slough, U.K.
- Champoiseau, P. G., Jones, J. B., and Allen, C. 2009. *Ralstonia solanacearum* race 3 biovar 2 causes tropical losses and temperate anxieties. Online. Plant Health Progress doi: 10.1094/PHP-2009-0313-01-RV.



Figure 1. Wilting, yellowing, and stunting of potato plant (center). (Courtesy A. Hayward)



Figure 2. External symptoms on tubers. (Courtesy D. Thurston)



Figure 3. Distinct grayish brown ring and bacterial ooze from the vascular tissues of tubers. (Courtesy A. Hayward)



Figure 4. Geranium leaf with umbrella-like appearance. Lower leaves become yellow and necrotic. (Courtesy M. Daughtrey)



Figure 5. Infected vascular tissues and bacterial ooze on geranium stem. (Courtesy) M. Daughtrey



Figure 6. Stem rot and wilt of geranium. (Courtesy M. Daughtrey)



Figure 7. Browning and rot of geranium cuttings. (Courtesy M. Daughtrey)