Bacterial Wilt Host Relations

PRINCIPAL INVESTIGATOR:
Dr. David J. Norman, Department of Plant Pathology, Mid-Florida Research and Education Center, University of Florida, IFAS, Apopka, Florida 32703; E-mail: djn@ufl.edu; Phone: 407-884-2034.

PROJECT OBJECTIVES:
The bacterial wilt strain of *Ralstonia* known as Race 3, Biovar2 (R3B2) had never been reported in the United States until 1999 when it was introduced via geranium cuttings imported from Guatemala. Since R3B2 is considered a potential threat to the potato industry if the bacterium becomes established and spreads into major potato producing areas in the United States, *Ralstonia solanacearum* R3B2 was listed as one of the 10 plant pathogens in USDA's Agricultural Bioterrorism Protection Act of 2002. As a result, the recent detection of *Ralstonia solanacearum* R3B2 in the spring of 2003 on imported geranium and a subsequent outbreak in 127 nurseries in 27 states in the United States forced APHIS to destroy over 2 million geranium and other ornamentals causing an estimated $5 million losses to the geranium industry.

The objectives of our research at the University of Florida have been: 1) Genetic profiling of bacterial wilt strains entering North America and host range determination; 2) Methods for disease control by inhibiting *Ralstonia* cell division; 3) Identification of host resistance within geranium cultivars; and 4) Examining pathogenicity of *Ralstonia* populations under cool weather conditions found in temperate climates. These studies are important steps towards better understanding the pathogen and preventing the disease from becoming established in the United States. Our research provides a direct benefit to the $300 million per year geranium industry, and helps safeguard the $1.2 billion per year U.S. potato industry.

ACCOMPLISHMENTS:
Our research accomplishments are as follows:

1) Identified cultivars of scented and regal geraniums that are highly resistant to infection with R3B2. It was found that R3B2 does not colonize the roots of certain cultivars. Resistant cultivars may contribute to a breeding program to transfer this resistance to zonal geraniums. Zonal geraniums themselves were found to have varying degrees of resistance to *R. solanacearum*. (HortScience 44 (5): 1504-1508)
2) Developed rep-PCR protocols to clearly distinguish clonal populations of *R. solanacearum*. Determined that rep-PCR is the quickest and most effective way to identify the source of a *Ralstonia* outbreak when it occurs. (Phytopathology 99:1070-1077)
3) Reduced or prevented root system infection of geranium cuttings by use of phosphorous acid (H_3PO_3). Phosphorous acid inhibits *R. solanacearum* cell division. (Plant Disease 90:798-802)
4) Evaluated strains of *R. solanacearum* from indigenous populations within the United States and from commercially imported ornamental propagative plant material for in vitro multiplication at 18 °C and 30 °C. Population build up was slower at 18 ºC than at 30 ºC, although final densities were similar with all strains. This suggests that pathogenicity of *Ralstonia* in temperate climates may not be limited by cool weather. Certain biovar 1 strains

were able to infect and produce wilt symptoms on potato and tomato at 18 ºC and in some case at rates similar to strains belonging to R3B2 group. We found evidence that R3B2 strains are not unique in their ability to infect plants under cool weather conditions; other populations in other races of *R. solanacearum* also have the potential of infecting host plants under temperate conditions.

TECHNOLOGY TRANSFER/IMPACT: APHIS sanitation guidelines require the usage of purified irrigation water in offshore production facilities. If, however, any compromise to the water system occurs or if bacterial wilt enters production via any other method, we have demonstrated that infections can be prevented with applications of phosphorous acid. By the use of rep-PCR (repetitive sequences of DNA) we have been able to fingerprint populations of *Ralstonia* entering North America from offshore plant propagation facilities. This gives us ability to identify distinct clonal populations and distinguish R3B2 populations from other bacterial wilts. This protocol can accurately trace backward any epidemic. These research findings provide information necessary for prudent regulatory procedures and the development of efficient eradication procedures if outbreaks occur. A broad spectrum of geranium cultivars has been screened for their susceptibility to bacterial wilt. Zonal and ivy cultivars are most at risk while regal and scented cultivars have the highest resistance to infection. Our research findings provide a direct benefit to the $300 million/year geranium industry and the $1.2 billion/year U.S. potato industry.

ADDITIONAL FUNDING/EXTERNAL SUPPORT:
University of Florida Institute of Food and Agricultural Sciences, USDA Tropical Subtropical Agricultural Research, Caribbean (TSTAR-C) Grant Program, and The Fred C. Gloeckner Foundation.

COLLABORATORS: The following companies provided in-kind gifts of plants, potting media, and fertilizer for testing purposes. Without their generosity this research could not have been done: Agri-Starts, Inc., Apopka, Florida; Ball Horticultural Company, West Chicago, Illinois; Fischer USA, Inc., Boulder, Colorado; Goldsmith Seeds, Inc., Gilroy, California; Oglevee Ltd, Connellsville, Pennsylvania; Shady Hill Gardens, Elburn, Illinois; and Yoder Brothers, Inc., Barberton, Ohio.; Conrad Fafard, Inc., Apopka, Florida, and the Scotts Miracle-Grow Company, Marysville, Ohio.