MAR 19

Pathogen of the month – March 2019

Ralstonia solanacearum (Smith, 1896) Yabuuchi et al. 1995

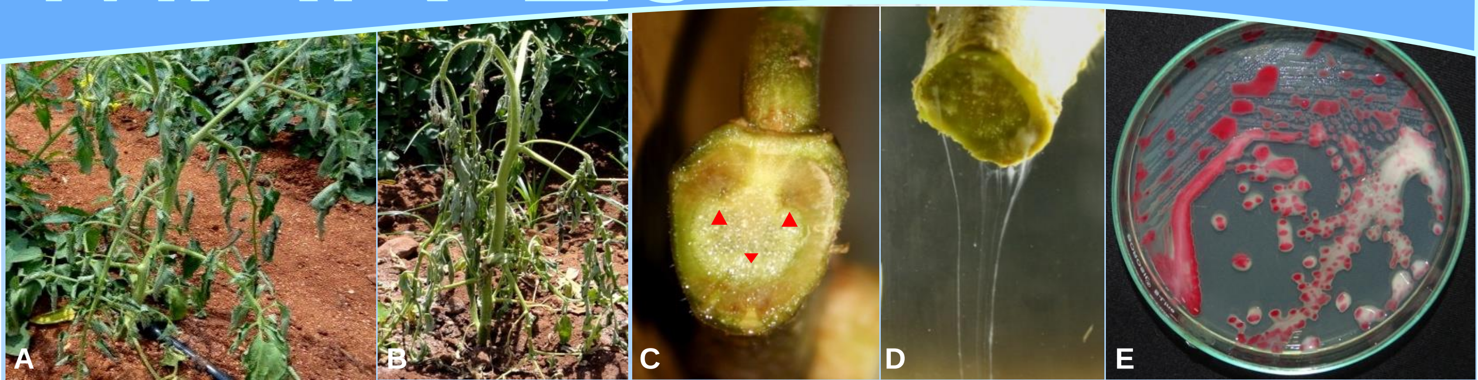

Figure 1. **(A)** Field view of bacterial wilt symptoms in tomato including sudden wilt of young foliage; **(B)** Progression of infection leads to complete wilting; **(C)** Cross section of infected stem showing vascular browning (see red arrowhead); **(D)** Typical milky white ooze or slimy strands from the cut end of infected stem; **(E)** Culture morphology of *R. solanacearum,* white fluidal colony centered with pink pigmentation on Kelman medium.

Common name: *Ralstonia solanacearum*
Disease: Bacterial Wilt of Tomato
Classification: **Kingdom:** Bacteria **Division:** **Proteobacteria** **Class:** Beta-proteobacteria
Order: Burkholderiales **Family:** Ralstoniaceac **Genus:** Ralstonia

Bacterial wilt in tomato, caused by *R. solanacearum* is a very serious disease, causing lethal effects on its host. It is ranked 2nd amongst the top ten important plant pathogenic bacteria, based on scientific and economic importance. This pathogen was introduced into tomato growing region of Tamil Nadu, a southern Indian state.

The Pathogen:

R. solanacearum (formerly, *Pseudomonas solanacearum*), the causal agent of bacterial wilt disease, was first reported by E.F. Smith in 1896 from tomato, eggplant and potato. This pathogen is a soil borne, gram-negative, aerobic and non-spore forming bacterium, infecting many economically important crop plants.

Symptomatology and Pathogen biology:

Wilting of young green foliage is the first noticeable symptom of the disease. Wilting may start on one side of the plant, progressing to the whole plant, which typically wilts without yellowing, culminating in the rotting of the stems. Characteristic ooze can be seen from the cut end of the stem when placed in a container of water, typical for *R. solanacearum* infection. This test is preliminary an easy and quick diagnostic tool and can be carried out under field conditions. *R. solanacearum* infection enters the roots through wounds, root tips and emerging lateral roots. Upon entry into the root cortex, the bacteria then spreads to the xylem where it rapidly multiplies, producing EPS (exo-polysaccharides). This leads to the blockage of the xylem vessels, accompanied by wilt symptoms and plant death. The bacteria can be spread through water, infested soil, contaminated farm equipment, root knot nematode, latently infected seeds and plant material (potato tubers).

Distribution and host range:

R. solanacearum is widely distributed in tropical, sub-tropical and warm temperate regions of the world, causing severe crop losses in almost 450 different plant hosts. Based on geographical origin, *R. solanacearum* is classified into four phylotypes: phylotype I (Asia), phylotype II (America), phylotype III (Africa) and phylotype IV (Indonesia and Australia). This pathogen is very complex in nature due to its broad host range, which include solanaceous plants (tomato, eggplant, chilli, potato, tobacco), leguminous plants (groundnut, French bean), trees and shrub (mulberry, olive, cassava, eucalyptus), ornamentals (pelargonium, anthurium, rose), few monocotyledons (banana, ginger), and model plant *Arabidopsis thaliana*. Based on host range, this pathogen can further be classified into five races; race 1 (infecting tomato, eggplant, chilli, tobacco), race 2 (moko wilt in banana), race 3 (predominantly in potato), race 4 (ginger, cardamom) and race 5 (mulberry). Among the five races, race1 is genetically and geographically more diverse in nature.

Impact:

Accurate economic impact of *R. solanacearum* is difficult to quantify, but this pathogen is extremely damaging to crops, due to its aggressiveness, wide geographical distribution with many hosts. *R. solanacearum* infection on tomato, eggplant and potato, can reduce the yield between 10-90%. In potato alone, it is estimated to cost US$1 billion in crop losses each year worldwide.

Management options:

Effective chemical management of bacterial wilt disease is not available to date, although in some countries antibiotics have shown some degree of control of this disease. Hence, alternative control options such as cultural, biological and use of resistant cultivars should be considered. Cultural control practices could include such things as avoid planting during warm weather when the soil condition remains wet for prolonged periods. Other cultural control options could include crop rotation with maize, sorghum and other grains crops, avoid irrigation from infested water sources and the use of resistant cultivars. Biological control is an option and many rhizosphere beneficial microbes eg. *Bacillus subtilis, B. amyloliquefaciens*, *P. fluorescens* and other *Pseudomonas* spp., have been reported as have some effect in the suppression of *R. solanacearum* in the field and under green house conditions. Breeding for resistance has been effective in some cases, but hampered by the evaluation of new biological races of the pathogen. Grafting of plants onto the resistant root stock of *S. torvum,* has shown to be an effective alternative management option.

Further Reading: Kelman (1954); Genin & Boucher (2002); Elphinstone (2005); Alvarez et al. (2010); Mansfield et al. (2012); Ramesh et al. (2012&16); Safni et al. (2014); Potato South Africa Factsheet (2015); Sakthivel et al. (2016&19); Bergsma-Vlami et al. (2018).

Key Contacts: **A. Balamurugan[1], M. Muthamilan[1], A. Kumar[2], K. Sakthivel[3] and M. Ashajyothi[2]**

1. Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore, India, **E- Mail:** abalamurugan555@gmail.com
2. Division of Plant Pathology, Indian Agricultural Research Institute, ICAR, New Delhi, India
3. Central Island Agricultural Research Institute, ICAR, Port Blair, Andaman & Nicobar Islands, India.