Ralstonia solanacearum Race 1 (Bacterial wilt of solanaceous crops)

1. Identity

Preferred Scientific Name:

- *Ralstonia solanacearum* race 1 (Smith 1896) Yabuuchi et al. 1996

Other Scientific Names:

- *Burkholderia solanacearum* race 1 (Smith 1896) Yabuuchi et al. 1992,
- *Pseudomonas solanacearum* race 1 (Smith 1896) Smith 1914

Common Names:

- Bacterial wilt of solanaceous crops

Taxonomic position:

- **Domain:** Bacteria,
- **Phylum:** Proteobacteria
- **Class:** Betaproteobacteria
- **Order:** Burkholderiales,
- **Family:** Ralstoniaceae

Figure 1. Wilting symptoms on young shoots of *Rosa* plants. Photo courtesy of Netherlands Plant Protection Organization

2. Hosts/Species affected

The host plants affected includes: *Arachis hypogaea* (groundnut), *Capsicum annuum* (bell pepper), *Musa* (banana), *Nicotiana tabacum* (tobacco), *Rosa* (roses), *Solanum lycopersicum* (tomato), Solanum melongena (aubergine) and *Solanum tuberosum* (potato).

3. Growth stages affected

Ralstonia solanacearum race 1 attacks the host plant during vegetative growth.

4. Biology and Ecology

High temperatures (with growth optimum of 35-37°C) and high soil moisture generally favors *Ralstonia solanacearum* race 1, the exception being certain Race 3 strains that are pathogenic on potato and are able to grow well at lower temperatures with an optimum of 27°C (CABI, 2016). The pathogen thrives in many different soil types and over a wide range of soil pH. The organism survives in infected plant materials, propagation materials, wild host plants and soil. *R. solanacearum* race 1 infects host plants through their roots by entering through wounds formed by lateral root emergence or by root damage caused by handling or soil borne organisms such as the root-knot nematode. The bacterium can also enter plants by way of stem injuries resulting from insects, handling or tools. Sources of inoculums include: Contaminated irrigation systems, infested soil, latently infected weeds in and around fields, contaminated farm equipment, contaminated planting material, propagating infected plants, taking cuttings without disinfecting implements between plants, pinching buds of plants without sanitizing, transfer of contaminated soil (on equipment or shoes) to disease-free areas and generally Poor Phytosanitary protocols.

5. Symptoms

On Rosa plants, stems develop black discoloration and necrosis. Leaves and young shoots become chlorotic and wilt eventually the entire plant withers away.

Figure 2: Necrotic stems and brown discoloration of stems on Rosa. Photo courtesy of Netherlands Plant Protection Organization

6. Means of movement and dispersal

R. solanacearum race 1 is spread mainly through movement of infected planting material and through contaminated water.

7. Movement in Trade

In trade the pathogen is spread by latently infected seed potatoes and other vegetative propagating materials. Infection of true seed has been established also in groundnuts (Kelman

et al., 1994; Singh, 1995). Growing medium accompanying plants is also known to transmit the pathogen during movement in trade.

8. Impact

In the Philippines, in 1966-1968 average losses of 15% in tomatoes, 10% in aubergines and Capsicum and 2-5% in tobacco were recorded (Zehr, 1969).

9. Phytosanitary significance

Ralstonia solanacearum race 1 is categorized in A2 List of pests recommended for regulation as quarantine pests in the EPPO region in plants for planting (EPPO, 2016). It also has quarantine significance for Asia and Pacific Plant Protection Commission (APPPC) and the Inter-African Phytosanitary Council (IAPSC). *Ralstonia solanacearum* race 1is reported as present in Kenya commonly affecting solanaceous crops and weeds. So far it has not been reported on roses. It is one of the regulated pests in regard to importation of Rosa plants into Kenya.

10. Detection and inspection

Potato tubers can be visually checked for internal symptoms by cross sectional cutting. In the field, symptoms on infected plants can be looked out for and confirmed through Bacterial streaming test. In bacterial streaming, a stem section is cut from a plant with vascular discoloration using a sharp knife or razor blade. The stem section is placed against the inside wall of a water-filled clear beaker or test tube so that the end of the section just touches the water surface. Milky white strands containing bacteria and extracellular polysaccharide will stream from the cut ends of the xylem. Other diagnostic screening tests in the laboratory include Serological test, Use of semi-selective medium (SMSA) and DNA-based methods such as Real-Time PCR

11. Management

Cultural control

- Greenhouse spread is controlled by application of exclusionary and Phytosanitary practices including avoidance of ebb-and-flow and flooding irrigation systems.
- Growing and propagating from pathogen-free stock material

- Use of sterilized soil or other media to establish stock plants that are tested and known to be free from *Ralstonia solanacearum* race 1
- Rogueing and appropriately discarding infected plants

Chemical control

- Metam sodium (510g/L) is registered in Kenya as a pre-plant soil disinfectant for control of bacterial wilt in tomatoes.
- Bronopol (27%w/w) is also registered in Kenya as an agricultural bactericide for the control of bacterial wilt in tomatoes and potatoes

12. References

CABI, 2016. Crop Protection Compendium, 2016 Edition. © CAB International Publishing Wallingford, UK. www.cabi.org. Retrieved on 27th October 2016

EPPO, 2016. EPPO A2 List of pests recommended for regulation as quarantine pests. https://www.eppo.int/QUARANTINE/listA2.htm. Accessed on 28Th October 2017

Kelman,A.; Hartman, G.L.; Hayward, A.C. (1994) Introduction. In: Bacterial wilt: the disease and its causative agent, Pseudomonas solanacearum (Ed. by Hayward, A.C.; Hartman, G.L.), pp. 1-7. CAB International, Wallingford, UK.

Singh, R. (1995) Seed transmission studies with Pseudomonas solanacearum in tomato and eggplant. ACIAR Bacterial Wilt Newsletter No. 11, pp. 12-13.

Zehr, E.I. (1969) Studies of the distribution and economic importance of Pseudomonas solanacearum in certain crops in the Philippines. Philippine Agriculturist 53, 218-223.