1. PaDIL Species Factsheet

Scientific Name:
*Ralstonia solanacearum* (Smith 1896) Yabuuchi et al. 1996 race 2
(Bacteria: Proteobacteria: Burkholderiales: Burkholderiaceae)

Common Name
Moko disease of banana

Image Library
Australian Biosecurity

Partners for Australian Biosecurity image library

- Museum Victoria

- CRC National Plant Biosecurity

- Plant Health Australia

- Department of Agriculture, Fisheries and Forestry

- Department of Agriculture and Food, Western Australia
2. Species Information

2.1. Details

**Specimen Contact:** Dr Jose R. Liberato - jose.liberato@nt.gov.au  
**Author:** Liberato JR & Gasparotto L  
**Citation:** Liberato JR & Gasparotto L (2006) Moko disease of banana (*Ralstonia solanacearum*) Updated on 7/27/2016 Available online: PaDIL - http://www.padil.gov.au  
**Image Use:** Free for use under the Creative Commons Attribution 3.0 Australia licence

2.2. URL

Live link: http://www.padil.gov.au:80/pests-and-diseases/Pest/Main/136650

2.3. Facets

**Status:** Exotic Regulated Pest - absent from Australia  
**Group:** Bacteria  
**Commodity Overview:** Horticulture  
**Commodity Type:** Fresh Fruit  
**Distribution:** USA and Canada, Central and South America, Africa, South and South-East Asia

2.4. Other Names

*Burkholderia solanacearum* (Smith 1896) Yabuuchi et al. 1993 race 2  
*Pseudomonas solanacearum* (Smith 1896) Smith 1914 race 2

2.5. Diagnostic Notes

The bacteria:

Moko disease is a bacterial wilt caused by *Ralstonia solanacearum* invading the vascular tissues of hosts. *Ralstonia solanacearum* is a species complex with exceptional diversity amongst strains from different hosts and geographical origins. Many strains have less than 70% DNA-DNA homology, which has been considered a threshold level within a species. A general description of this species was provided by Saddler (1994). A detailed summation of identification techniques for *R. solanacearum* can be found in the European and Mediterranean Plant Protection Organisation Bulletin (2005). Strains of *R. solanacearum* have been divided into five host-specific races and five biovars based on biochemical properties. Both classifications do not consistently correspond with each other (Hayward 1991, 1994). The term race is misused for *R. solanacearum* and means pathovar. Race 2 is pathogenic to banana and Heliconia. The race 2 strains cluster into three multi-locus genotypes: MLGs 24, 25 and 28 (Cook & Sequeira 1994); and are also classified in nine ecotypes groups: A, AFV, B, D, H, R, SFR, SFR-C and T (Thwaites et al. 2000, French & Sequeira (1970). Fegan & Prior (2005) proposed a hierarchical classification for *R. solanacearum*, based on phylogenetic analysis of 16S-23S ITS and endoglucanase gene sequences, where race 2 strains belong to Phylotype II, sequevars 3, 4 and 6. Prior & Fegan (2005) has developed a multiplex PCR technique for identification of the race 2 strains. Race 2 occurs mainly in tropical areas from South and Central America causing moko and in the Philippines, causing bugtok disease. According to Fegan (2005), bugtok, which is only know in the Philippines, and moko are one and the same disease.

**Note:**
Additional synonyms for R. solanacearum are listed by Saddler (1994).

Symptoms:

The symptoms of moko disease are very similar to those of banana blood disease (BDB), caused by blood disease bacterium, which is considered a member of the R. solanacearum species complex, belonging to phytotype IV (Fegan & Prior 2005, 2006). Usually, it is not possible to distinguish moko and BDB based on the symptoms. Bacterial wilt and Fusarium wilt of banana can be distinguished as in Fusarium wilt there are no symptoms on fruits and no bacterial ooze.

Fruit rot and fruit stalk discoloration as well as wilting or blackened regrowth suckers are characteristic (non-exclusive) symptoms for moko. On young plants, wilt can progress rapidly. It can take a week or less from the initial symptoms to the collapse of the plant. Light to dark brown vascular discoloration occur in the pseudostem, rhizome and in sheaths of the leaves. Bacterial ooze may exude as droplets from the cut surface of vascular tissues, mainly in the peduncle or pseudostem. Fruit can be smaller and the fruit pulp can show a firm brown or gray rot. The sequence of symptoms depends on the route of infection and the ecotype of bacterial strain. If the infection occurs via the roots and rhizomes, yellowing and wilting of the oldest leaves will occur first and the plant will collapse. Bacterial ooze of some strains (mainly A, SFR, and SFR-C) can occur in the male inflorescence and the disease can be transmitted by insects visiting these flowers. In this case, the symptoms occur initially in the flowers bud and peduncles, which become blackened and shrivelled. The bacteria spread to the fruit causing internal rot. Eventually, the entire plant is infected and collapse. Some strains cause less severe symptoms. (Buddenhagen 1961, 1994, Stover 1972, Thwaites et al. 2000).

2.6. References

3. Diagnostic Images

**Wilting of adult plants**

**Host Symptoms:** Dr Luadir Gasparotto

*Embrapa*

**Wilting of young plant**

**Host Symptoms:** Dr Luadir Gasparotto

*Embrapa*

**Vascular discoloration on peduncle**

**Host Symptoms:** Dr Luadir Gasparotto

*Embrapa*

**Vascular discoloration on peduncle**

**Host Symptoms:** Dr Luadir Gasparotto

*Embrapa*

**Fruit internal rot**

**Host symptoms - fruit:** Dr Luadir Gasparotto

*Embrapa*

**Fruit internal rot**

**Host symptoms - fruit:** Dr Luadir Gasparotto

*Embrapa*
Results Generated:
Monday, February 17, 2020