Acidovorax anthurii

Introduction

Anthurium bacterial leaf spot was first reported by Prior and Rott (1989) from Martinique and Guadeloupe. The causal agent was identified as possibly a new species of *Pseudomonas*, since it could readily be distinguished from other plant pathogenic pseudomonads by a number of morphological and physiological characteristics.

In 1992 a similar disease was reported from Trinidad and attributed to *Pseudomonas* sp. (Dilbar, 1992). Three years later Saddler et al., (1995) studied a number of isolates from diseased anthuriums from Trinidad, using chemotaxonomic and molecular methods in order to determine the identity of the causal agent. On the basis of certain standard morphological and biochemical tests as well as fatty acid and PCR-RAPD analyses, the authors concluded that the leaf spot pathogen had strong similarities to the genus, *Acidovorax*. This provisional identification was confirmed by Gardan et al., (2000) following an exhaustive study designed to produce a full taxonomic description of the bacterium. This was completed and the name, *Acidovorax anthurii*, was proposed.

Identity

Authority : Gardan
Classification
- Kingdom : Procaryotae
- Phylum : Gracilicutes
- Class : Proteobacteria (ß – subclass)
- Family : Comamonadaceae
- Genus : *Acidovorax*
- Species : *anthurii*
- Synonyms : *Pseudomonas* sp.
- Common names : Anthurium bacterial leaf spot, bacterial leaf spot of anthurium, Pseudomonas leaf spot of anthurium
- Role : Pest

The first, complete description of the causal agent of anthurium bacterial leaf spot was published by Gardan et al., (2000). The pathogen was named *Acidovorax anthurii* sp. nov. The genus, *Acidovorax*, was originally proposed by Willems et al., (1990) and, in 1992, a further proposal was made to transfer several plant pathogens from the genus, *Pseudomonas*, to the new genus, as subspecies of *A. avenae* (Willems et al., 1992). The reasons were that a) all *Acidovorax* sp. form a separate subclass, based on features of their rRNA and b) the *Acidovorax* genus can be distinguished phenotypically from other taxa in the acidovorans rRNA complex. A new family, Comamonadaceae, was proposed for these taxa, which are in the β-subclass of the Proteobacteria. Similarities, in fatty acid profiles, in the results of RAPD analyses and in the nature of the single hydroxy fatty acid found in all isolates, between some of the pseudomonads that were transferred to the

genus, *Acidovorax,* and the Trinidad isolates of the anthurium pathogen were demonstrated by Saddler et al., (1995).

Signs & Symptoms

Early symptoms are small, angular, water-soaked spots located near veins and leaf margins on the lower surface of leaves and on spathes (Fig. 1). Initial spots enlarge rapidly into black, necrotic areas which later turn greyish- black. Infected leaves may be distorted, a symptom that is expressed on leaves that are infected at an early stage of development and on certain varieties. The necrotic areas are surrounded by narrow, water-soaked and chlorotic borders (Fig. 1). The halos around lesions on spathes are violet in colour. Under humid conditions that often exist especially before sunrise in shade houses or outdoor locations in the rainy season, a slimy, bacterial ooze from the margins of lesions can be observed (Fig.2). The pathogen has a systemic phase, which is manifested as a general chlorosis of the leaf lamina accompanied by characteristic brown to black necrosis of the petiole and main veins. Water-soaked symptoms bordering veins in the earlier stages are clearly visible (Fig. 3,4). Systemic infection terminates in soft rotting of tissues of the stem and of leaf and spathe petioles, abscission and death of the plant.

Morphology

The exhaustive study conducted by Gardan et al., (2000) demonstrated unequivocally that the anthurium bacterial leaf spot pathogen was a new species of the genus, *Acidovorax*. The description of *Acidovorax anthurii* sp. nov. is as follows:

> "On YBGA, colonies are circular, raised with an entire margin and white-creamy and brown diffusible pigment is produced. Cells are gram-negative, straight rods, 0.2-0.7 x 1.0-5.0µm, motile by a polar flagellum. Oxidase, catalase and urease are positive. Strictly aerobic, poly-β-hydroxybutyrate is accumulated in the cell, arginine is used as sole source of carbon. H_2S is produced from cysteine and cellulose is hydrolysed. Indole, levane and acetoin are not produced. Casein and aesculin are not hydrolysed. Acid is produced from galactose, arabinose and glycerol. Acetate, formiate, glycerol, DL-5-amimobutyrate, D (-) tartrate and azelate are utilized. Trehalose, caprylate, D-ribose, D-glucose, N-acetyl glucosamine, L-arginine, saccharose, inositol, sarcosine, itaconate, D-xylose, L-triyptophan, aesculin and mannitol are utilized. The sole hydroxylated fatty acid present is 3-hydroxy-decanoic acid. The G + C content of the strain CFBP 3232^T determined by thermal denaturation method is 63.5 mol%. All strains elicit a hypersensitive reaction on tobacco leaves (HR) and are pathogenic on anthurium, producing typical leaf-spot symptoms. The type strain has been deposited in the CFBP, Angers, France as CFBP 3232^T."

Biology & Epidemiology

To date, there is no published report on the epidemiology of *A. anthurii*.

Observations on the disease in shade houses in both Martinique/Guadeloupe and Trinidad indicated that infection levels are higher in the rainy season. Splashing rain or irrigation by sprinklers serve to disseminate the bacterium onto foliage and systemic infection results from contamination of the substrate, presumably by bacteria washed from infected foliage. Prior and Rott (1989) were able to establish systemic infection by incorporating bacterial suspensions into a bagasse substrate before transplanting healthy anthuriums. Foliar symptoms in artificially infected plants appeared within 5-6 days, when humidity was maintained at 75-100% at temperatures of 25-28 C. Typical symptoms of systemic infection were observed within 3 weeks after transplanting and plant death occurred in 5 weeks.

Local introduction of the disease into uninfected farms and longer- range dissemination would be by man, through the movement of infected planting material. Within farms and individual beds it is likely that the bacterium is moved on the hands and apparel of workers, on tools and on equipment used in cultural operations.

Dispersal / vectors

Splashing rain or irrigation by sprinklers can disseminate the bacterium onto foliage and systemic infection results from contamination of the substrate. Introduction of the disease into uninfected areas would be by man.

Management

At the present knowledge of anthurium bacterial leaf spot, management strategies should focus on reducing the inoculum and the possibilities for dissemination.
The following come to mind:

1. Locate houses to make the best use of natural airflows.
2. Ensure that planting material is free of the pathogen. Every source should be suspect until proven otherwise.
3. Conduct regular testing of all varieties being offered by suppliers and plant only those that show the highest levels of resistance.
4. Practise the most thorough sanitation in the production of the crop:
    - Isolate cultural operations (including harvesting), in any house(s) where the disease is present, from uninfected houses by scheduling operations in clean houses first and by performing any activity with the aim of attending to the houses in ascending order of infection level.
    - Disinfect tools with 70% ethanol for 3 min or with any other appropriate sterilant, e.g., formaldehyde.
    - Remove infected leaves, spathes and systemically infected plants, placing all prunings in plastic bags for immediate removal.
    - Handle infected plants with gloves.
    - Schedule irrigation to allow time for all plants to be dry 2 hr before sunset.
    - Provide foot baths in every house and ensure workers use them.

- Support research with money or in kind and express the needs of growers in meetings with researchers.

- Seek information on any improvements in anthurium production.
- Keep notes of observations made at all growth stages of the crop; note differences in varietal performance.

Host Notes

Hybrid Anthurium spp., *A. martinicense, Dieffenbachia seguine* (artificial inoculation)

Distribution

To date, anthurium bacterial leaf spot has been reported only from Martinique, Guadeloupe and Trinidad. In these countries the disease causes significant damage; on some farms losses are severe even where cultural methods are carefully executed. The disease occurs only on hybrid *Anthurium* spp. in Trinidad, but the pathogen has been isolated also from *Anthurium martinicense* in Guadeloupe. Differences in varietal susceptibility among the hybrids have been observed, but none is resistant.

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Fig. 1: Anthurium leaf showing early symptom of bacterial leaf spot caused by ***Acidovorax anthurii.***

Fig. 2: Droplets of bacterial ooze from spots on anthurium leaf infected by ***Acidovorax anthurii.***

Fig. 3: Anthurium leaf showing necrosis of the veins due to systemic infection by ***Acidovorax anthurii.***

Fig. 4: Anthurium leaf showing necrosis of the laminar and chlorosis typical of advanced stage of systemic infection by ***Acidovorax anthurii.***

NOTE:

- **Figures 1, 3 and 4:** After: Annelle Holder (2000), [Poster]: ***Development of a method of Screening Resistance in Anthurium andraeanum, to Bacterial leaf spot (Acidovorax anthurii);*** NIHERST 11th Conference of Agricultural Research and Development in Trinidad and Tobago.

- **Figure 2:** From Assim Dilbar (1992) [Thesis]: ***Studies on a new bacterial disease and other diseases of Anthurium in Trinidad***.