MiSAC matters
MICROBIOLOGY IN SCHOOLS ADVISORY COMMITTEE
50th Anniversary Articles

‘What – no bananas today?’

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The ability to grow crop plants together in high densities gives abundant yields to feed large populations, but also provides ideal conditions for the spread of pathogens.

In 1874 banana wilt disease, caused by the soil borne pathogenic fungus *Fusarium oxysporum* f. sp. c*ubense,* was reported from Eagle Farm, Brisbane, Australia. It was next reported from Panama in 1890 and within ten years it was found to have infected banana plantations in most Central American countries and the Caribbean and was commonly known as Panama disease. By 1950 production of the popular banana cultivar Gros Michel became non-viable and the pathogenic isolates causing the disease became classified as race1.

Figure 1. Photograph showing *Fusarium* wilt (Panama disease) of banana. *Fusarium oxysporum* f. sp. *cubense* race 1 causing wilt and rapid yellowing of leaves. Photo by Scot Nelson 2018. (https://www.flickr.com/photos/scotnelson).

The fungus enters the plant through the roots and invades the vascular system causing the older leaves to turn yellow; as the disease progresses they collapse and form a skirt of dead leaves around the lower part of the plant. Splitting of the pseudostem is also a common symptom. The xylem vessels become severely discoloured and eventually become blocked preventing water getting to the aerial parts of the plant, which then die.

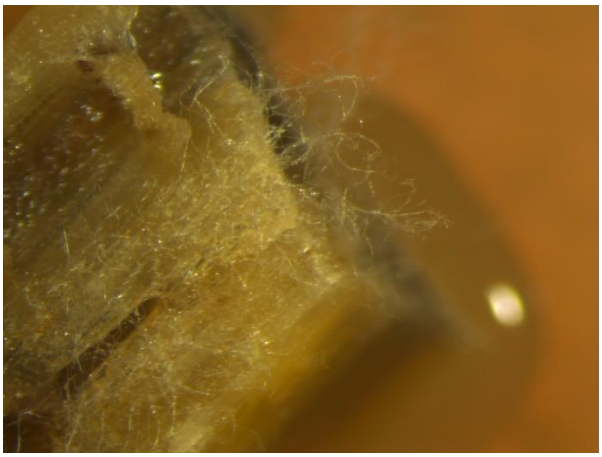

Figure 2. *Fusarium oxysporum* f. sp. *cubense* race 1 (Foc) mycelium emerging from infected banana pseudostem section after 24 hours incubation. Photo Scot Nelson.

The fungus can survive in the soil for decades even in the absence of banana plants and can re-infect from infected material or spores in the water, infected soil or alternative host plants. To reduce the impact of the disease fresh plantations were frequently established by clearing of tropical rain forests, causing severe environmental damage. To combat the disease in the plantations of Central America and the Caribbean cultivars of Cavendish, a different variety of banana which exhibited resistance to race 1 pathogen, were planted in

place of the highly susceptible Gros Michel and this enabled banana growing to continue in these countries. When symptoms of *Fusarium* wilt were later observed in Cavendish cultivars the isolates were classified as race 4. These were subsequently subdivided into subtropical race 4 (STR4) and tropical race (TR4).

When TR4 started affecting commercial plantations of Cavendish cultivars in the 1960s it resulted in the massive decline in banana exports from Taiwan to Japan. Later, the arrival of TR4 in Indonesia and Malaysia in the 1990s destroyed recently developed export plantations within a few years and by the late 1990s TR4 had wiped out most of the banana plantations in Northern Territory, Australia. Then on 4 March 2015 it was announced that TR4 had been detected on a Northern Queensland farm. Since around 95% of Australia's bananas are grown in Northern Queensland the arrival of TR4 was an economic disaster for an industry valued at over 600 million Australian Dollars. The farm in Northern Queensland where TR4 was detected was quarantined and movement of banana plant material from Northern Territory to Queensland prohibited. TR4 has also decimated banana production in the Philippines and arrived in Africa when it was reported for the first time in November 2013 in Madagascar. It is now widely established throughout banana plantations in Africa.

Bananas are grown in 135 countries and the vast majority of producers are small-hold farmers who cultivate the crop for home consumption or for sale in local markets. Although the annual global banana export market is valued at over 10 billion US Dollars, the social consequences of banana wilt caused by *Fusarium* will be severe as they are an important source of food, income and employment in many tropical countries. What is the future for the banana? A favourite food in developed nations: will they soon be eaten only on special occasions or not at all?

AUTHOR PROFILE

Anthony Whalley is Emeritus Professor of Mycology at Liverpool John Moores University and visiting professor at Chulalongkorn University, Bangkok, Thailand, where he is active in research and student supervision. He is past president of the British Mycological Society and is currently the society's International Advisor. His research interests are in the ecology, metabolites and taxonomy of ascomycete fungi, the study of which has led to extensive collaboration with international institutes, particularly in Asia and Australia.