Plant Pathology Seminar Series

"Global emergence of *Fusarium oxysporum* f. sp. *cubense* (*Foc*) tropical race 4"

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Although banana (*Musa* spp.) is widely grown worldwide, it is thought to have originated in East Asia and Oceania. Currently, banana is the 8th most important food commodity grown worldwide. Among the different banana types, the Cavendish banana (*M. acuminata*) is extensively grown, accounting for approximately 47 percent of global banana production (FAOSTAT, 2018). Banana is susceptible to a wide range of pathogens. Among them, the soil-borne fungal pathogen, *Fusarium oxysporum* f. sp. *cubense* (*Foc*), causes fusarium wilt or panama disease. In the early 20th Century, Gros Michel (*M. acuminata*-AAA group) was the principal dessert banana cultivar grown in Central America and the Caribbean. However, by the 1950's, this cultivar was decimated by *Fusarium oxysporum* f. sp. *cubense* Race1 (*Foc* Race1). *Foc* Race1 was controlled through the introduction of the resistant Cavendish banana (*M. acuminata*-subgroup of the AAA group), which has become the main dessert cultivar planted for commercial production. Recently, a new variant of *Fusarium oxysporum* f. sp. *cubense* has emerged that is able to overcome the resistance of Cavendish. This *Foc* race has been identified as Tropical Race 4 (*Foc* TR4) and has become a serious threat to the production of Cavendish banana worldwide (Ploetz, 2006b).

Foc TR4 has caused substantial losses to susceptible Cavendish bananas in five Asian countries including the Philippines, Malaysia, China, Indonesia and Taiwan and Australia (Ploetz, 2006). Recent reports of *Foc* TR4 in the Middle East and Lebanon, Pakistan, Laos, Vietnam and Myanmar and Mozambique indicate that this race is spreading and threatening banana production worldwide (Zheng et al. 2018). Similar to other *Foc* races, the pathogen infects banana roots, colonizes and occludes the xylem vessels and causes a reddish-brown discoloration of the rhizome and pseudostem. Before the plant exhibits wilting symptoms, leaves of infected plants become bright yellow and collapse around the pseudostem. Heterokaryon compatibility has been used to characterize vegetative compatibility groups (VCGs) in *Fusarium oxysporum* f. sp. *cubense* populations. Among 24 known VCGs, *Foc* TR4 belongs to a single group, VCG 01213 (Koenig et al. 1997). The pathogen can survive as chlamydospores in the soil for more than 20 years which complicates disease control. The fungus can be disseminated via infected planting material, weeds (*Chloris inflata* and *Euphorbia heterophylla),* banana weevil *(Cosmopolites sordidus)*, contaminated farm tools, soil, and irrigation water.

Rapid detection of *Foc* TR4 using PCR is helping to enforce quarantine measures for preventing spread via infected plant materials. Effective long-term management of fusarium wilt is challenging due to the perennial nature of bananas, long-lived primary inoculum and the lack of efficacy of chemical and biological control methods. Genetic resistance remains the primary tool for managing this disease in which somaclonal variants of cultivar Giant Cavendish have shown tolerance to infection by *Foc* TR4 with minimal impact on fruit yield and quality (Hwang and Ko, 2004). In field studies conducted recently in Australia, transgenic banana lines showed resistance to *Foc* TR4 (Dale et al. 2017). Currently, strict quarantine regulations and the use of pathogen-free planting material are recommended to prevent the spread of *Foc* TR4. In the longer-term, the deployment of resistant cultivars with novel sources of resistance will be required for sustainable cultivation of bananas worldwide.

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