Plant Pathology Seminar Series

“Panama Disease Threatens Banana Production”

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Panama disease (*Musa* spp.), caused by *Fusarium oxysporum* f. sp. *cubense* (Foc), is responsible for one of the worst plant disease epidemics in history and continues to cause enormous losses in banana production in regions of SE Asia and Africa (Ploetz, 2005). The pathogen directly penetrates the roots and rhizome of the banana plant, an herbaceous perennial. The fungus infects the vasculature and conidia are translocated to the pseudostem and leaf tissue where mycelium colonizes necrotic plant tissue. Characteristic chlorosis and wilt symptoms observed on older leaves may be the first visual evidence of Foc infection (Ploetz, 2015). An emergent variant, Foc tropical race 4 (TR4), poses a real threat to production for smallholder farmers who rely on dessert banana and plantain as staple foods and a ready source of income (Ghag and Ganapathi, 2017). The vulnerability of banana production is due in part to the narrow genetic base for dessert banana and plantain cultivars grown worldwide (Ploetz, 2005). Another factor is the human movement of Foc TR4 infested plant materials (Ploetz, 2015). Smallholder farmers generally source planting materials locally (Karangwa et al., 2016). Movement of the Foc TR4 from its center of origin in Indonesia to Taiwan, China, Africa, the Philippines, and Australia has occurred rapidly (Ordonez et al., 2015). The pathogen spreads undetected to new locations in shipments of rhizome planting stocks and leaf debris, irrigation water and streams, and in attached soil on shoes, animal hooves, and farm tools (Ploetz, 2015). Insidious infection of vegetative planting materials requires detection of the pathogen using molecular diagnostic tools (Dita et al., 2010). The re-sequencing data of an international collection of Foc TR4 isolates with the reference genome sequence of Foc TR4 strain II5 reveals a low percentage of single nucleotide polymorphisms (SNPs) (ca. 0.01%). In addition to the SNPs dataset, the highly similar set of 4,298 DArTseq markers produced by the genome-wide genotype-by-sequencing analyses suggests the dispersal of a single clone (Ordonez et al., 2015). A multiplex PCR assay targets the intergenic spacer region of Foc TR4 present in plant tissue, water, and soil samples. The diagnostic tool remains a good option for reliable and rapid detection (Dita et al., 2010). Prompt quarantine measures, good farm hygiene, and eradication of infected plant tissue are the primary approaches to slow the spread (Ploetz, 2005). Two cultural control strategies, namely intercropping with Chinese leek (*Allium* spp.) (Wibowo et al., 2016) and annual cropping of tissue culture plantlets, have had mixed results (Ploetz, 2015). Banana breeding for resistant cultivars to Foc TR4 is a challenge due to triploidy and parthenocarpic fruit development (Ghag and Ganapathi, 2017). Successful resistant breeding efforts are also hindered by low consumer acceptance of new fruit traits (Ploetz, 2015). Genetic engineering for resistance to Foc TR4 is an important focus of current research (Ploetz, 2015).

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