Risk assessment of Eastern African Highland Bananas and Plantains against *Fusarium oxsporum* f. sp. *cubense (Foc)* Tropical race 4 (TR4)

A.B.Molina[1], E.G.Fabregar[2], D. Karamura[3], E.B.Ramillete[2] and V.O.Sinohin[1]

[1]Bioversity International- Asia Pacific, Los Baños, Laguna, Philippines; [2]Lapanday Foods Corporation, Davao City, Philippines; [3] Bioversity International- Regional Office, Kampala, Uganda, Musa Programme

Introduction

Fusarium wilt of banana has widely been considered as one of the most devastating diseases in agricultural history, until resistant banana cultivars replaced susceptible ones in Central America. New outbreaks of the disease in Asia, caused by *Fusarium oxysporum* f. sp. *cubense* (*Foc*) tropical race 4 (TR4), have raised concerns that the disease is, and again, threatening banana production in the world. Of particular concern is the threat to food security in Africa, where the East African Highland bananas (EAHB) and plantains form the staple diet and only source of income to millions of Africans.

The study was conducted to establish the resistance of EAHBs and other plantains to Foc TR4 in collaboration with African and Asian research institutions under the coordination of Bioversity International. The outcome of this project will be of great significance not only to Africans, but also to the Americas, where plantain is widely grown. The research proposed here is a pro-active effort to prepare Africa against the potential introduction of Foc TR4 into the continent, and to select or develop material with resistance to the pathogen.

Nine important African cultivars, one Philippine local cultivar and two common Cavendish cultivars as susceptible checks were evaluated in *Foc* TR4-infested farm in Davao City, Philippines. The 9 African cultivars and 1 Cavendish cultivar (Williams) were provided by the International Transit Centre (ITC) of Bioversity International in Leuven, Belgium (Table 1).

Table 1. Evaluated African and Cavendish cultivars for resistance to Fusarium wilt Tropical race 4 in Davao City, Philippines

ITC Code	Cultivar	Genome	SubGroup
ITC0081	Igitsiri	AAA	EAHB
ITC0084	Mbwazirumi	AAA	EAHB
ITC0166	Ingagara	AAA	EAHB
ITC0179	Inkira	AAA	EAHB
ITC0217	Akpakpak	AAB	Plantain
ITC0519	Obubit Ntanga	AAB	Plantain
ITC1354	Enzirabahima	AAA	EAHB
ITC1355	Kazirakwe	AAA	EAHB
ITC1465	Ibwi	AAA	EAHB
ITC0570	Williams	AAA	Cavendish
	Lakatan	AAA	Lakatan
	Gran naine	AAA	Cavendish

Methodology

The study was conducted to evaluate the resistance of 9 African banana cultivars and 2 common Cavendish cultivars (as susceptible checks) against Foc TR4 in a heavily infested commercial farm in Davao City, Philippines. The experiment was conducted at Callawa, Davao City, located at 7°11'47"N Lat and 125°33'57"E Long, approximately 22m above sea level. Davao City is characterized by a uniform distribution of rainfall, temperature, humidity and air pressure. It has no pronounced wet or dry season. Weather predictability makes it highly conducive to agricultural production. Temperature ranges from 21 to 35 degrees Celsius and average rainfall is up to 2,000 mm yearly. The trial was planted from July to September 2011, set up in RCBD, with 20 plants/cultivar/plot, replicated 5 times.

Field resistance/susceptibility reactions of the various cultivars were evaluated by assessing the incidence of Foc infection on a weekly basis. Infection was determined based on the typical Foc external symptoms that include yellowing of leaves starting at older leaves and/or pseudostem splitting. Once the plants show apparent symptoms, they are cut down cross-sectionally at pseudostem level to verify internal vascular discolorations indicative of Foc infection. Plants positive for *Foc* infection were recorded and subsequently eradicated. TR4 was verified by isolating the pathogen from infected pseudostem samples and tested against the primer of VCG 01213/16 developed by Dita *et al* (2010).

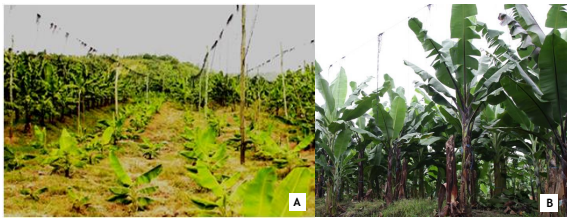

Figure 1. Field evaluation of the African cultivars and common Cavendish cultivars against Fusarium wilt tropical race 4: (A) newly planted experimental area; (B) 14-month old plants of Kazirakwe (Davao City, Philippines)

Results & Discussions

Disease incidence: Table 2 shows the number of Fusarium wilt infected plants observed from 8-month old plants in the experimental plots. Highest Fusarium wilt disease incidence was observed from two local Cavendish cultivars (Williams and Grand Naine). The rest of the evaluated African cultivars had less than 10% disease incidence, except for the cultivar Ibwi. Zero Fusairum wilt disease incidence was observed on the cultivar Obubit Ntanga. Other common banana diseases such as Moko and banana bunchy top disease were also observed to have infected the cultivars (Figure 2).

From these preliminary results, it was found that, despite of the low disease incidences observed, the EAHB cultivars and one African plantain evaluated at Davao City (22m asl) can be infected with *Foc* TR4. The variety Ibwi showed the highest incidence among the African cultivars. The EAHB varieties and plantains, however, are much less affected compared with the susceptible commercial varieties in the Philippines that were used as checks. This being the case, the African varieties may be less at risk to TR4 compared with the susceptible varieties in the Philippines. Nonetheless, more extensive evaluation studies need to be done to confirm these preliminary results.

Table 2. Fusarium wilt and other disease incidence observed of the African and Cavendish cultivars in Davao City, Philippines (2011 to 2012)

Variety	Fusarium wilt incidence (%)	Moko disease Incidence (%)	Bunchy Top Disease incidence (%)
Igitsiri	3	0	0
Mbwazirumi	2	2	7
Ingagara	5	0	2
Inkira	4	0	0
Akpakpak	1	0	0
Obubit Ntanga	0	0	0
Enzirabahima	1	0	1
Kazirakwe	1	0	6
Ibwi	29	0	11
Williams	46	0	3
Lakatan	91	0	5
Gran Naine	66	1	4

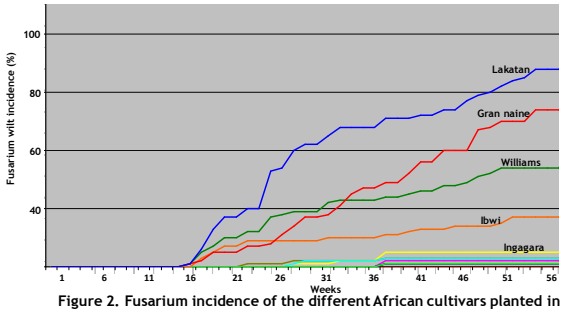

Figure 2. Fusarium incidence of the different African cultivars planted in Davao City, Philippines (2011-2012)

Figure 3. Whole plant and bunch pictures of selected African cultivars evaluated against *Foc* TR4 in Davao City, Philippines

Poster paper presented during the International Banana Symposium, 19-22 November 2012, The Lees Hotel, Taiwan