

Preliminary evaluation of IMTP-III varieties and local cultivars against fusarium wilt disease in South China

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Fusarium wilt caused by *Fusarium oxysporum f. sp. cubense* (Foc) is an important disease in the banana-producing areas of South China. Although Foc race 1 is believed to have been in China earlier, it was only officially reported in 1996 (Qi 2001). This race has been seriously attacking the popular local variety 'Fenjiao' (ABB, Pisang Awak).

Fusarium wilt infection on 'Cavendish' was reported in localized areas in Panyu District in the late 1990s. Believed to be Foc race 4, this pathogen is regarded as economically important because of its damage to 'Cavendish'. Recently, some infections were observed on Cavendish farms in Qionghshan and Sanya, Hainan Province (Linbing 2003). Heavy infections were similarly observed in Zhongshan City, Panyu District, Dongguang City, along the Delta Pearl River.

The increasing epidemic of fusarium wilt on Cavendish plantations poses a real threat to the 90% predominantly Cavendish banana industry in South China. In an effort to develop an effective IPM strategy against this disease, a collaborative study between the Guangdong Academy of Agricultural Sciences (GDAAS) and the International Network for the Improvement of Bananas and Plantain (INIBAP) was initiated in 2003. Improved varieties being evaluated through the International *Musa* Testing Programme (IMTP), which were reported to include fusarium-resistant varieties (Molina et al. 2002) were introduced through the Pomology department of GDAAS and evaluated in the field for their resistance to fusarium wilt.

Materials and methods

Twenty-three IMTP varieties were received as proliferating cultures from INIBAP Transit Centre (ITC) by the Pomology department. These were then immediately multiplied into rooted plantlets. Representatives of each variety were planted and maintained as foundation stocks in an insect-proof nursery at the Pomology department. Tissue-culture seedlings from each variety were used to carry out field evaluation against fusarium wilt.

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Field screening was carried out in two sites, namely Zengcheng and Panyu District, both in Guangzhou, Guangdong Province. Zengcheng was chosen as Site 1. It was previously planted with 'Fenjiao', a variety heavily infected by fusarium wilt. Although there were no analyses to determine what VCG type of Foc was present in this site, it was designated as Foc race 1 site, judging from the variety that was severely affected.

Panyu District was selected as Site 2. This area was previously planted with 'Xiangjiao' (Cavendish), of which 95% were affected by fusarium wilt. Similarly, no analyses were conducted to determine the actual VCG group of the Foc pathogen found in this area. However, since the previous crop that was heavily infected by fusarium wilt was a 'Cavendish' variety, this site was designated as Foc race 4 area.

The planting started on 18 August 2003 in Site 1 and 26 August 2003 in Site 2. Due to the differences in the number of seedlings developed from the original culture, the number of plants per variety was not the same. The number of seedlings ranged from 5 to 20 plants per variety. These were planted in a completely randomized block design.

Disease assessment was done by counting the incidence of infected plants. The infected plants were identified by the typical yellowing and eventual necroses of leaves on unshot plants, which started from the older leaves. The infection was confirmed by examining the internal vascular necrosis. Visual symptoms also included pseudostem splitting.

The plants that survived the attack of fusarium wilt reached maturity, yielded fruits and were evaluated for their agronomic characteristics.

Results and discussion

The results of the evaluation in two sites are summarized in Table 1. The measure of resistance and susceptibility of the various varieties were determined by the percentage of infected plants per variety in the two trial sites. Results showed that selection pressure was amply high as reflected by the high percentage of infection in susceptible variety.

In Zengcheng (Site 1) and designated as Foc 1 trial site, 'Gros Michel', which is known to be susceptible to Foc 1, and Bita-2 sustained 100 percent infection, while CRBP-39 and 'Pisang Ceylan' showed 40% and 10% infected plants respectively. All the other varieties were not affected by fusarium wilt.

Two significant results are evident in Site 2. First, several varieties including the popular 'Cavendish' varieties, 'Baxi' and 'Williams' were

Table 1. Reactions of IMTP varieties against fusarium wilt in two locations.

Varieties	% infected plants	
	Site 1*	Site 2**
FHIA-01	0	0
FHIA-02	0	0
FHIA-18	0	0
FHIA-25	0	0
'AAcv Rose'	0	0
'P. Jari Buaya'	0	0
GCTCV-119	0	9
FHIA-03	0	9
CRBP-39	40	13
FHIA-21	0	25
Bitas-2	100	50
'Pisang Ceylan'	10	75
GCTCV-106	0	90
GCTCV-247	0	83
Bitas-3	0	100
FHIA-17	0	100
FHIA-23	0	100
'Williams'	0	100
'Yangambi Km 5'	0	100
'Cachaco'	0	100
SH3640	0	100
'Gros Michel'	100	100
SH3436-9	0	100
'Baxi' (control)	0	100

*Site 1 is considered Foc race 1 trial

**Site 2 is considered Foc race 4 site

highly susceptible to fusarium wilt in Panyu district, trial Site 2. Although no analysis was done to establish the VCG type in Site 2, the results indicate that Foc race 4 is now a serious disease in South China. Several FHIA varieties, FHIA-17, FHIA-23, SH 34369 and SH-3640, were also observed as susceptible as the 'Cavendish' varieties. Two 'Cavendish' somaclones from the Taiwan Banana Research Institute (TBRI), which were previously reported resistant to Foc race 4 in Taiwan (Hwang 2000) were observed susceptible in Site 2. The second interesting result is the observation that several varieties, FHIA-01, FHIA-02, FHIA-03, FHIA-18 and FHIA-25 were resistant to the disease in Site 2. GCTCV-119, a 'Cavendish' somaclone from Taiwan was relatively resistant to fusarium wilt in Site 2.

Table 2 summarizes some agronomic characteristics of some varieties that were resistant to Foc race 4 in Site 2.

This preliminary study showed very relevant and interesting results. A more extensive and thorough evaluation is planned to be established.

Table 2. Agronomic traits of varieties not destroyed by Foc in site 2.

Genotype	Plant height (cm)	Stem girth (M) (cm)	Stem girth (B) (cm)	Days to shooting (days)
FHIA-01	219.5	65.0	87.5	447
FHIA-02	241.8	50.6	67.4	352
FHIA-03	292.9	69.1	89.1	398
FHIA-18	242.1	51.7	67.2	352
FHIA-21	315.6	59.6	78.3	386
FHIA-25	266.6	72.2	93.4	392
'AAcv Rose'	187.5	28.7	35.0	335
'P. Jari Buaya'	280.5	43.5	62.8	387
CRBP 39	313.7	51.3	67.3	355
'Bita 2'	318.0	65.0	87.5	447
GCTCV-119	284.4	48.4	67.3	418

This will include a higher number of experimental plants per variety and sequential assessment will be done to determine onset and disease progress rate. Efforts will also be done to characterize the pathogen in the experimental sites. This preliminary study, however, has opened up an important area of banana research concern in China.

References

- Hwang S.C. 2003. Somaclonal variation approach to breeding Cavendish banana for resistance to fusarium wilt race 4. Pp 173-183 *in* Advancing banana and plantain R&D in Asia and the Pacific-Vol.11. Proceedings of the 1st BAPNET Steering Committee meeting held in Los Banos Laguna Philippines (A.B. Molina, J.E. Eusebio, V.N. Roa, I. Van den Bergh and M.A.G. Maghuyop, eds.).
- Linbing Xu. 2003. Production and banana R&D in China. Pp 77-80 *in* Advancing banana and plantain R&D in Asia and the Pacific-Vol.11. Proceedings of the 1st BAPNET Steering Committee meeting held in Los Banos Laguna Philippines (A.B. Molina, J.E. Eusebio, V.N. Roa, I. Van den Bergh and M.A.G. Maghuyop, eds.).
- Molina A.B. and J.V. Escalant. 2002. The International *Musa* Testing Programme (IMTP): a worldwide programme to evaluate elite *Musa* varieties. Pp 14-15 *in* Global Conference on Banana and Plantain (H.P. Singh and N.K. Dadalani, eds.) Bangalore India, 28-31 October 2002. AIPUB, New Delhi. Abstract.
- Qi P. 2001. Status Report of banana fusarium wilt disease in China. Pp 119-120 *in* Banana fusarium wilt management: Towards sustainable cultivation (A.B. Molina, N.H.Nik Masdek and K.W.Liew, eds.). INIBAP-ASPNET, Los Banos.



(a) a susceptible variety showing external symptom of yellowing that starts on older leaves; (b) Huang Bingzhi and Xu Linbing at the Fusarium Experimental Site 2, Panyu District, Guangdong Province; (c) FHIA-02 showing high resistance to Foc race 4 in Site 2 and a severely wilted susceptible variety; (d) a susceptible variety showing internal symptom of vascular necrosis; (e) pseudostem splitting observed on a susceptible variety.