ception), the moderately susceptible 9-11 and the slightly susceptible 11-14. When examining banana varieties for resistance to black Sigatoka in the South Pacific, Jones (1993) demonstrated a range of YLS for each variety depending on location and disease intensity. Where black Sigatoka was severe and the YLS for the susceptible varieties 'Red Dacca' (AAA, Red subgroup) was 6.1 and 'Calypso' (AAAA hybrid) 7.4, plants with a YLS above 9.0 were listed as resistant. In other locations where the disease was not as severe and the YLS for 'Red Dacca' was 7.8-8.4 and 8.5-9.1 for 'Calypso', resistant varieties had a YLS of at least 10.6. In other studies, the critical YLS was 8.0 (Stover and Simmonds, 1987), 9.0 (Stover, 1974) and 10 (Ramsey *et al.*, 1990).

In this study, where the disease pressure was high (YLS of 5.3 for 'Williams' and 7.3 for 'Mata Kun' (AAA, Red subgroup), cultivars were placed arbitrarily into four categories: very susceptible (VS) YLS<6.0, susceptible YLS 6.0-9.0 or 6.0-8.5 if YL33 <11.5, resistant (R) YLS 9.1-9.9 or 8.6-9.9 if YL33>11.5, and highly resistant (HR) YLS≥10.0 or if total functional leaves <YLS (no mature spots). All four accessions of Australimusa were highly resistant as were all accessions of AAT (three accessions), ABB (9), ABBB (1), BB (3) and Fe'i Banana (1) (Table 2). Six of the 81 accessions in the AA genomic group were highly resistant while another 26 were resistant. There were no highly resistant accessions in the AAA genomic group and only three resistant accessions. This characterisation is only preliminary and the allocation to categories may change. Additional studies are required over a range of environments and where the accessions are assessed together with a number of varieties with known reactions to yellow Sigatoka.

Although none of the Papua New Guinea accessions would be useful as direct replacements for the main local cultivar, 'Williams' (AAA, Cavendish subgroup), grown in north Queensland because of their much lower yields and as most are better suited for cooking than for dessert purposes (Daniells and Bryde, 1994) they may be useful as a source of resistance to yellow Sigatoka. Varieties which may be of interest to conventional breeding programmes because of their high degree of resistance to yellow Sigatoka include the *Musa acuminata* subsp. *banksii* accessions PNG151, PNG181 and 'N.Qld'. The wide range of responses to yellow Sigatoka among the *Musa acuminata* subsp. *banksii* accessions in our study had been found previously by Vakili (1968). Varieties of interest as female parents in breeding programmes would be the AAB variety PNG310 (Kofi), and the ABB varieties PNG148 (Kandrian) and PNG171 (Dwarf Kalapua) which already possess good agronomic features (Daniells and Bryde, 1994). The very high resistance in *M. schizocarpa* and the Australimusa section is not readily useable by conventional breeding programmes, but could be of interest to programmes using molecular techniques.

Forty-seven varieties in this study were among the 147 examined for resistance by Jones (1994) using juvenile plantlets in a rapid glasshouse screening technique. In Table 3, the data for each of the 47 varieties from the two systems are compared. Fifty seven percent of varieties recorded similar results in both tests. In the 17 varieties which gave a susceptible reaction in the glasshouse test, 65% also exhibited a similar reaction in the field. Thirteen of the 47 varieties were categorised as extremely resistant in the glasshouse test and 85% of these varieties also were categorised as highly resistant in the field. In the 17 varieties categorised as partially resistant in the glasshouse test, only 29.4% gave the intermediate resistant reaction in the field while 41.2% were susceptible and 29.4% were highly resistant.

Despite the difference in results, the glasshouse test using juvenile tissue does offer a rapid and relatively cheap method of screening large populations of *Musa* accessions. Used as a means to screen out the susceptible material from the population examined, the glasshouse test reduced by one third the population requiring further examination in the field. This provides considerable savings in both time and resources. The test, however, results in some material being discarded that may have a useful level of resistance. In the material examined, six lines which gave a resistant reaction in the field would have been discarded.

Acknowledgements

We wish to thank the staff of the DPI South Johnstone Research Station for assistance in conducting the trial. ■

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New telephone system in France

As of 18 October 1996, France Telecom will change the telephone numbers throughout France to a 10 digit system. For the south-east France, this means the addition of the area code 04. The 0 should not be dialled when calling from abroad. INIBAP's phone number will become 04 67 61 13 02 (33-4-67 61 13 02 when dialling from aboad) and fax number will be 04 67 61 03 34 02 (33-4-67 61 03 34 when dialling from abroad).

Germplasm evaluation

Novaria—A new banana mutant induced by gamma irradiation

C. Mak, Y. W. Ho, Y. P. Tan and Rusli Ibrahim

Banana (*Musa*) is one of the most important fruit crops in the world providing major export income as well as being a staple food for millions in the developing countries. In Malaysia, about 36,000 hectares of banana were planted in 1992, mainly by smallholders. Recently, this crop has also become an important commodity with Cavendish types and Pisang Berangan being planted on a commercial scale for both domestic and export markets.

As banana cultivars are vegetatively propagated clones, generally triploid, sterile and bearing parthenocarpic fruits, their genetic improvement through sexual recombination is extremely difficult, time consuming and expensive. The use of mutation techniques and biotechnology offers an opportunity to enhance genetic variability for the improvement of agronomic traits such as earliness in fruiting, pest and disease resistance, yield and quality (Ho *et al*, 1993, 1994; Novak *et al*, 1990, 1993; Novak, 1992; Smith *et al*, 1993). In addition, the availability of tissue culture techniques also facilitates induction, selection and multiplication of mutants.

Materials and Methods

This report outlines trials undertaken with GN-60A, an early flowering mutant of Grande Naine (Novak *et al*, 1990). A total of 27 tubes of GN-60A mutant ramets (clonal progeny of a single plant) were introduced into Malaysia in 1990 from the International Atomic Energy Agency (IAEA) for local evaluation and selection. Of these, 22 plants were established and evaluated at the United Plantations Bhd at Jendarata in Perak State. Early flowering plants with outstanding bunch yield were selected for micropropagation using modified MS medium (Ho *et al*, 1993) and sufficient plants produced for evaluation trials where they were compared with Williams (AAA 'Cavendish'). Those plants which flowered between 22 to 24 weeks were again selected for micropropagation to produce a population of about 2,000 plants for commercial evaluation at a planting density of 1,667 plants per hectare with tissue culture Grande Naine planted at random as control. The planting pattern adopted was the double hedge-row system where the distance between rows was 1m and 5m and the spacing between plants was 2m. Comparisons were made with plants derived from the original parental clone of Grande Naine and the selected GN-60 A were named Novaria.

Results and Discussion

A total of 22 ramets were successfully established in the field after three months of acclimatisation in the nursery. The plants showed vigorous growth and produced an average of 10 leaves over a period of four months (i.e. from the 3rd to 6th month after field planting). Two plants were abnoral in appearance. One showed a leaf abnormality in the form of crinking, uneven lamina and variegation. The other developed an abnormal bunch (i.e. a small, deformed bunch with a choking appearance) and had a paler pseudostem and leaves.

Flower emergence occurred between 24 and 40 weeks after field planting with a mean value of 28.5 ± 3.7 weeks. However, 55% of the plants had flowered within 26 weeks. Plants were harvested 11 weeks later. Plant to plant variation was also observed in bunch weight, ranging from 18.7kg to 28.7kg with a mean value of 24.2 ± 2.3kg. Early flowering plants with high yield potential (Table 1) were selected for tissue culture to produce sufficient plants for subsequent comparison with Williams (AAA 'Cavendish').

Table 1. Bunch weight (kg) of selected early flowering individuals

	Harvest		
Plant No.	First	Ratoon	Mean
1.7	24.2	22.7	23.5
1.8	25.5	22.0	23.8
2.6	26.4	25.4	25.7
2.8	28.7	32.1	30.4
2.9	23.0	28.0	25.7

Novaria - a selection derived from an early flowering mutant GN-60A

Results indicated that 21% of the selected GN-60A plants showed shoot emergence between 22 and 24 weeks whereas for Williams, shoot emergence occurred only after 25 weeks (Table 2). At the end of the 28th week after field planting, 13% of the Williams plants had flowered in comparison to 60% of the GN-60A plants. After 40 weeks, 72% of Williams had flowered and 100% of the GN-60A. The selected GN-60A plants also showed better mean performance than Williams (Table 3). Early flowering plants were again tissue cultured to produce about 2000 plants for commercial evaluation in the United Plantation Bhd in September 1993. This selection has been named Novaria.

The performance of Novaria in comparison to the parental clone Grande Naine is presented in Table 4. No abnormal or chimerical plants of GN-60A were observed in the field. This suggests that the mutation is already stable.

On average, Novaria was about 10 weeks earlier in flowering than Grande Naine. Other fruit characteristics such as bunch weight, hand weight, average number of fingers per hand and average finger length were not significantly different from Grande Naine. In general, the performance of Novaria was not as good as this in the 2,000 plant trials. There was a delay in flowering and a reduction of mean bunch weight. This was attributed to the topography of the fields—the 1993 planting went through a period of flooding prior to inflorescence emergence. This experience also highlights the adverse effects of inundation even for a few days.

Table 2. Flowering census of selected early flowering plants of GN-60A mutant and 'Williams'

Clone	Total Planted	Percentage of Plants Flowering at Weeks*					Total %
		22-24	25-28	29-32	33-36	37-40	
GN-60A+	103	21	39	20	19	1	100
Williams	196	0	13	21	25	13	72

** Weeks from field planting to flowering*
+ Selected early flowering plants of GN-60A

Table 3. Mean performance of selected GN-60A plants and 'Williams'

	GN-60A (n=64)		Williams (n=78)	
	Mean ± S.D.	Range	Mean ± S.D.	Range
Bunch weight (kg)	24.7 ± 3.4	14.9-31.0	21.4 ± 3.0	12.8-27.6
Hand weight (kg)	2.5 ± 0.9	1.9-3.0	2.2 ± 0.7	1.6-3.0
Mean No. finger/hand	16.3 ± 2.5	12.2-21.4	15.5 ± 1.8	12.4-18.3
Mean finger length (cm)	14.6 ± 1.6	12.0-16.7	14.1 ± 1.6	11.5-16.3

Table 4. The performance of Novaria in comparison to the parental clone Grande Naine

	Novaria (n=1255)		Grande Naine (n=37)	
	Mean ± S.D.	Range	Mean ± S.D.	Range
Weeks to flower	35.1 ± 2.6	26-41	45.1 ± 6.3	32-55
Bunch weight (kg)	20.8 ± 4.5	10-34	21.4 ± 5.2	10.9-31.4
Hand weight (kg)*	2.67 ± 0.3	1.9-3.3	2.45 ± 0.4	1.4-3.1
Mean No. finger/hand*	15.9 ± 1.1	14.1-17.8	15.5± 1.1	12.9-17.5
Mean finger length (cm)*	15.4 ± 0.7	14.1-17.2	15.3 ± 1.1	11.4-17.0

** Based on a sample of 62 plants for Novaria*

Experimental comparison on keeping quality also showed that Novaria tended to have stronger fruit pedicel, resulting in relatively better keeping quality. It also has good flavor and good pulp texture.

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Evaluation of new banana germplasm in South Florida

Randy C. Ploetz and David Benscher

Thirty-seven cultivars of banana, many of which had not been grown previously in the United States, were introduced to South Florida as tissue-culture derived plantlets. In general, each accession had been previously indexed for banana bunchy top virus, banana streak virus and cucumber mosaic virus. Thus, plantlets were free of the important viral pathogens of banana, as well as fungal, bacterial and nematode pathogens. As of April 1996, most of the accessions were well-established in polybags in preparation for two replicated field experiments at TREC. In the first experiment, adaptation of the introduced germplasm to the area's poor soils, wind and winter temperatures will be assessed in soil not previously planted to bananas. In a second experiment, reaction of the introductions to race 1 and 2 of Fusarium wilt (Panama disease) will be assessed in artificially infested soil. In each experiment, host growth (height), suckering rate, yield and cycling time will be recorded. In addition, disease progress (incidence and severity) will be recorded during the second experiment. It is hoped that high-yielding, resistant genotypes will identified during the study which could replace either those that are currently affected by Fusarium wilt, or which yield poorly under conditions in South Florida.

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*Musa*forum

Letters from readers are published by INFOMUSA in their original language.

This refers to the *Musa*News item appeared on the INFO*MUSA* Vol. 4 N° 2 (December 1995). In that article you have stated that I have isolated *Pseudomonas solanacearum* from banana. That is not correct. I have never isolated *P. solanacearum* from banana. That was in fact isolated from *Centella asiatica* (a leafy vegetable belongs to family Umbelifereae) which you have seen intercropped with banana in Dehiowita area. You might have got confused with the information given at that time. Would you please correct that. I also agree with you that there is no evidence to conclude that Moko disease is present in Sri Lanka.

Thank you very much for helping to confirm the presence of BBMV and BSV in Sri Lanka.

It is interesting that the causal fungus of leaf spot infected samples sent, were identified as a different species of *Mycosphaerella* with Septoria as the asexual stage. I am just wondering whether more samples could be tested from different parts of the country, to see the differences of the pathogen. If there is a possibility of testing them, I can send more samples for that purpose.

Dr I. J. de Zoysa, Head, Plant Fathology Division, Horticultural Crop Research & Development Institute, PO Box 11, Gannoruwa, Peradeniya, Sri Lanka.

Just received the December 1995 issue of INFO*MUSA*. What a super issue, touching on so many aspects of banana and plantain research and development. You are both to be congratulated.

Just three years ago, in the middle of INIBAP's financial crisis, I wondered if INFO*MUSA* would ever appear again. But you have not only kept it going, you have improved it immensely.

Best wishes for continued success in 1996.

Bob Huggan, Head, Information Centre, IRRI, PO BOX 933, Manila, Philippines.

Letter to Dr Jeff Daniells

I was much taken by your article, alongside Neil Bryde, in Vol. 4 N° 2 of December. This reached me on Tuesday and I'm hurrying to comment, before I forget or get too lazy to bother. The last is no empty threat now that I am officially retired.

It is to be hoped that my ex-colleagues in Brazil will take note as they have also been propagating Yangambi Km5 in meristem culture. This was to provide a nucleus stock for further conventional multiplication and release as a "poor man's banana", resistant to just about anything except *Radopholus* in Brazil. One target area ought to be the Amazon basin, where it could offer something of a screen against the southward drift of *Mycosphaerella fijiensis*.

What I particularly wanted to take you up on was the distribution of this AAA cultivar in Asia. When I went there in 1985 with Francisco Ferreira and Hugues Tézenas du Montcel, we found it here, there and everywhere. It came back to Brazil under two names from Thailand, 'Khom' and 'Klue Thong Ruong' and we were sure that 'Kapas' at MARDI was the same. Hugues confirmed later that another synonym at Bogor-Sibinong is 'Sarapipip'. Any suggestion therefore that the variety had an African origin is not very believable.

You did not put it in a genome group. Was this because you weren't sure of the ploidy? If so you are in good company as I long suspected it as being diploid from the erect leaf habit. As a confirmed triploid, however, it has little to offer as germplasm for conventional breeding.

Dr. Kenneth Shepherd, Rua do Maçarico 20, 1 Esq., Quinta da Bicuda, Torre, 2750 Cascais, Portugal.

Germplasm evaluation

Variability in storage potential of banana shoot cultures under medium term storage conditions

Abstract of an article published in *Plant cell culture and organ culture* 42:269-274

I. Van den houwe, K. de Smet, H. Tézenas du Montcel and R. Swennen

Shoot cultures of 401 banana clones were conserved under medium term storage conditions (16±1°C; 25µM m^{-2} s^{-1}). Storage duration—defined as 60% survival time of 20 shoot cultures of a clone—was 344 days on average. However, large differences in storage capacity were noted both among different genome (sub)groups and within genome (sub)-groups. East African highland bananas and non-plantain AAB bananas can be stored for significantly longer periods. The storage duration of wild *Musa balbisiana* accessions is significantly shorter than the storage duration of any genomic (sub)group of parthenocarpic bananas. Shoot tip cultures of another 41 bananas clones maintained at higher ambient temperature (22±3°C) needed to be subcultured every 20 days on average.

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Conferences

XII ACORBAT Meeting

The XIIth meeting of the Association for Cooperation in Banana Research in the Caribbean and Tropical America (ACORBAT) will be held in Santo Domingo, Dominican Republic, from October 27 to November 2, 1996. Various themes will be covered through presentation of the most recent results, lectures, round table discussions and posters sessions.

Registration should be made before July 15, 1996. The rate is 150 US$ (members), 250 US$ (non-members).

For more information, please contact: Comité Organizador ACORBAT/JAD – Calle Euclides Morillo No. 51, Arroyo Hondo, Apartado Postal 388-9, Santo Domingo, Dominican Republic. Tel: (1809) 5636178 – Fax: + (1809) 5636181.

Challenges for Banana Production and Utilisation in 21st Century

The Association for the Improvement in Production and Utilisation of Bananas (AIPUB), in collaboration with ICAR and INIBAP/ASPNET, organises at Trichy, India on 24-25 September 1996 a conference on "Challenges for Banana Production and Utilisation in the 21st Century". The conference aims at designing a model approach to improve production and utilisation of this important crop. Sessions will cover banana growing scenario (global and national), germplasm management and improvement, application of biotechnology, production technology, pest and diseases, post harvest handling, processing and transport.

Registration to the conference is open to researchers, entrepreneurs, growers and should be made before August 31, 1996. The fees are Rs 500/60 US$ (members), Rs 750/80 US$ (non-members) and Rs 1000/100 US$ (Corporate members).

For further details, please correspond with : The Organising Secretary, Conference on "Challenges for Banana Production and Utilisation in the 21st Century, C/o NRC on Banana, 44, Ramalinga Nagar, Vayalur Road, Trichy-620 017, Tamil Nadu, India.
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