

**REPORT ON THE SECOND IBPGR/QDPI
BANANA GERMPLASM COLLECTING
MISSION TO PAPUA NEW GUINEA**

22 OCTOBER TO 27 NOVEMBER 1988

S.L. SHARROCK¹, J.W. DANIELLS², R. KAMBUOU³

1. Maroochy Horticultural Research Station, P.O. Box 5083, Sunshine Mail Centre, Nambour, Queensland, 4560, Australia.
2. South Johnstone Research Station, P.O. Box 20, South Johnstone, Queensland, 4859, Australia.
3. Laloki Agricultural Research Station, P.O.Box 417, Konedobu, Port Moresby, Papua New Guinea.

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22.10.88 - 27.11.88

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1. INTRODUCTION

The International Board for Plant Genetic Resources (IBPGR) in agreement with the Government of Papua New Guinea, is funding the collection of Musa germplasm in Papua New Guinea. This is being carried out in collaboration with the Queensland Department of Primary Industries (QDPI) who are providing facilities for the tissue culturing and disease screening in quarantine of the collected germplasm.

Papua New Guinea is an important centre of diversity of wild bananas with nine species from the genus Musa found there. Conservation of this wild genepool is of particular importance for future banana improvement programmes. A great diversity in cultivated diploid (AA) bananas also exists in Papua New Guinea the only country in the world where the cultivation of such diploid (AA) bananas is of agricultural significance. (Stover and Simmonds, 1987). Vigorous triploid clones are however invading the country and it is feared that they will eventually replace the diploids in banana cultivation. It is therefore important that these unique Papua New Guinea diploids are collected and conserved before they are lost forever.

Germplasm collecting is being carried out during a number of missions to Papua New Guinea during 1988-9. This report gives details of the second mission which took place during November 1988.

The first collecting mission was held in March 1988 and a total of 70 accessions were collected from East New Britain, Morobe, East Sepik and West Sepik provinces. Full details of the first mission are given in reports written by Dr. D. Jones, Miss S. Sharrock and Dr. H. Tezenas du Montcel.

A map showing the location of collecting sites visited during both the first and second missions is given in Appendix 1 and a full itinerary of the second mission in Appendix 2.

2. PARTICIPANTS IN THE SECOND COLLECTING MISSION

Mr J. Daniells. QDPI Banana Agronomist.

Responsible for identification of banana clones to be collected.

Mrs R. Kambuou. Papua New Guinea representative for IBPGR and Food Crops Research Officer with Papua New Guinea Department of Agriculture and Livestock (DAL). Responsible for local organization, liaising with Papua New Guinea Government officials and provincial DAL Officers. Advisor on local banana cultivars.

Miss S. Sharrock. IBPGR Intern. Responsible for organizing the mission, tissue culturing the collected germplasm and ensuring all disease indexing is carried out before transfer of germplasm to genebanks.

3. THE PNG NATIONAL BANANA GERmplasm COLLECTION, LALOKI, PORT MORESBY

The national banana germplasm collection was initiated in the early 1970's by the Papua New Guinea Biological Foundation. A total of 675 accessions were collected by Dr. George Argent and assembled at Lae, Morobe. This collection was re-located at Laloki Agricultural Research Station during 1979-81 but over the years many accessions have been lost.

The collection now consists of 196 cultivars from the original collection, which according to Shepherd and Ferreira (1984) fall into the following genomic groupings:

AA - 54	ABB - 31	AAAB/AABB - 10
AAA - 47	AAS ¹ - 4	ABBS - 2
AAB - 46	AAAA - 1	AAAT ² - 1

¹S = M. schizocarpa

²T = Australimusa - cultivars classified on the basis of shiny green bracts, typical of this section of the genus Musa.

Recent Japanese collecting missions have added 36 cultivars and two wild species, M. balbisiana and M. maclayi ssp. maclayi, and a further 36 cultivar accessions have been planted in the collection by Mrs. Kambuou, the officer-in-charge of the collection. It was noted that the M. maclayi ssp. maclayi at Laloki is different to M. jackeyi collected in north Queensland. M. jackeyi appears to show a closer affinity with M. maclayi ssp. ailulai as described by Argent (1976) as both have persistent bracts on the male axis.

A disease survey of the Laloki collection was carried out by Dr. David Jones, QDPI Plant Pathologist, during the first collecting mission and full details are given in his report on that mission.

The growth of bananas in the collection at the time of this second visit was generally poor. No pest or disease control was being practised, partly due to a lack of funding and partly to monitor pests and disease susceptibility. This is however resulting in the loss of accessions and funds are badly needed to ensure the maintenance of this valuable collection. Work has recently been initiated on the characterization of clones in the collection.

Duplicates of all the accessions collected during the IBPGR/QDPI banana germplasm collecting missions will be added to the Laloki collection.

4. METHOD OF GERmplasm COLLECTION

Germplasm of cultivars was collected in the form of suckers, which were dug from the mat, cleaned and allowed to dry for one to two days before being wrapped in newspaper and stored in an air-conditioned room. For each accession, four suckers were collected. Of these two were sent back to Australia for tissue culturing at the QDPI's horticultural research

station at Maroochy, and two were initiated in culture in Papua New Guinea. Where no local laboratory was available, a mobile cabinet was used as a clean working area. Such a cabinet could be set up in an office or hotel bedroom if necessary.

Full details of this *in vitro* collecting are given in Section 7.

Germplasm of the wild species was also collected as suckers, but if mature seed was available this was also taken.

5. QUARANTINE REQUIREMENTS

The collected germplasm is established in tissue culture to eliminate risks from fungal, bacterial and nematode pathogens. Once established, representative plants from each cultured meristem are screened in quarantine for virus diseases such as Cucumber Mosaic Virus (CMV) and banana bunchy top virus (BBTV) by QDPI plant pathologists. Tissue cultures will be released from quarantine once the representative plants are deemed free of disease. The germplasm will then be distributed to designated genebanks and banana improvement programmes world-wide.

6. GERmplasm COLLECTING SITES

1. East New Britain Province

East New Britain is an important centre for the cultivation of diploid bananas and during the first mission, 34 cultivars were collected there. Due to contamination problems however, 20 of these were subsequently lost in tissue culture. Prior to the second collecting mission therefore, a short visit was made to E.N.B. to re-collect these lost accessions. In addition, 29 new accessions were collected including 27 cultivars and 2 collections of *M. balbisiana*. Full details of these accessions are given in Appendix 3 and in the report on the first collecting mission (Sharrock, 1988). Assistance in the collecting work in E.N.B. was provided by the Lowland Agricultural Experiment Station at Keravat and by the PNG Cocoa and Coconut Research Institute, for whose help we are most grateful.

2. Madang Province

Bananas with yam and taro form the staple food crops in this area and banana cultivation, as in ENB is based on starchy diploid cultivars. These cultivars are selected on the basis of taste and fruit quality regardless of yield and disease resistance, and a wide diversity is maintained in most gardens.

The Amele area of Madang is being surveyed as part of a joint PNGBF/IMR/DAL project on the production and consumption of bananas in PNG. As a result the workers involved in this project have built up some considerable knowledge on banana production in this area. Our collecting in Madang was greatly facilitated by the assistance of the Institute of Medical Research (IMR), and we are particularly indebted to Dr. Robin Hide and also to Ms. Janet Banag, who assisted us in the collecting work.

a. Cultivars

A total of 29 cultivars were collected, consisting of 21 AA diploids, 1 AAA triploid, 4 ABB triploids and 1 AAT? triploid. Two Fe'i cultivars were also collected.

Many of the AA diploids being cultivated in Madang and in other parts of PNG, are similar to the the African plantains, often having few large pendant fingers and exhibiting inhibited suckering. These diploids differ from the African plantains in their small size and in having a cream rather than a yellow/orange compound tepal in the male flower. Variable persistence of flowers and bracts on the male axis and occasional degeneration of the male bud are also characteristics of these diploids.

The ABB cultivars collected included a dwarf Yawa (P.awak) and dwarf and giant Kalapua. These dwarfs may be useful female parents in breeding programmes as they already combine disease resistance with short habit (2-2.5m). Both Yawa and Kalapua were common in Madang and various forms of both were seen. A possible tetraploid Yawa was seen at Nagada Beach.

Both the Fe'i cultivars collected had degenerating male buds. One had large pointed fingers and the other smaller rounded fruit. Two other interesting cultivars were Sar (PNG 186) and Ato (PNG 187). Sar had a green shiny pseudostem and shiny male bracts indicating some Australimusa in its genome. Ato was a cultivar with dark green, bottle-necked fruit similar to the wild species (M. schizocarpa).

Other cultivars seen in Madang province were Laknau, Gros Michel, Cavendish, Mysore and Red (Red Dacca).

b. Wild Species

Four wild Musa species were found in Madang province. These were: M. balbisiana, M. peekelii ssp. angustigemma, M. acuminata ssp banksii and M. schizocarpa.

M. balbisiana was found in only two locations and was the least common species.

M. peekelii ssp. angustigemma was the most common species in this area, being abundant along roadsides and on the edges of cultivated land. Some variation was noted in bract retention and colour of the male bud, but generally it fitted the description given by Argent (1976). Two collections were made of this species.

M. acuminata ssp. banksii was the second most common species, growing in similar habitats to M. peekelii ssp angustigemma. Variation in bract colour, which varied from green to dark purple and in fruit shape, was noted. Undeveloped basal fingers were sometimes seen. Six collections of this species were made, including one from a plant with a particularly good bunch containing more than 20 hands of good-sized fruit.

M. schizocarpa was less common than M.a. banksii but seen in several locations. Little variation was noticeable and the plant closely followed the description given by Argent (1976). The hybrid between M.a. banksii and M. schizocarpa was seen wherever the two species were growing together. This hybrid is intermediate in characteristics between the two parents and is recognizable by the partly developed, often blackened, fruit.

In one location M. schizocarpa was found growing next to M. peekelii ssp. angustigemma. Between them a unknown plant was growing. This could have been a young M. schizocarpa with an unusually lax bunch of pale coloured fruit or alternatively, a hybrid between the two species.

Seeds of M. a. banksii and M. peekelii ssp angustigemma were also collected from Kar Kar Island, off the coast of Madang Province by colleagues from the Q.D.P.I.

c. Diseases and Pests

The wild species were, on the whole, little affected by diseases or pests. The common leaf diseases seen amongst the cultivars were black Sigatoka (Mycosphaerella fijiensis), black cross (Phyllacora musicola) and cordana (Cordana musae). Freckle (Guignardia musae) was seen on some ABB clones. Variable levels of resistance to leaf spot diseases were seen among the diploid cultivars.

Among the pests affecting bananas were the giant african snail and the banana skipper (Erionota thrax) which has only been in PNG since 1987.

3. Eastern and Western Highlands Provinces

The staple food crop in the highlands of PNG is sweet potato. Bananas however are common as they are frequently planted as shade for coffee, which is a major cash crop for the highlanders. Diversity in the highland bananas is not extensive and as a shade crop high market value varieties are chosen. Such varieties are usually triploids, the fruit of which is valued for use in "bride price" and other local ceremonies and can fetch up to 10 K (US\$13.00) per bunch.

The practise of covering the bunch and removing the male bud is common throughout the highlands and makes varietal identification difficult. Bunch covers are made from leaves removed from the plant, often leaving only two to five leaves intact. One would expect some loss in bunch weight as a result of removing this amount of leaf area. Banana cultivation in the highlands reaches its limit at around 1800 m and diversity declines with altitude.

Twenty eight cultivars were collected in the highlands, 7 AA diploids, 13 AAB and 6AAA triploids, 1AAAB? tetraploid and 1 Fe'i cultivar. Many of the AAB triploids had rounded fruit and lax bunches resembling the Popoulou-types of the Pacific region. They also had yellow /orange compound tepals, similar to the African plantains, rather than the cream colour found in the plantain-like diploids. These cultivars were however unusual in having extremely erect leaves. Other cultivars seen in the highlands included Cavendish, Yawa, Kalapua and Red.

Two wild species were found in the highlands. M. peekelii, ssp angustigemma occurred occasionally up to 1200 m and between 1200 and 1700 m. M. ingens was found.

M. ingens, the largest herb in the world (Purseglove, 1972), grows within the highland forests, rather than on the edge of lowland forests where the other Musa species are commonly found. Measurements were made of one specimen from Aiyura, Eastern Highlands. This was 11.5 m tall with a circumference around the pseudostem of 2.5 m. one metre above the ground. A full description of this huge species is given by Argent (1976).

Leaf spot diseases were less severe in the cooler highland climate than in Madang and less severe in the drier Eastern Highlands than the Western Highlands. The common diseases were black Sigatoka, cordana and black cross and one disease not present in Madang was Malayan leaf spot

(Haplobasidium musae).

7. TISSUE CULTURE INITIATION AND IN-VITRO COLLECTING

1. Tissue Culture Initiation

During the first collecting mission a total of 70 accessions were collected. Unfortunately, due largely to bacterial contamination in culture, 34 (49%) of these were subsequently lost. The major factor contributing to these high contamination levels was found to be inadequate surface sterilization of the explant and in an attempt to reduce contamination levels, a new surface sterilisation treatment was developed.

Previously surface sterilization had been carried out by soaking explants for 15 minutes in 3.5% sodium hypochlorite (commercial bleach) with a drop of detergent, followed by rinsing in sterile water and cutting away the damaged outside tissue before placing the explant in the culture medium.

In trials conducted at M.H.R.S. on locally collected banana suckers, it was found that contamination levels could be substantially reduced by using two successive surface sterilization treatments. The method subsequently adopted consists of the following steps:

1. Banana suckers cut down to a block of tissue approximately 5 x 2 cm containing the central meristem.
2. Explants soaked for 15 minutes in 3.5% Sodium hypochlorite (with a drop of detergent).
3. Rinsed in sterile water.
4. Bleach damaged tissue cut away from outside of explant using straight clean cuts.
5. Explants soaked for 10 minutes in 3.5% sodium hypochlorite (with detergent).
6. Rinsed three times in sterile water.
7. Bleach damaged tissue again cut away and explant placed in culture medium.

2. In-Vitro Collecting

During the second collecting mission, in an attempt to reduce the length of time for which suckers had to be stored, it was decided to initiate cultures in PNG. As a back-up, duplicate suckers were also sent back to M.H.R.S. at intervals during the mission so that the maximum storage time for any of the suckers was three weeks.

For the in-vitro collecting, media was prepared before the mission and dispensed into pre-sterilized screw-top plastic bottles. All the necessary instruments and containers were carried with the collecting team.

Two methods of in-vitro collecting were tested:

a. **East New Britain**

In E.N.B. cultures were initiated in the tissue culture laboratory belonging to the PNG Cocoa and Coconut Research Institute, located at the Lowland Agricultural Experiment Station, Keravat. Here work was carried out in a laminar flow cabinet. The double surface-sterilization method outlined above was used and instruments were sterilized by an alcohol dip followed by flaming using a small spirit burner. Commercial bleach was used to surface sterilize the explants and water for rinsing was sterilized by autoclaving.

72 explants were initiated and the resulting contamination rate was surprisingly high at 78%.

b. **Madang**

In Madang a mobile, folding wood cabinet was used as a clean working area. This was set up in a hotel room to test the method away from laboratory facilities. The cabinet was cleaned with commercial bleach and instruments were sterilized by a rinse in bleach followed by an alcohol dip and flaming in a candle flame.

Explants were surface sterilized in commercial bleach, using the method outlined above. Water for rinsing was sterilized using water sterilizing tablets. 78 explants were initiated using this method with a contamination rate of 51%.

These results compare with initiations carried out at MHRs where the double surface sterilization method was used and instruments were sterilized by an alcohol dip and flaming in a "Bacti-cinerator". Out of a batch of 69 suckers from PNG, the contamination rate was 13%.

These results indicate that such in vitro collecting methods have to be improved before they can be used satisfactorily for banana and that the main problem to be overcome is bacterial contamination. Fungal contamination was not a problem and those explants not contaminated continued to grow in culture. The use of antibiotics in the culture media may be one way of overcoming the bacterial problem and this needs to be investigated further.

8. CONCLUSIONS

1. A total of 106 cultivars were collected during this mission. Of these 54 are thought to be AA diploids, 43 are probably triploids consisting of 13 AAAs, 19 AABs and 11 ABBs, 3 are possibly tetraploids, 3 are Fe'1 cultivars and 3 are of unknown genomes. 15 collections were also made from 5 wild Musa species. Of these 121 accessions, 16 did not establish in tissue culture, leaving 105 accessions which are now being multiplied at MHRs. Details are given in Appendix 3.
2. There is great diversity amongst bananas in PNG, and this is particularly so in areas such as East New Britain and Madang where bananas constitute a staple food crop.
3. A great many varieties are characterised by a green-yellow male bud, something which is shared with Musa acuminata ssp. banksii and Musa

schizocarpa which are likely parents. Many of the varieties with plantain-like fruit have these green-yellow male buds but do not belong to Simmond's plantain subgroup as they do not have a yellow-orange compound tepal. These "plantains" often also have retarded suckering as is the case in the true plantains. There is considerable diversity within the Papua New Guinea "plantains" with variations in finger shape, fruit colour, plant colour, bract persistence and so forth, as can be found in the true plantains. Of the plantains we collected several possess only small differences from one another and are likely to have resulted as mutations from just a few original forms.

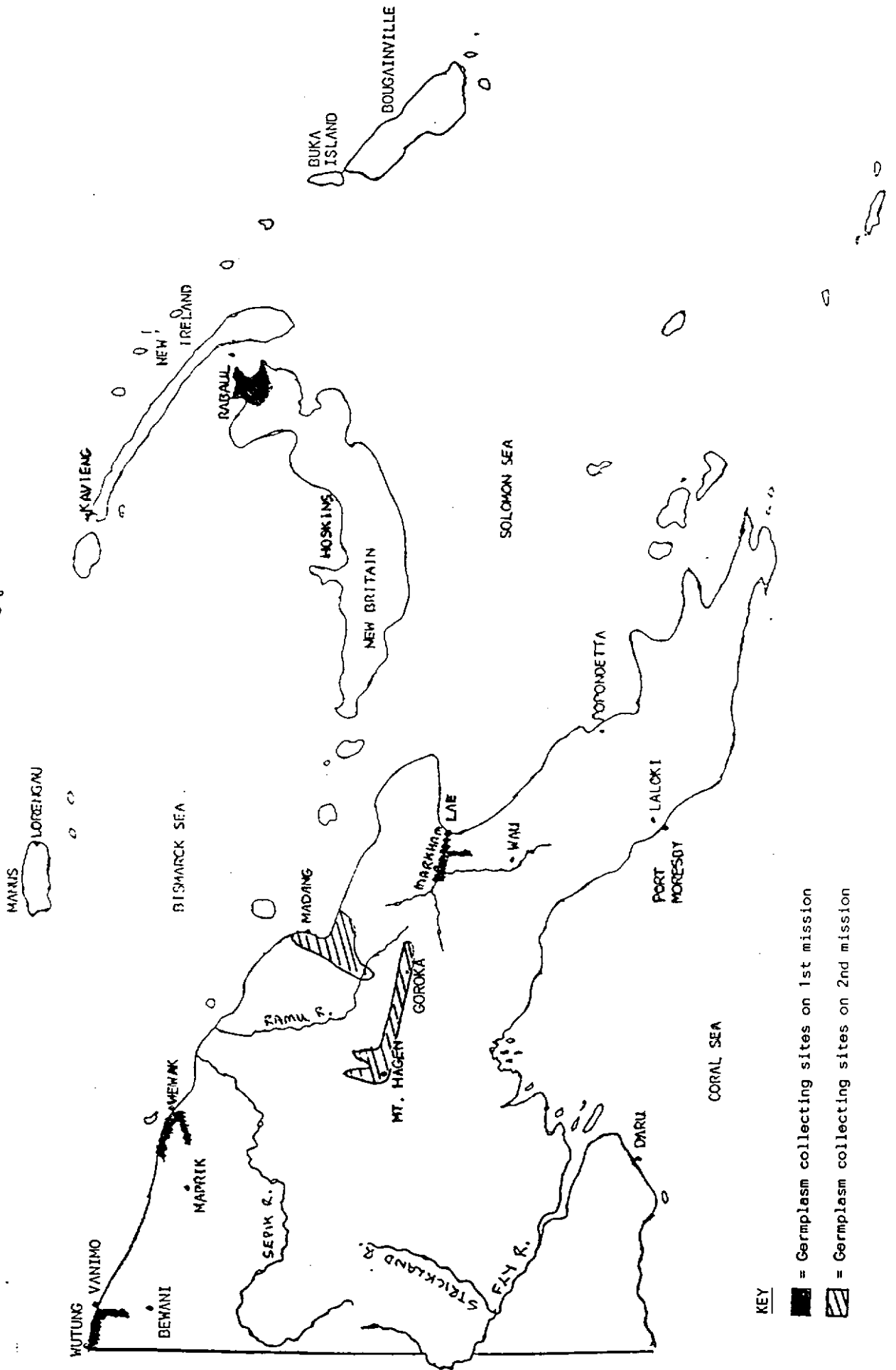
4. Many varieties examined possessed floral aberrations with various fusions of male flowers to give flowers with two to three free tepals or fused stamens and tepals. Several also had six stamens.
5. In some cases it was not possible to identify the ploidy of varieties collected. Some of the larger varieties may be tetraploids but it will be necessary to carry out chromosome counts when these varieties are properly characterised.
6. The upright leaf habit amongst some of the $3n$ plantains in the highlands was interesting. In the consideration of plant ideotypes it would be interesting to compare productivity of these plantains with others of a more droopy habit.
7. Many of the varieties collected have some resistance to black Sigatoka and will be useful in areas affected by this disease and as parents in breeding programmes.

References

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PAPUA NEW GUINEA

APPENDIX 1



APPENDIX 2

ITINERARY

22/10/88		Brisbane - Port Moresby - Rabaul
23/10/88 - 27/10/88		Collecting in East New Britain
28/10/88 - 29/10/88		Initiating suckers in tissue culture
30/10/88		Rabaul - Port Moresby
31/10/88 - 2/11/88		Port Moresby, Laloki Banana Collection
3/11/88		Port Moresby - Madang
4/11/88	am	Visit to I.M.R., Madang
	pm	Collecting at Omuru, Madang
5/11/88		Collecting at Yelso, Madang
6/11/88		Initiating suckers in tissue culture
7/11/88		Collecting at Dalam and Wagaen, Madang
8/11/88		Collecting at Malpine and Bieteta, Madang
		Visit to Christensen Research Institute, Madang
9/11/88		Collecting at Brahaman, Madang
10/11/88		Collecting at Uya and Erima, Madang
11/11/88		Initiating suckers in tissue culture
12/11/88		Madang - Goroka
13/11/88		Rest day
14/11/88		Collecting at Kafana, E. Highlands
15/11/88		Collecting between Goroka and Kassam. Visit to Aiyura Agricultural Research Station
16/11/88		Collecting at Aiyura
17/11/88		Collecting between Goroka and Mt. Hagen
18/11/88		Collecting in Wahgi Valley, Western Highlands
19/11/88		Collecting at Moitam, W. Highlands

20/11/88	Collecting in Middle Jimmy Valley, W. Highlands
21/11/88	Collecting in Baiyer River Valley, W. Highlands
21/11/88	Collecting at Tabibuga, W. Highlands
23/11/88	Visit to Kuk Agricultural Research Station, Mt. Hagen - Port Moresby.
24/11/88 - 26/11/88	Port Moresby, Organizing collected suckers
27/11/88	Port Moresby - Brisbane

Acc No.	Genotype	Local Name	Language Group	Location	Use1	Diseases2 Present	Main Characteristics3	Photo No.
PNG 101	AA	Kekiau	Kuanua	E.N.B. Vunapalading Block 626	C	BS, BC, C	See PNG 001	1/13
PNG 102	AA	Pitu	.	.	C	Rust	See PNG 003	1/14, 2/12
PNG 103	AA?	Gorop = Karukaru	.	.	D	BS, C	See PNG 006	1/16
PNG 104	AA?	Tangamor	.	.	C	BS, C	See PNG 007	-
PNG 105*	AA?	Lagun	.	.	C	BS, BC, C	See PNG 008	1/15
PNG 106*	AA	Meme = Muruk	.	.	C	BC, C	See PNG 019 ♂ bud frequently degenerates	1/18 - 1/21
PNG 107	AAA?	Mamakila	.	.	C	BS	Red margin to petioles. Inhibited suckering Robust	-
PNG 108	AA?	Mangara	.	.	C	BC, C	See PNG 005	-
PNG 109*	AA?	Amayer	.	Vunapalading Block 669 E.N.B.	C	BS	Sub-horizontal long, green fruit ♂ bud green	1/22
PNG 110	AAB?	Apindikay	.	.	C	?	Small, curved, sub-horiz fruit. Orange flesh. Winged margins.	1/24
PNG 111	AAB?	Avalira	.	.	C	?	Green/white chimera Long, blunt-tipped pendant fruit. Robust plant, waxy.	1/27, 1/28

Acc No	Genotype	Local Name	Language Group	Location	Use1	Diseases2 Present	Main Characteristics3	Photo No
PNG 112	AA	Agul = Rangalka	Kuanua	Vunapalading Block 669 E.N.B.	C	BS, BC, C	See PNG 009	1/30
PNG 113	AA	Alom = Spiral	*	*	C	BC, C	See PNG 010	-
PNG 114	AA	Tamal	*	*	C	BC, C	See PNG 012	1/25, 1/26
PNG 115	AA?	Aivip	*	*	C	BC, C	See PNG 020	1/31
PNG 116	AA	Marakudu	*	*	C	BS, BC, C	See PNG 017	1//29
PNG 117	AA	Katual No.2	*	*	C	?	= O.T.P. (PNG 011)?	-
PNG 118	ABB	Tukuru	*	Vunallir E.N.B.	C	Freckle	Tall and robust Little blotching, waxy. Bunch sub-horizontal, many hands, fruit- angular, bottle- necked. ♂ bud purple/yellow.	1/35, 1/36
PNG 119	AA	Katual Vunallir	*	*	C/D	BC, C	See PNG 016	1/34
PNG 120	AAA?	Lagur Vunallir	*	*	C	BC, C	See PNG 018	1/32, 1/33
PNG 121	AA	?(Pink Striped)	*	Kokopo E.N.B.	O	BS	Ornamental - small no bunch, extensive purple/red colouring on leaves	2/1
PNG 122*	AA	Tomolo	*	*	C	BC, C	See PNG 023	2/2
PNG 123	AAB?	Kokor	*	Tingnavudu E.N.B.	C/D	BC, C	See PNG 033	2/3

Acc No	Genotype	Local Name	Language Group	Location	Usc1	Diseases ² Present	Main Characteristics ³	Photo No
PNG 124	AA	Niukin	Kuanua	Tingenavudu E.N.B.	D	BS, C	= Pisang Jaribuaya See PNG 032	-
PNG 125	BB?	Auko	"	Ulaulatava E.N.B.	D	BC, C	See PNG 034	2/4
PNG 126	AA?	Karakum	"	Rapitok No.3 E.N.B.	C	C	See PNG 026	2/5
PNG 127*	AAA?	Bulu	"	"	D	BC, C	See PNG 024	2/8
PNG 128*	AA	Kabia Malum	"	"	D	BS, C	See PNG 022	2/25
PNG 129	AA	Lalalur	"	"	D	BS, BC, C	See PNG 021	2/7
PNG 130*	Fe' 1	Vuro	"	"	C/D	-	Australimusa. Bright green shiny pseudostem, erect bunch, red sap. Not popular.	2/12
PNG 131	ABBS?	Daru	"	"	C/D	?	Tall, robust, few blotches, compact bunch of angular, bottle-necked fruit. Dark green skin, ♂ bud green/purple rounded. Introduced from Daru Is.	2/6
PNG 132	AA	Kirkirnan	"	"	C/D	BS	Extensive red coloration on pseudostem, petiole and midrib. Fruit red round-tipped, thin skinned bud purple. colour not fading inside bract. ♂ flower, white irregular = 1037 Laioki?	2/10
PNG 133*	BB(sp)	Bush Banana	Pidgin	"	W	-	M. balbisiana See PNG 035, PNG 147	2/14, 2/15 2/16

Acc No	Genotype	Local Name	Language Group	Location	Use1	Diseases2 Present	Main Characteristics3	Photo No
PNG 134*	ABB	Kalapua	Pidgin	Rapitok No 3 E.N.B.	C	Freckle	Tall, robust, few blotches, Bunch sub-horizontal, compact, fruit small, angular, blunt tipped. V. common	2/17 2/18
PNG 135	AA?	Pama	Kuanua	.	C/D	?	Small, slender plant Red on pseudostem, petioles and midribs. Fruit small rounded, bright green. ♂ bud purple. ♂ flower white, irregular. Pollen present. Bracts persistent.	2/19
PNG 136	AAB?	Garunga	.	Warangol Block 119 E.N.B.	C/D	BS	Robust, pale green pseudostem. 7-8 hands sub-horizontal, long, angular blunt-tipped fruit. ♂ bud purple/yellow, ♂ flower cream. Pollen present.	2/21
PNG 137*	AAB?	Au-u	.	Warangol Block 148 E.N.B.	C	BS	Robust plant. Spotting on petioles Fruit large rounded horizontal. ♂ bud pointed, green bracts ♂ flowers irregular	2/22, 2/23
PNG 138	AAB	Palakaur	.	.	D	BS	Robust, green shiny pseudostem, Red on dorsal face of cigar-leaf. Fruit pendant, long, round-tipped. ♂ bud green/purple =Lalalur (PNG 021)?	2/27
PNG 139	AA	Tubunatar?	Kuanua	Kokopo E.N.B.	C	C	Red coloration on plant and fruit. Fruit blunt-tipped. flowers irregular. ♂ bud purple	10/1

Acc No	Genotype	Local Name	Language Group	Location	Use1	Diseases2 Present	Main Characteristics3	Photo No
PNG 140	AA	Vudu Beo?	Kuanua	Kokopo E.N.B.	C	C	Petiole margins red, 5 hands, rounded, sub-horizontal fruit. Long pedicels. ♂ bud purple	10/2
PNG 141	ABB	Tukuru No 2	.	.	C	Freckle	V. vigorous. Fruit large angular, waxy ♂ bud purple. Floral aberrations.	10/3
PNG 142	AA?	Tagomor ?	.	Vunamami E.N.B.	C	BC, C	Petiole margins red. Long pendent fingers. Sun-exposed peel, red. Persistent neutral flowers ♂ bud purple.	10/4
PNG 143	ABB?	?		Vunapope E.N.B.	C	BC, C	Robust, 10 hands of short, blunt, angular fingers. ♂ bud purple pink on compound tepal = Yowa (Laloki)	10/5
PNG 144	AAA?	?		Vunamami E.N.B.	C/D	C	Robust, bunch sub horizontal, 10 hands ♂ bud green/purple	10/6
PNG 145	ABB	Kalapua No. 2	Pidgin	Vunapope E.N.B.	C	Freckle	Robust, 10 hands angular fruit. ♂ bud purple. Orange tip to compound tepal	10/7
PNG 146	AAA?	Luba	Kuanua	Kokopo E.N.B.	C	?	Red peduncle, 5 hands of yellow fruit. ♂ bud purple	10/8
PNG 147	BB(sp) M. balbisiana	?		.	W	-	Typical M. balbisiana cf Argent (1976). Seed only	10/9
PNG 148	ABBB?	Kandrian	?	Laloki - 1035 (ex Kandrian W.N.B.)	C	C, BC	V. Vigorous. 10 hands fruit shaped like Bluggoe	10/10

Acc No	Genotype	Local Name	Language Group	Location	Use1	Diseases2 Present	Main Characteristics3	Photo No
PNG 149	ABB?	Rana	?	Laloki collection	C	C, BC Freckle	V. vigorous plant	-
PNG 150	M. peekelii ssp angustigenma	God mun	Amele	Erima Madang	W	-	Abundant in this area ♂ bud bronze/green Typical, cf. Argent (1976)	4/7 - 4/11
PNG 151	M. acuminata ssp banksii AA (SP)	God mun	.	.	W	BS	Typical M.a. banksii. Small, poor growth ♂ bud green	4/13
PNG 152	AA	Mah	Amele	Omuru Madang	C	BS, BC	Pseudostem, dull green 4-5 hands, fruit pointing upwards, angular, blunt-tipped. ♂ bud green with purple edge to bracts	4/17
PNG 153	AA	Bud	.	.	C	BS	Suckering inhibited, 4 hands, fruit pointing upwards. lax bunch, round- tipped fingers. ♂ bud green with purple stripes.	4/6, 4/18
PNG 154	AA	Kahur	Amele	Omuru Madang	C	BS	Long, curved sub-horiz fruit, 3-5 faces rounded apex, persistent neutral flowers. ♂ bud purple/ green some pollen. Floral aberrations	4/20, 4/30
PNG 155	ABB	Yawa (Dwarf)	.	.	D	-	Dwarf P. awak 2-2.5m. Good bunch	4/16, 4/22
PNG 156	AA	Kombok	Watut	.	?	?	Suckering inhibited Extensive blotching. 5-6 hands, long, curved sub-horizontal, blunt- tipped fruit. ♂ bud green. Pollen Present.	4/21

Acc No	Genotype	Local Name	Language Group	Location	Use1	Diseases2 Present	Main Characteristics3	Photo No
PNG 157*	AA(sp) M.a. banksii	?		Omuru Madang	W	-	Typical M.a. banksii Good bunch but fingers small.	4/14 4/15
PNG 158	M. peekellii ssp. angustigemma	?		Yelso Madang	W	-	Typical. V. tall, 7-8 m seed only.	4/23, 4/24 4/25, 4/26
PNG 159	AA	Maleb	Amele	.	C	BS, BC	Long, pendant, angular 3 - faced fruit. Persistent neutral flowers. ♂ bud green, purple edge to bracts. 5 hands.	4/28
PNG 160	AA	Gonub	Amele	Yelso Madang	C	?	Sub-horizontal, angular 3-faced fruit. Neutral flowers and bracts persistent. ♂ bud purple/yellow. ♂ flowers cream, irregular. 3-4 hands	4/29, 4/32
PNG 161	AA	Manameg (Red)	.	.	C	?	Red coloration on pseudostem, petiole, midrib and fruit. Fruit small, curved, upwards, bottle-necked Persistent bracts and neutral flowers ♂ bud purple, 4-6 hands.	4/31
PNG 162	AA(sp) M.a. banksii	?		.	W	-	Typical M.a. banksii but with purple ♂ bud Good bunch but many undeveloped fruit at base of bunch. Seed only.	4/33
PNG 163	AA	Manameg (green)	Amele	Umulin Madang	C	?	Same as Manameg (Red) but with less red coloration on plant and fruit.	5/3

Acc No	Genotype	Local Name	Language Group	Location	Use1	Diseases ² Present	Main Characteristics ³	Photo No
PNG 164	AA	Sihir	Amele	Umuin Madang	C?	BS, C	Small, slender plant. Fruit, small, curved upwards, angular, pale green. ♂ bud green Bunch sub-horizontal 5 hands. With pollen.	4/34
PNG 165	AA	Bago	.	.	C	BS	Good suckering. Dark green pseudostem. Fruit curved upwards, blunt-tipped, rounded. Neutral flowers persistent, ♂ bud green/purple.	5/20
PNG 166*	AA	Meleh	Amele	Dalam Madang	C	BS, BC	Similar to Maleb, Dull green pseudostem Curved, sub-horizontal fruit. Persistent neutral flowers ♂ bud yellow-green, pointed. 5 hands	5/4
PNG 167	AAB	Midi	Rempi		C	BS, BC	V. like French Plantain. Persistent neutral flowers ♂ bud purple/yellow. Brought from Lae. 6 hands	5/13
PNG 168	AA	Gunih	Amele	Wafaen Madang	C	BS, BC	Pale pseudostem, red petiole margins. Round-tipped, rounded yellow fingers. ♂ bud purple, bracts curling round apex. Abnormal flowers.	5/17, 5/18
PNG 169	AA	Bogia Mun	Amele	Hudini Madang	C	BS	Extensive blotching on pseudostem. Fruit pale curved, sub-horizontal Persistent neutral flowers. ♂ bud purple 4 hands.	5/21

Acc No	Genotype	Local Name	Language Group	Location	Use1	Diseases2 Present	Main Characteristics3	Photo No
PNG 170	ABB?	Kalapua (Giant)	Pidgin	Madang Town	C	-	V.vigorous, large plant. Many hands ♂ bud dull purple. Huge. Brought from Port Moresby	5/22, 5/23 5/24
PNG 171	ABB	Kalapua (Dwarf)	Pidgen	Madang Town	C	-	Typical Kalapua but only 1.5m tall Brought from Samarai	5/25, 5/26
PNG 172	SS(sp) M.schizocarpa			Malpine Madang	W	-	Typical M.schizocarpa cf. Argent (1976) Seed only	5/27
PNG 173*	SS? Hybrid?			Malpine Madang	W	-	Bright green, shiny pseudostem. Fruit pale green, curving upwards, bottle-necked. Possible immature M.schizocarpa or M.schizocarpa x M.peekellii?	5/28
PNG 174	AA(sp) M.a.banksii				W	-	Typical M.a.banksii ♂ bud green. Seed only	5/35
PNG 175	AA	Mossmun	Amele		D	-	=P.Mas. V.vigorous many hands. Leaves somewhat drooping	5/1, 5/36
PNG 176	AA(sp) M.a.banksii			Bieteta Madang	W	-	M.a. banksii with purple ♂ bud. Fruit round-tipped with v.long pedicel	6/1
PNG 177	Fe'1	Wain	?		C	-	Erect bunch, no ♂ bud. Red sap. Bright green pseudostem. Fruit pointed at apex 5-6 hands	6/2

Acc No	Genotype	Local Name	Language Group	Location	Uset	Diseases ² Present	Main Characteristics ³	Photo No
PNG 178	AA	Bagul	Bell	Brahmin Madang	C	?	Small plant. Fruit curved upwards. ♂ bud purple/yellow, with pollen. 4-5 hands.	6/7
PNG 179	AA?	To'o	Bell	Brahmin Madang	D	BS	Red peduncle, long fingers, curving upwards. Persistent neutral flowers and bracts. ♂ Bud purple/yellow, 4 hands	6/8
PNG 180	AS (sp) M.a.banksii x M.schizocarpa			Brahmin Madang	W	-	Intermediate between parents. Fruit + black. Typical cf. Argent (1976)	6/10, 6/11 6/12
PNG 181	AA(sp) M.a.banksii			Ono base camp. Madang	W	-	Typical M.a.banksii V.good bunch - 20 hands. Long fingers ♂ bud green. Seed only.	6/15, 6/16 6/17
PNG 182	AAA?	Kenar	Garea		C/D	-	Long rounded fingers pointing upwards 10 hands. ♂ bud yellow/purple, pointed apex	6/20
PNG 183	ABB?	Angari	Amele	Uya Madang	C	BS, BC	Compact bunch of small fruit with pointed apex. Persistent neutral flowers and bracts. Bracts not rolling. ♂ bud purple, colour not fading inside bract. Much white sap in fruit. Deep rooted suckers.	6/22

Acc No	Genotype	Local Name	Language Group	Location	Use ¹	Diseases ² Present	Main Characteristics ³	Photo No
PNG 184	AA	Enar	Amele	Erima Madang	C	-	V. shiny leaves, red on petiole margins. Fruit small, curved, sub-horiz. Bracts persistent. ♂ bud purple. Leaves not shredded by wind.	6/27
PNG 185	AA	Uyam	Amele	Erima Madang	C	BS	Suckering inhibited. Fruit pendant. ♂ bud yellow/red. Neutral flowers persistent. 4 hands	6/29
PNG 186	AAT?	Sar	Amele	Erima Madang	C	-	Bright green, shiny pseudostem, weak petioles, fruit green shiny pointing upwards persistent neutral flowers. ♂ bud purple /green, shiny, imbricate	6/30, 7/4
PNG 187	AA/AS?	?		Ato Madang	?	-	Compact bunch of dark green, bottle-necked fruit. ♂ bud purple 9 hands	7/2, 7/3
PNG 188	AA	? (MeLeng)		Madang Town	D/C	-	Extensive red on petioles and midribs, large rounded fruit. long pedicels, 3-4 fingers/hand. ♂ bud purple.	7/7
PNG 189*	Fe'1	?		-	D/C	-	Erect bunch. Red sap long pointed fingers no ♂ bud	4/38, 10/11
PNG 190	AAA?	Tonton Kepa	Maia	Madang Town	D	C, Freckle	Inhibited suckering Fruit pointing upwards, pointed apex, 9 hands, ♂ bud green/yellow. Some pollen	10/12

Acc No	Genotype	Local Name	Language Group	Location	Use1	Diseases2 Present	Main Characteristics3	Photo No
PNG 191	AAB	Bene	Gahuku	Kafana E.Highlands	C		Robust, erect leaves Red on petioles, and midribs. Fruit curving upwards. Persistent neutral flowers. ♂ bud purple. Pollen present.	7/20, 7/24
PNG 192	AAB	Gamaha	Gahuku	Kafana E.Highlands	D	BS	Robust, erect leaves Fruit fat, horizontal thin-skinned. Orange flesh. ♂ bud purple compound tepal yellow/ orange. Popoulou-type Inside bract crimson	7/21
PNG 193	AAB	Moruah	"	" E. Highlands	C	BS	Short, rounded, horizontal fingers. Extensive blotching on pseudostem. Flesh yellow. Persistent neutral flowers. ♂ bud yellow/purple Erect leaves	7/23
PNG 194	AAAB?	Ambiri	"	"	C	-	Robust, tall, good bunch. Long fingers, pointing up. ♂ bud yellow/purple. Drooping leaves.	7/25
PNG 195	AAB	Kununamba (Yamunamba)	Kafe (Asaro)	Kingkio E.Highlands	D	Freckle	Robust, erect leaves Purple peduncle. Short rounded fingers, yellow/orange flesh ♂ bud purple. Red on compound tepal. 6 hands	8/4, 8/10
PNG 196	AAB	Uzakan	Kafe	Zabunka E.Highlands	D	Freckle	Pale pseudostem, Red peduncle. 3 nodes before basal hand. Short rounded fruit Orange flesh ♂ bud red. 5-6 hands.	8/12

Acc No	Genotype	Local Name	Language Group	Location	Use1	Diseases2 Present	Main Characteristics3	Photo No
PNG 197	AAA	Tempua	Agarawe	Tuempinka E.Highlands	D	Malayan Leaf spot	Whole plant very red. Fruit dark green/red small, curving upwards ♂ bud purple. Some pollen Fruit remains green when ripe.	8/14, 8/15
PNG 198	AA?	Kuyu	Kasup	Kassam E.Highlands	C?	BS	Green, shiny pseudostem. Fruit long, pointing up, not well filled. ♂ bud green/purple with pollen and occasional seed. 5 hands. Persistent neutral flowers	8/18
PNG 199	AAB	Kanim	Kasup	Kassam E.Highlands	D	Malayan leaf spot	Good bunch of fat rounded fingers. white flesh, ♂ bud purple. With pollen Maia Maole type. 8 hands	8/17
PNG 200*	M.ingens			Aiyura E. Highlands	W	-	Huge. Typical, cf Argent (1976) Ht-11.5m Pseudostem circumference 2.5m at 1 m above ground level.	8/20 - 8/26 9/2 - 9/6
PNG 201	Fe'i	Rimina	Watabung	Kenadiro Chimbu	C (only eaten by men)	-	Bright green pseudostem. Erect bunch. Short, fat angular fruit. No ♂ bud. Red sap Thick peduncle.	9/16, 9/17
PNG 202	AAB	Yaurie	Gumini	Miunde W.Highlands	C	BS	Tall, erect leaves Long fingers pointing upwards. Orange flesh ♂ bud green/purple ♂ flower cream No pollen	9/19, 9/22

Acc No	Genotype	Local Name	Language Group	Location	Uset	Diseases ² Present	Main Characteristics	Photo No
PNG 203	AAB	Kerua	Gumini	Miunde W.Highlands	C	?	Shorter than Yourie short, fat rounded fingers. Orange flesh ♂ bud purple/yellow ♂ flower cream	9/21
PNG 204	AAA	Kumbak	?	Tanig W.Highlands	C	B.S	Extensive blotching Large gaps between hands. Fingers long pointing upwards bud purple. ♂ flower cream, green ovary Tall plant, 5 hands.	9/23, 9/24
PNG 205	AAA	Mata kun	Melpa	Mt Hagen W.Highlands	D/C	-	= Red? Similar to Red but flesh more orange V.vigorous. 4-5 hands	9/26
PNG 206	AAB	Rukumamb tambey	.	Moitam W.Highlands	D/C	BC, C	Pseudostem black, peduncle purple. Fruit horizontal rounded. ♂ bud purple. Many abnormal ♂ flowers. Orange flesh, 6 hands	9/27, 9/28
PNG 207	AAB	Rukumamb	.	.	D/C	BC, C	As PNG 206, but pseudostem green, fruit less tasty. Remains green when ripe	
PNG 208	AAB	Terema	.	Yan W.Highlands	C	BS	Pale pseudostem. Long pendant fingers. V. erect leaves ♂ bud yellow/green. Tall plant. Yellow flesh	9/29
PNG 209	AAA?	Suga	.	.	D	BS	Small, rounded fingers Extensive blotching ♂ bud purple. 6 hands. Brought from Chimbu	9/31

Acc No.	Genotype	Local Name	Language Group	Location	Use1	Diseases2 Present	Main Characteristics3	Photo No
PNG 210	AAA	Agu (=Kator, E.N.B.)	Melpa	Yan W.Highlands	C	BS	Tall, robust. Good bunch, fruit pointing up, blunt-tipped ♂ bud purple, rounded apex	9/30
PNG 211	AA	Kungor	Midwahgi	Kauil W.Highlands	C	BS	Small, fruit curved upwards. Some pollen, stamens red	9/34
PNG 212*	AAA?	Koku	.	.	C	-	Robust, Rounded fruit with long pedicel, pointing upwards. Persistent neutral flowers. ♂ bud purple/yellow. Abnormal flowers	9/33
PNG 213	AA	Yeldem-banz	Midwahgi	Kauil	C	BS	Extensive black blotching. Fruit curved upwards. Persistent neutral flowers. Small, slender plant	9/35
PNG 214	AA	Kospuke	.	.	D	BS	V.slender, shiny pseudostem, red on petioles	-
PNG 215	AAB	Kunaimp	Melpa/Baiyer	Baiyer River	C	BC, C	Similar to P.rajah, lax bunch, fruit curved upwards. Persistent bracts and neutral flowers. ♂ bud purple, compound tepal orange. 5 hands white flesh.	9/36
PNG 216	AA?	Yalim	.	.	C	Malayan leaf spot C	Extensive black blotching. Fruit small, curved upwards. ♂ bud purple/yellow. With pollen. Yellow flesh.	-

PNG 217	AA	Bega	Melpa/Baiyer	Baiyer River	C	BC, C	Small, slender plant Long, sub-horizontal fingers ♂ bud green/purple. flowers abnormal	9/37
PNG 218	AA?	Mena	Melpa	Tabibuga W.Highlands	C	BS	Small, slender plant fingers pointing upwards blunt-tipped. ♂ bud green/purple. Little pollen. Yellow flesh.	
PNG 219	AA	Kuspaka (=Kospuke PNG 214)?	Midwahgi	Kuk W.Highlands	D	?	Tall, slender. Much black on pseudostem Fruit rounded, pointed tip, horizontal. ♂ bud purple.	
PNG 220	AA (sp.) M. acuminata ssp. banksii			Kar Kar Island Madang	W	?	Typical M.s. banksii	No photo
PNG 221	M. peekellii ssp. angustigemma			*	W	?	Typical cf. Argent (1976)	No photo

Key

1. Use: D = Dessert, C = Cooking, O = Ornamental, W = Wild
2. Diseases: BS = Black Sigatoka, BC = Black Cross, C = Cordana
3. Main Characteristics: Details of PNG 001 to PNG 070 are given by Sharrock (1988)

* Did not establish in tissue culture