**Banana Collecting Mission in the Autonomous Region Of Bougainville (AROB), Papua New Guinea.**

October, 18 – November, 2 2016

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**Front cover credits:**

Man with a Fe’i bunch on Buka island (G. Sachter-Smith)

**Introduction**

Banana (*Musa* spp.) is a crop of major importance in the tropics for both subsistence and food security (FAOSTAT 2014). Its peculiar propagation mode, vegetative, makes this crop particularly vulnerable to disturbance. Extremely low levels of sexual reproduction limit the occurrence of new, potentially better adapted genotypes to occasional mutation events. Thus, the diversity of cultivated banana is fixed over long periods of time to existing genotypes. In this context, assessing the extant of the diversity existing in banana, conserving and making it available for further use is a priority.

The Global Musa Genetic Resources Network (MusaNet) aims at supporting the implementation of priority research activities as identified in the Global Musa Conservation and Use Strategy. Following experts consultation, the Strategy identified priority areas for collecting both cultivated bananas and wild relatives and-two collecting missions took place in Indonesia (see the 2012/2013 Triangle Missions Reports) jointly organized by the International Tropical Fruit Research Institute (ITFRI) and Bioversity International.

Papua New Guinea (PNG), including neighbouring islands, is a recognized centre of diversity and potentially a domestication centre for banana (Christoleva et al. 2016; Lebot 1999; Sardos et al. 2016; Volkaert, 2011). IBPGR and QDPI (current DAF) in co-operation with the PNG Department of Agriculture and Livestock (current NARI) and supported by INIBAP (current Bioversity International), organized 4 collecting missions to mainland PNG and the Bismarck Archipelago in 1988-1989. In total, these missions allowed the collection of 264 wild and cultivated accessions out of which 86 % appeared to be original genotypes (Arnaud and Horry 1997). The collected accessions were sent to both the National Banana Germplasm Collection at Laloki, Port Moresby and to the International Transit Centre (ITC) in Belgium for conservation purpose. They were also characterized and evaluated at the QDPI South Johnstone Research Station in Australia. Since 1994 and the signature of an agreement between Bioversity and FAO, all the germplasm conserved in the ITC, including the PNG material, is available to all on the understanding that it remains on the public domain. Therefore, more than 25 years after the PNG missions, 230 of the accessions collected in PNG are still conserved in-vitro in the ITC. Over the years, the PNG accessions constituted and still constitute significant and valuable resources for breeders and researchers and contributed to significantly improve our knowledge and perception of banana diversity and diversification. They were indeed widely used in research studies (e.g. PNG291 - ITC0896 *Musa acuminata* ssp. *banksii:* a non-exhaustive list of publications using this accession can be found in the "Publications" section of the webpage https://www.crop-diversity.org/mgis/accession/01BEL084896; for the other "PNG accessions", go to this page https://www.crop-diversity.org/mgis/content/musalogue-catalogue-musa-germplasm-papua-new-guinea-collecting-missions-1988-1989). Due to civil conflict (1988-1998), what is nowadays the Autonomous Region of Bougainville (AROB) was not visited by the expeditions in the 1980s.

The Pacific region is known to host important levels of genetic diversity of a wide range of crops including bananas. Numerous crop collections have been performed in the past in an attempt to bring together these different resources into national or regional *ex-situ* collections. However, environmental hazards are numerous in the region (earthquakes, tsunamis, drought, hurricanes…) and local agricultural systems often appear more resilient in face of hazards than conventional ex-situ collections.

Encouraged by the Global Crop Diversity Trust and by the Crop Wild Relatives project, seeds conservation has been investigated for a couple of years as a complementary method for the conservation of banana wild relatives. However a number of key questions remain, notably on the amount of populations and of plants per population to sample or on the number of seed per plant to be conserved. It will be necessary to perform population genetics studies on several *Musa* species to answer these questions.

Organized by NARI and Bioversity International and-funded by the Genebank CGIAR Research Programme with a contribution of the Belgium government through the PhenSeeData project, the Banana Collecting mission in the AROB was set up from October, 19 to October, 31 2016 and explored the islands of Bougainville, Buka and Sohano. The goals of the mission were i) to collect new wild and cultivated genotypes for conservation purpose, ii) to explore the possibility of on-site conservation and iii) collect samples for population genetics studies of the two wild species present, *Musa maclayi* spp. *maclayi* var. *erecta* and *M. bukensis*.

We present in this report the results of this intense 13 days mission to AROB.

**Materials and methods**

The collecting team was composed of Janet Paofa (curator of the *Musa* collection in NARI Laloki), Gou Rauka (phytopathologist in NARI Lae), Steven Janssens (Research fellow at Botanic Garden Meise), Gabriel Sachter-Smith (Banana taxonomy expert, consultant for Bioversity International) and Julie Sardos (co-chair of the MusaNet Diversity Thematic Group, Genetic Resources Associate Scientist in Bioversity International). Due to potential safety uncertainty, a local guide, Mr Zohn Bosco from Bougainville Express Tours (BET), was contracted. Officers from Department of Primary Industries (DPI) offices in Buka, Kieta and Buin were also contacted to support the team locally.

Choice of Time and itinerary

The mission was set up in October as it is before the rainy season. The itinerary is presented below (Tab. 1, Fig. 1).

Table 1: Planned itinerary for AROB banana collecting trip

| Day | Date | Exploring | Estimated kilometres covered in a day |
|---|---|---|---|
| 1 | 18/10/2016 | Visiting team arrive to PNG and rest | |
| 2 | 19/10/2016 | Team travel to Buka – courtesy visit to DPI secretary and meet Mr Joshua Koles (assigned officer) | |
| 3 | 20/10/2016 | Travel to Arawa (PM – Meet with Ms Delwin Ketsian – AWIA president) | 160 km |
| 4 | 21/10/2016 | Meet with Ms Elma Maxwell (DPI officer) and explore around Kieta | approx. 12 km |
| 5 | 22/10/206 | Explore around Kieta | 45 km |
| 6 | 23/10/2016 | Explore towards Buin to Arawa | 108 km |
| 7 | 24/10/2016 | Meet with Mr Leo Paupau (Buin DPI officer) and explore around Buin | |
| 8 | 25/10/2016 | Explore towards Siwai | 60 km |
| 9 | 26/10/2016 | Explore around Panguna through to Arawa | 70 km |
| 10 | 27/10/2016 | Explore around Central Bougainville | 115 km |
| 11 | 28/10/2016 | Travel back to Buka and explore around Selau and Tinputz | 160 km |
| 12 | 29/10/2016 | Explore Buka Island (East) | 40 km |
| 13 | 30/10/2016 | Explore Buka island (West) | 35 km |
| 14 | 31/10/2016 | Travel back to Port Moresby | |
| 15 | 01/11/2016 | Visit CEPA and NAQIA for export permit and phytosanitary certificates for the samples to be sent abroad; visit to Laloki collection | |
| 16 | 02/11/2016 | Team departs Port Moresby | |

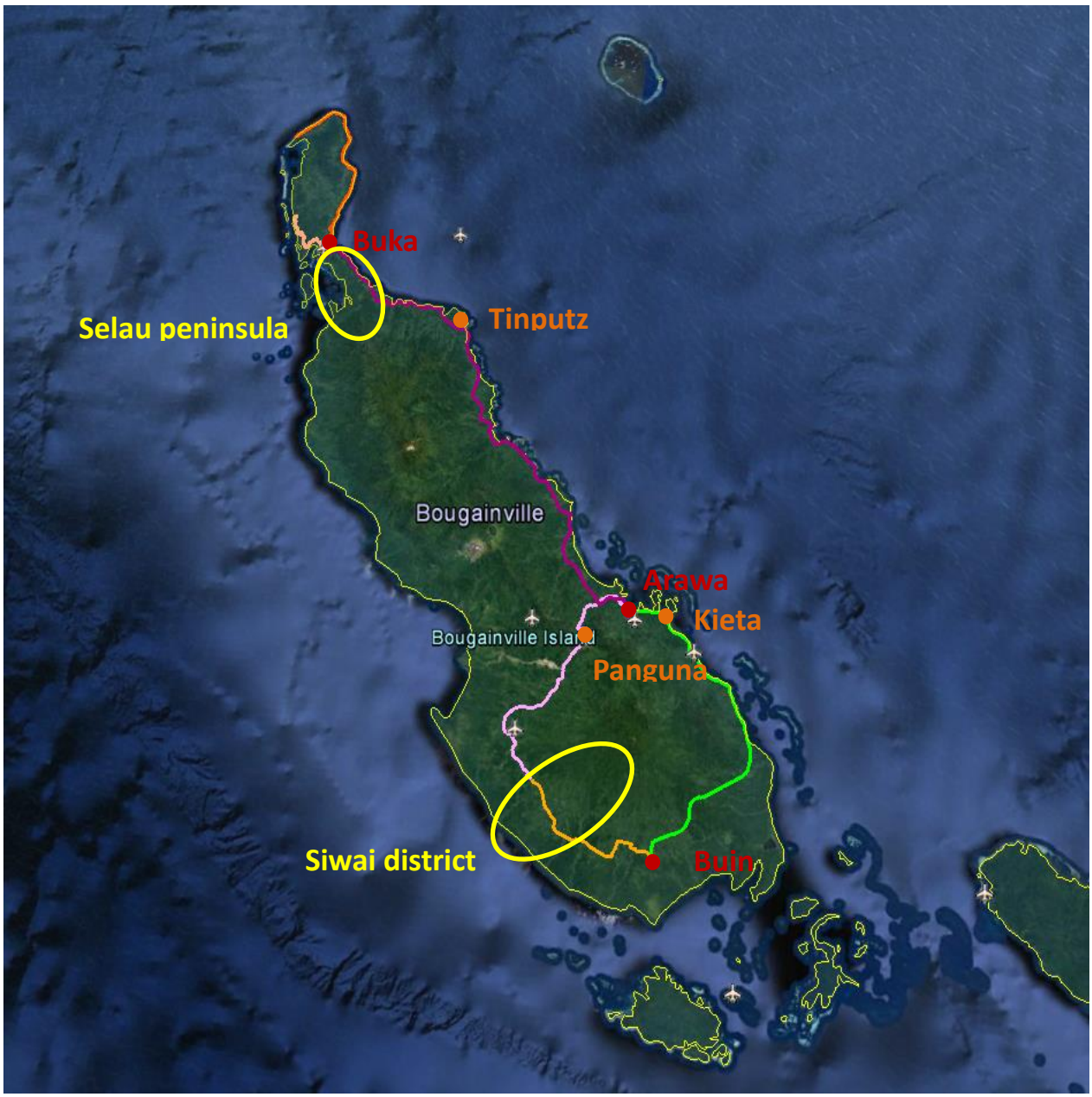


Figure 1: Planned itinerary

Types of material collected

All collections, except when made in abandoned garden, were made with the authorization of the field's owner (or a relative). Suckers were collected when cultivated varieties were unknown from the team-based on their morphology. The Fe'i types being quite uncommon, all Fe'i met were collected along with a few samples of wild Australimusa (*M. bukensis* and *M. maclayi* spp. *maclayi* var. *erecta* previously described by Argent (1976)). Once collected, the varieties and wild specimen were given a unique ID code and became an accession. Whenever possible, six suckers were collected per accession to further allow transferring three suckers to NARI Laloki while three other suckers could be planted in Arawa (see the on-site section).

Fresh leaf tissues, preferentially cigar leaves, were collected from all the accessions and conserved in an electric cooler that could be plugged to the car and in any guest house equipped with power. Back-up samples of the fresh leaves were kept in DNAgard following the protocol displayed in Annex 1.

In order to collect large quantities of leaf material for molecular genetic studies on wild populations of *Musa bukensis* and *M. maclayi* ssp. m*aclayi* var*. erecta*, silica grains were used for sample storage. Silica grains dehydrate leaf tissue very rapidly resulting in inactivating the enzymes that could degrade the DNA in the cells. The accessions collected as fresh leaf tissue and in DNAgard were also sampled using silica grains as additional back up. When possible, we tried to sample the second leaf after the cigar leaf. Leaf samples of *M. bukensis* and *M. maclayi* ssp. *maclayi* var. *erecta*, were sampled throughout the whole island of Bougainville and Buka. For each population, we aimed to sample at least 15 individuals. In addition, at least 20 populations across the island had to be collected in order to conduct analyses on the population genetic structure such as the assessment of genetic diversity, allele number per locus and population and the percentage of polymorphic loci.

Seeds were collected for two scientific purposes: 1) to study the ecological trigger that stimulates germination of *Musa* seeds 2) to examine the amount of gene flow between and within populations by comparing the mother plants within populations with their seeds. Seeds were collected from both *M. bukensis* and *M. maclayi* ssp. *maclayi* var*. erecta*. Instead of pooling all the seeds for a certain species, each individual was separately sampled. Also within each individual, seeds were sampled per different hand and fruit so that the population genetic history of each seed could be traced back as well as that different stages of fruit maturity can be taken into account for germination experiments. Seeds were removed from the fruits and stored into paper bags. A small amount of dehydrating silica gel grains was added to the bags to avoid fungal growth or bacterial rots.

Root samples were taken in order to study the associated mycorrhizal fungi with both cultivars and wild populations. For each cultivar or wild specimen that was collected using DNAgard, also a root sample was also collected. Fresh root tips were immersed in a 2x CTAB buffer (2% CTAB, 100mM TrisHCl, 20mM EDTA and 1.4M NaCl) in 1.5 ml tubes and stored at 4°C in an electric cooler in the car or at guesthouses. Before submersing them in CTAB, the roots were rinsed with water to remove soil particles that could contaminate the buffer. When possible, the lateral, branched parts of the roots were collected, as these are most likely to be colonized by fungi. Because mycorrhizal fungi are often unevenly distributed along the root, we tried to collect as much of the root surface as possible.

Data recorded (GPS location, minimum descriptors data, descriptive photos)

For each accession collected and each patch of wild population sampled, latitude and longitude coordinates were recorded using a GPS Garmin GPSMAP® 64.

For each accession, the minimum set of descriptors for banana (https://drive.google.com/file/d/0B6WMCDtu_LjpYkdrM1RoMHZKQzQ/view) was used whenever possible (i.e. when plant was at the appropriate stage and organ still present). These accessions were also documented with pictures showing, when possible, striking characteristics of the plant

featured. When present, farmers were interviewed in order to gather passport data (the name, meaning of the name, known synonyms, origin of the variety, main uses and any linked history).

Figure 2: samples processing

Samples processing

Fresh leaf tissues were collected to be sent to the Musa Genotyping Center (MGC) in the Institute of Experimental Botany (IEB) based in Olomouc (Czech Republic) for ploidy analysis and SSR genotyping. When possible, cigar leaves were collected, following the recommendations provided by MGC (see Annex 2 protocol for leaf sending). On the second day of field trip (Day 5), the samples from the accessions collected the first day were tentatively sent from Arawa to Port Moresby in order to be further sent to Czech Republic by colleagues from NARI. However, the samples were lost and did not arrive to Port Moresby. It was therefore decided to keep the leaves collected during the rest of the mission in the electric cooler. These samples were then sent from Port Moresby on our way back home after the issue of an export permit and of a phytosanitary certificate from the appropriate government authorities.

## Results

Novel diversity: Accessions collected

In total, the mission ended up with 61 accessions collected. Synthetized results are presented in Table 2 and Table 3. Detailed identities of the accessions collected are presented in Annex 3 and in the catalogue “Bananas of the Autonomous Region of Bougainville” (Sachter-Smith 2017).

Table 2: Synthesis of collections (by day)

| Day | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **No. Accessions** | 6 | 7 | 1 | 8 | 8 | 8 | 3 | 9 | 5 | 6 | 61 |
| **No. of wild leaf samples** | 16 | 14 | 52 | 28 | 35 | 75 | 15 | 75 | 44 | 30 | 384 |

Based on their morphology and taking into account that the accessions collected were not all at the proper stage for formal identification, we anticipate however the occurrence of a few duplicates (notably AROB029 Popondetta / AROB031 Kouraï ; AROB042 Asi / AROB045 Glenda's Dwarf ; AROB051 Limot / AROB052 Poso-olohi and AROB043 Sausage banana / AROB061 Sausage banana). In addition, we may have recollected a few accessions previously made during the IBPGR-PNG missions: AROB003 Mero Mero may be a synonym of PNG203 Kerua and AROB019 Tavilo may be a synonym of PNG101 Kekiau. These suspicions will be confirmed or not after the full morphological characterization in the same environment and the SSR genotyping of the accessions concerned.

Based on morphology, one accession was identified as Maoli-Popoulu (AROB025 Taiop) and another as Iholena (AROB039 Kibirori). Four other were qualified of "Plantain-like" (AROB007 Navente 1, AROB011 Navente 1, AROB024 Seven Kina and AROB060 Bubun).

Table 3: Proposed classifications for the accessions collected

| No. | Proposed classifications | Notes |
|---|---|---|
| 30 | AA | |
| 3 | AAA | |
| 9 | AAB | |
| 2 | 4X? | |
| 6 | ? | ornamental, potential duplicates |
| 7 | Fe'i | With potential duplicates |
| 2 | *M. bukensis* | |
| 1 | *M. maclayi* ssp. *maclayi* | |
| 1 | *M. ornata* | |

Unexpectedly, 48 fresh leaf samples arrived in the MGC being fresh enough to get ploidy measurement done. The ploidy measurement results were ready 4 days only after the visiting team's

return in Europe / US. Twenty-nine accessions appeared diploids, 12 triploids and 2 tetraploids. In addition, 5 additional accessions may likely be diploids with higher genome sizes (Table 4). These 5 accessions correspond to one accession classified as M. maclayi spp. maclayi (AROB013 Kaura), 3 accessions classified as Fe'i (AROB029 Koraï 1, AROB031 Kouraï and AROB052 Poso-olohi) and the last one being either a Fe'i or a wild type (AROB030 Koraï 2). The results per accession are presented in Annex 3.

Table 4: Ploidy measurement results

| Ploidy | No. of accessions |
|---|---|
| 2X | 29 |
| 2X* | 5 |
| 3X | 12 |
| 4X | 2 |
| Total | 48 |

*Note: 2x* the peak ratio between Musa and internal standard was slightly higher than expected for a diploid. Based on our experience, these samples are most probably diploids with higher genome sizes, but chromosome counting would be needed to confirm it for 100% certainty.

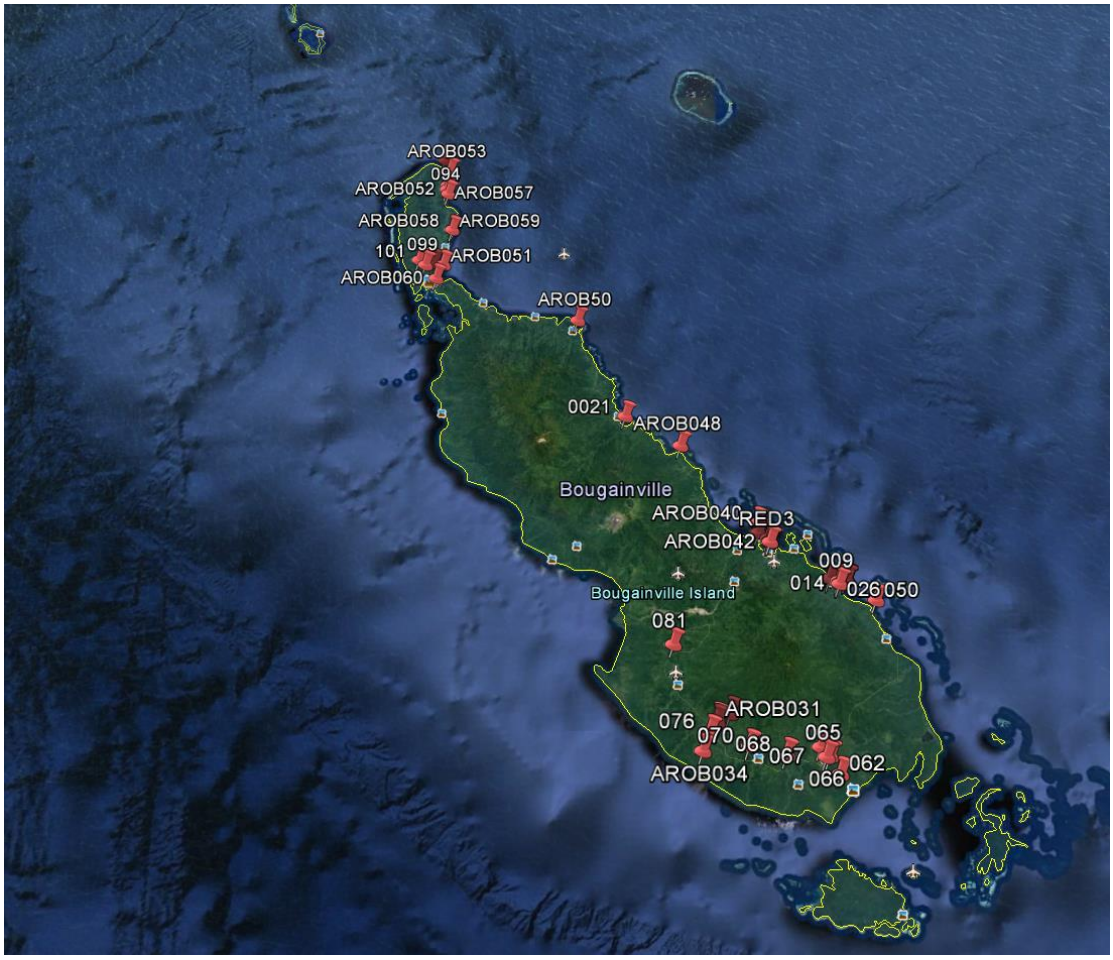


Figure 3: Points of collection for the AROB accessions

Local conservation

Due to the absence of local agricultural institution with the capacity to conserve a banana collection in Bougainville, Mrs Delwin Ketsian, president of the Arawa Women in Agriculture, the local branch of Papua New Guinea Women in Agriculture Development Foundation, was contacted prior the mission. She accepted to dedicate a plot (Arawa) of her land to the planting of the banana varieties collected by the team. The long term idea behind is the development of a type of on-site conservation initiative, based on what is done with the Community-Based Conservation Network in the Solomon Islands. Whenever possible, the team collected 6 suckers per accessions to allow the planting of 3 plants in Mrs Ketsian's garden. However, this ideal case where 6 suckers from a variety were available was not reached very often. Consequently, Mrs Ketsian received suckers from 23 accessions. The detailed number of suckers given to Mrs Ketsian per accession is presented in Table 5. We have to mention here that one of the accessions collected was not provided to Mrs Ketsian on purpose. This accession is AROB011 Navente11. Navente 1 is a legendary banana for the Clan of the Eagle (Central Bougainville) (Story in Annex 4, with permission of Mr Zohn Bosco, member of the Clan). Due to the legend, a taboo is associated to this variety: it is forbidden to bring it further the hill located at the north of the Clan territory. Different members of the Clan agreed to see Navente leaving its restricted territory for conservation purpose as "very few people are still planting it". However, it was decided to respect the taboo on the island and suckers were sent to Laloki, outside Bougainville territory but not to Arawa, located on the island north of the sacred hill.

[1] The banana is simply called "Navente" but it has a homonym, also a variety named "Navente" (AROB007) which is different from the legendary one. As the team collected both, 1 and 2 were added to both names to avoid confusion.

Table 5: number of suckers provided to Delwin Ketsian

| Code | Name | No. of suckers provided to Mrs Ketsian | Tentative classification |
|---|---|---|---|
| AROB003 | Mero Mero | 3 | AA |
| AROB004 | Wiau | 2 | AA |
| AROB005 | Duma* | 2 | AA |
| AROB007 | Navente 2 | 2 | AAB |
| AROB009 | Bukatawawe | 3 | AAA? |
| AROB010 | Bia Kaura | 3 | Fe'i |
| AROB012 | Musa ornata* | 1 | Musa ornata |
| AROB015 | Laguai* | 2 | AA |
| AROB016 | Nape'e | 3 | AA |
| AROB022 | Kararu 2* | 2 | AA |
| AROB023 | Morou* | 2 | AA |
| AROB024 | Seven Kina | 1 | AA |
| AROB026 | Kaurai | 2 | Fe'i |
| AROB029 | Korai 1 | 2 | Fe'i |
| AROB032 | Toitoi* | 2 | AAB? |
| AROB033 | Papua | 2 | AA |
| AROB036 | Mopere | 2 | AA |
| AROB040 | Navotavu | 2 | AA |
| AROB044 | Arawa* | 2 | AA? |
| AROB049 | Nono | 1 | AA |
| AROB052 | Poso-olohi | 2 | Fe'i |
| AROB054 | Huhu | 2 | AA |
| AROB060 | Bubun | 1 | AAB |

Wild Musa: Population Genetic Study

In total, 384 different individuals from both *M. bukensis* and *M. maclayi* ssp. *maclayi* were collected in 29 different localities on the islands of Buka and Bougainville. Based on the specimen density of the sampled localities, an estimated 20 to 25 different populations have been collected.

*M. bukensis* only occurs on Bougainville Island, whereas *M.maclayi* ssp. *maclayi* is present on both Bougainville and Buka Island. Although there is a clear shift from one species to another on the southeastern part of Bougainville Island, the delineation of the two species in southwestern Bougainville is less pronounced and a gradient from one species to another is seemingly more present there. Molecular genetics will show how genetically intermingled both species are on the island.

Seeds and fruits were collected from 9 different individuals of *M. bukensis* and *M. maclayi* ssp. *maclayi* var. *erecta.* Of each specimen from which seeds were collected, also a leaf sample of the mother plant was sampled in order to compare the genetic diversity between parents and off springs.

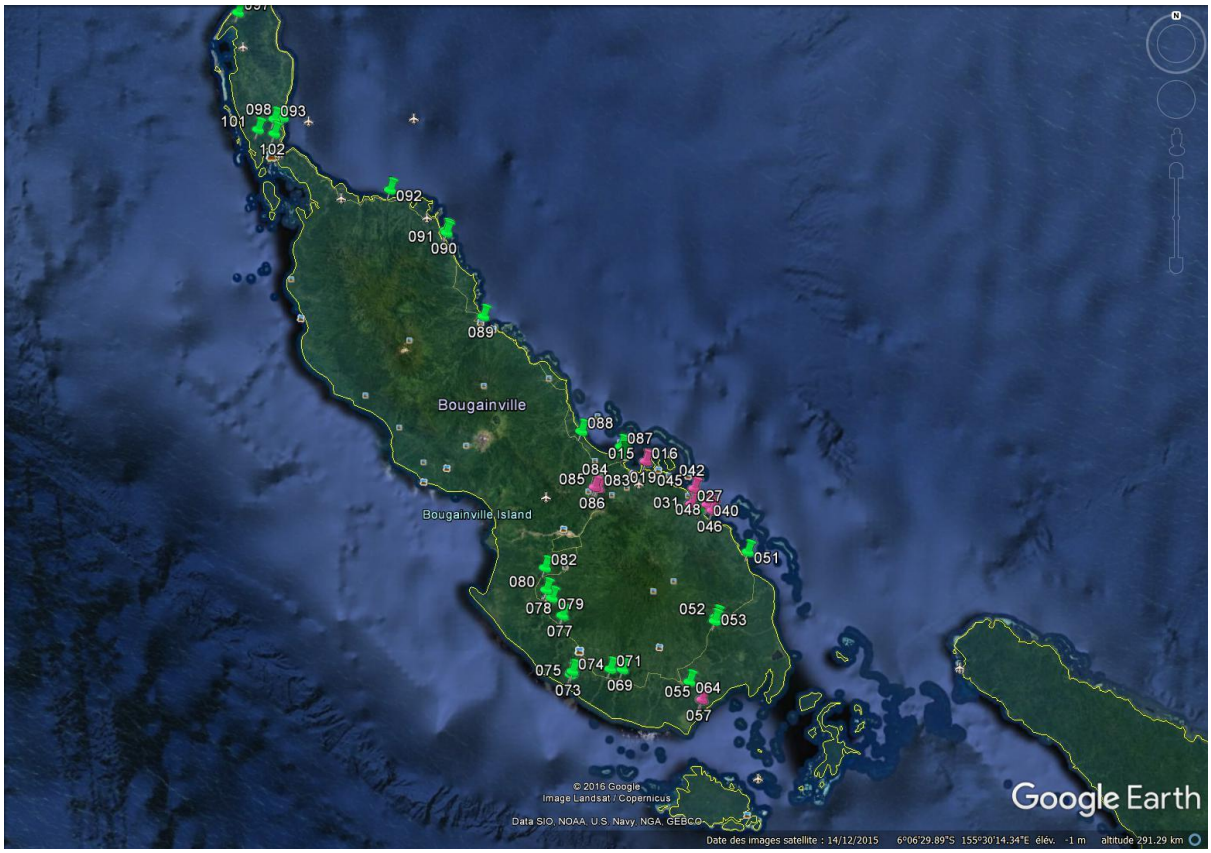


**Figure 3: Collection points for the wild specimen samples (population genetics study). Pink marks represent the bunches sampled.**

**Discussion**

Successes

The collecting mission to the AROB was a success. We collected 61 potentially new varieties and wild types of banana for further conservation. Notably, we collected quite a number of diploid AA suitable for cooking purpose that will enrich the pool of AAcv collected during previous missions to PNG and neighbouring islands and could be useful for Plantain breeding.

The flow cytometry results obtained from the MGC hosted in the IEB allowed to know rapidly the ploidy levels of 48 of the accessions collected. Interestingly 2 accessions appeared to be natural tetraploid (AROB027 Buka and AROB056 Kalmagol). We noted that AROB056 Kalmagol was likely collected by P. Allen in 1960 under the codes FHIA III-109 Kalamagol and / or FHIA III-186 Unknown which both do not exist anymore in the FHIA collection (Rosales et al. 1999). As none of these two FHIA accessions were sent to the ITC, it is interesting that we collected it again. Out of the 8 accessions classified as Fe'i or as local wild Australimusa for which we obtained flow cytometry results, 5 exhibited higher peaks than expected for diploids suggesting bigger genome sizes while 3 displayed normal profiles for diploids. The results of the genotyping assay may explain this pattern.

The big amount of leaf samples collected for population genetics studies will allow to 1) better understand gene flow and populations dynamics of wild species on Bougainville, 2) will allow to better define the species *M. bukensis* and *M. maclayi* spp. *maclayi* and 3) will provide useful insight into the domestication of Fe'i bananas that were domesticated from the section Australimusa.

Lessons learnt

The mission was too short to allow the visit of remote places, notably the west coast of the island which is only accessible by boat. The human populations living there are known to live a traditional way of life and it would be interesting to explore the diversity of banana planted there. In addition, we heard in Buin of another legendary variety that is said to be the "father of all the bananas". According to our informant, met in the guesthouse in Buin, it can be found at the market under the name "Susu sanap" and is consumed for customary ceremonies. Unfortunately we didn't have time to look for it as the schedule was tight, due to the planned itinerary and also to the rivers that we had to cross: at the end of the day, they are carrying more water and it becomes difficult to drive through.

Next

The suckers of the 61 accessions collected were sent to NARI and were planted first in the nursery due to bad weather conditions. Once planted on the field, they will be characterized (minimum set of descriptors) and documented (minimum set of pictures

https://drive.google.com/file/d/0B6WMCDtu_LjpblZZVktjSWpvdmM/view). In parallel, the molecular genotyping of these 61 accessions using SSR and RAD-sequencing is being performed. Once both types of data, morphological and molecular merged, the original genotypes/phenotypes identified will be sent to the ITC for medium and long-term conservation.

As highlighted in the previous sub-section, the time-lime was very short compared to the size of the island. Complementary missions, targeting specific places such as the west coast or the area of Buin may be considered in the future. It also would be interesting to plan follow-up missions to Arawa to visit Mrs Ketsian and evaluate the impact of the on-site conservation initiative.

**Conclusion**

Despite the 4 collecting missions organized in the past in PNG and neighbouring islands, new diversity of banana was discovered in Bougainville, highlighting the richness of the whole PNG region in terms of banana varieties. Therefore, the region of Papua-New-Guinea, including the neighbouring islands such as the Bismarck archipelago and the Autonomous Region of Bougainville, shows new evidence of being an amazing hotspot, probably the biggest in term of varieties number, for banana diversity. As such, this region deserves concentrated efforts to assess, investigate and conserve not only banana genetic resources but also the farming practices and the associated knowledge that allowed the emergence, accumulation and preservation of such an amount of diversity.

Left to right: G. Rauka, J. Paofa, G. Sachter-Smith, S. Janssens and J. Sardos

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Annex 2: Leaf shipment protocol

Annex 3: List of accessions collected, proposed classifications and ploidy measures obtained from MGC

Annex 4: The legend of Navente

**Annex 1: Protocol to process leaf samples with DNAgard**

First, collect cigar leaves in the field. If you can, put them in plastic bags to prevent exposure to air and don't forget to properly label them.

As soon as you're back to the office/lab or if you find any convenient place to do it, proceed to the storage in DNAgard as following:

1) Label the tube
2) Put 0.75 to 1 ml of DNAgard in the 2 ml tube (provided)
3) Cut a 2 cm slice of cigar leaf
4) Unroll it
5) Cut 2 cm x 5 cm piece of the lamina
6) Roll this piece tight
7) Put it in the tube
8) Fill the tube with DNAgard to the top, avoiding bubbles
9) Hide the tube from light

Sending fresh banana material

...step by step...

# ...Step one...

1. Please, cut fresh cigar leaves (A)
or use young fresh leaves (B)
at required weight



Please, do not use
old leaves (C) !!!!

# Step two – preparation leaves for sending

You will need:

- Paper tissue
- Distilled water
- Plastic bag
- Cooling blocks
- Polystyrene box

Wrapp the cigar leaves in moistened paper tissue (D) and place them in a not-sealed plastic bag (E, F). Mark the leaves or plastic bag (name of cultivar, accession code, ...).




Do not use sealed bag (G)!!!

# ...Step three...

Put the bag with banana leaves into a polystyrene box and add cooling blocks to avoid tissue damage (H)

Please, follow our instructions strictly to avoid damage of leaf tissues during the transport. Below are examples of damaged leaves that are not useful for further analysis.

Annex 3: List of accessions collected, their proposed classification and the ploidy measured in MGC.

| Code | Name | Proposed classification | Ploidy measurement (flow cytometry) |
|---|---|---|---|
| AROB001 | Flower banana | ? | np |
| AROB002 | Kaura | Musa bukensis | np |
| AROB003 | Meru Meru | AA | np |
| AROB004 | Wiau | AA | np |
| AROB005 | Duma* | AA | np |
| AROB006 | Nono | ? | np |
| AROB007 | Navente 2 | AAB | np |
| AROB008 | Kamura | Musa bukensis | np |
| AROB009 | Bukatawawe | AAA? | 3x |
| AROB010 | Bia Kaura | Fe'i | 2x |
| AROB011 | Navente 1 | AAB | np |
| AROB012 | Musa ornata* | Musa ornata | np |
| AROB013 | Kaura | Musa maclayi | **2x*** |
| AROB014 | Tamoa | AA or AAA | 3x |
| AROB015 | Laguai* | AA | 3x |
| AROB016 | Nape'e | AA | 2x |
| AROB017 | Banawa | AA | 3x |
| AROB018 | Tomea | AA | 2x |
| AROB019 | Tavilo | AA | 2x |
| AROB020 | Kararu 1* | AAB | np |
| AROB021 | Abau | AA | 2x |
| AROB022 | Kararu 2* | AA | np |
| AROB023 | Morou* | AA | 2x |
| AROB024 | Seven Kina | AA | 3x |
| AROB025 | Taiop | AAB -Maoli-Popoulu | 3x |
| AROB026 | Kaurai | Fe'i | 2x |
| AROB027 | Buka | ABB or Tetraploid | 4x |
| AROB028 | Popondeta | AA | 2x |
| AROB029 | Korai 1 | Fe'i | **2x*** |
| AROB030 | Korai 2 | Fe'i or wild | **2x*** |
| AROB031 | Kourai | Fe'i | **2x*** |
| AROB032 | Toitoi* | AAB? | 3x |
| AROB033 | Papua | AA | 2x |
| AROB034 | Nesuri | AA | 2x |
| AROB035 | Talasea | AA | 2x |
| AROB036 | Mopere | AA | 2x |
| AROB037 | Baby banana | AA | 2x |
| AROB038 | Sinsiruai* | AAB? | 2x |
| AROB039 | Kibirori | AAB - Iholena | 3x |
| AROB040 | Navotavu | AA | 2x |
| AROB041 | Glenda's Red* | ? | 2x |

| | | | |
|---|---|---|---|
| AROB042 | Asi | AA | 2x |
| AROB043 | Sausage banana | ? | 2x |
| AROB044 | Arawa* | AA or AAB | 3x |
| AROB045 | Glenda's dwarf | AA | 2x |
| AROB046 | Itonia | AA | 2x |
| AROB047 | Tobaung | AA | 2x |
| AROB048 | Kaesi | AA | 2x |
| AROB049 | Nono | AA | 2x |
| AROB050 | Sesévé | AA | 2x |
| AROB051 | Limot | Fe'i | 2x |
| AROB052 | Poso-olohi | Fe'i | **2x*** |
| AROB053 | Poso Huhu | AA | 2x |
| AROB054 | Huhu | AA | np |
| AROB055 | Tambra | AA | 2x |
| AROB056 | Kalmagol | 4x? | 4x |
| AROB057 | Sepik | ? | 3x |
| AROB058 | Korukapi | AA or AAA | 3x |
| AROB059 | Goum (pronounced Houm) | AA | 2x |
| AROB060 | Bubun | AAB | 3x |
| AROB061 | Sausage banana | ? | 2x |

**np**: not processed; *:Named by the collecting team (no name provided when collected); **2x*:** the peak ratio between Musa and internal standard was slightly higher than expected for a diploid. Based on the MGC experience, these samples are most probably diploids with higher genome sizes, but chromosome counting would be needed to confirm it for 100%certainty.

**Annex 4: Navente story:**

The ‘Navente’ banana is sacred to the Barapang (“eagle”) tribe of Bougainville Island. The name Navente is from an old language and means “a part of something”, as the ‘Navente’ banana is a part of all Barapang tribe members. It plays a central role in their creation story, and the plants and fruit are not shared with members of any of the other tribes of the island. Today, the fruit is still eaten, but always with great respect. The bunches of this cultivar are said to only have 2 or 3 fruit which are extremely large, and compared to the size of an adults entire arm.

A summary of the legend of the banana cultivar ‘Navente’ follows, as described by Josephine Kauna at Tunaniya, near Aropa, Bougainville Island, Papua New Guinea, on October 22, 2016.

There was a giant eagle which had killed almost everyone in the village except for one woman who took refuge under a large rock atop a hill. Seeing that everyone else had died and there were no men left to be fathers, she used the ‘Navente’ banana fruit as a mate, and became pregnant. Two sons were born, and they became the first members of the newly founded Barapang tribe. The woman raised her sons and taught them how to make a bow and arrow so that one day they could kill the eagle. When they were old enough and skilled enough, the woman built a fire atop the same hill where the previous massacre took place to show there were surviving people, and to signal to the eagle that it should return to the area to kill the remaining people. They all hid, and when the eagle came, the sons ambushed the eagle and shot it with their arrows. The eagle was injured and flew away, eventually dying in a river which became stained red with its blood. This hill was from then on known as “Victory Hill”. As a reward for killing the eagle, other residents of the island from a different tribe gave the sons a pig as a gift. The sons fought over the pig, and now being skilled warriors, ended up killing each other and turned into stone. Their mother, upon seeing her dead sons who were now stones, began crying so hard that she too died and turned into stone. To this day, the three stones are present on “Victory Hill”, and as a sign of respect ‘Navente’ plants and fruit are not brought to or past the area of the hill.