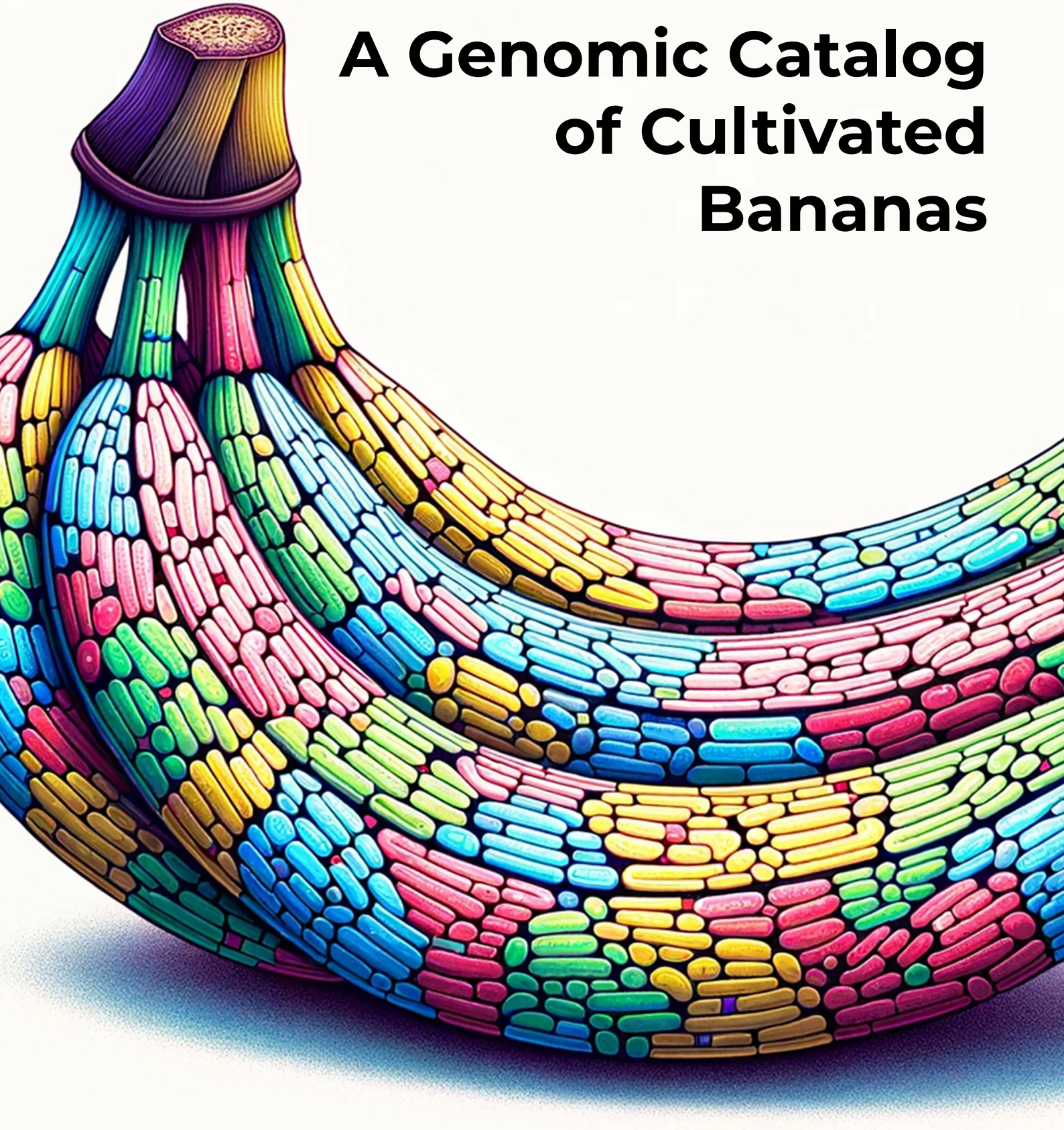
A Genomic Catalog of Cultivated Bananas



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MusaNet

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The Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT) delivers research-based solutions that harness agricultural biodiversity and sustainably transform food systems to improve people's lives. Alliance solutions address the global crises of malnutrition, climate change, biodiversity loss, and environmental degradation.

The Alliance is part of CGIAR, a global research partnership for a food-secure future.

https://alliancebioversityciat.org www.cgiar.org

MusaNet is the global collaborative framework for *Musa* related research and a partnership of all key stakeholders, aiming to ensure the long-term conservation and increased use of *Musa* diversity globally.

https://musanet.org/

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https://www.cirad.fr/en

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A Genomic Catalog of Cultivated Bananas

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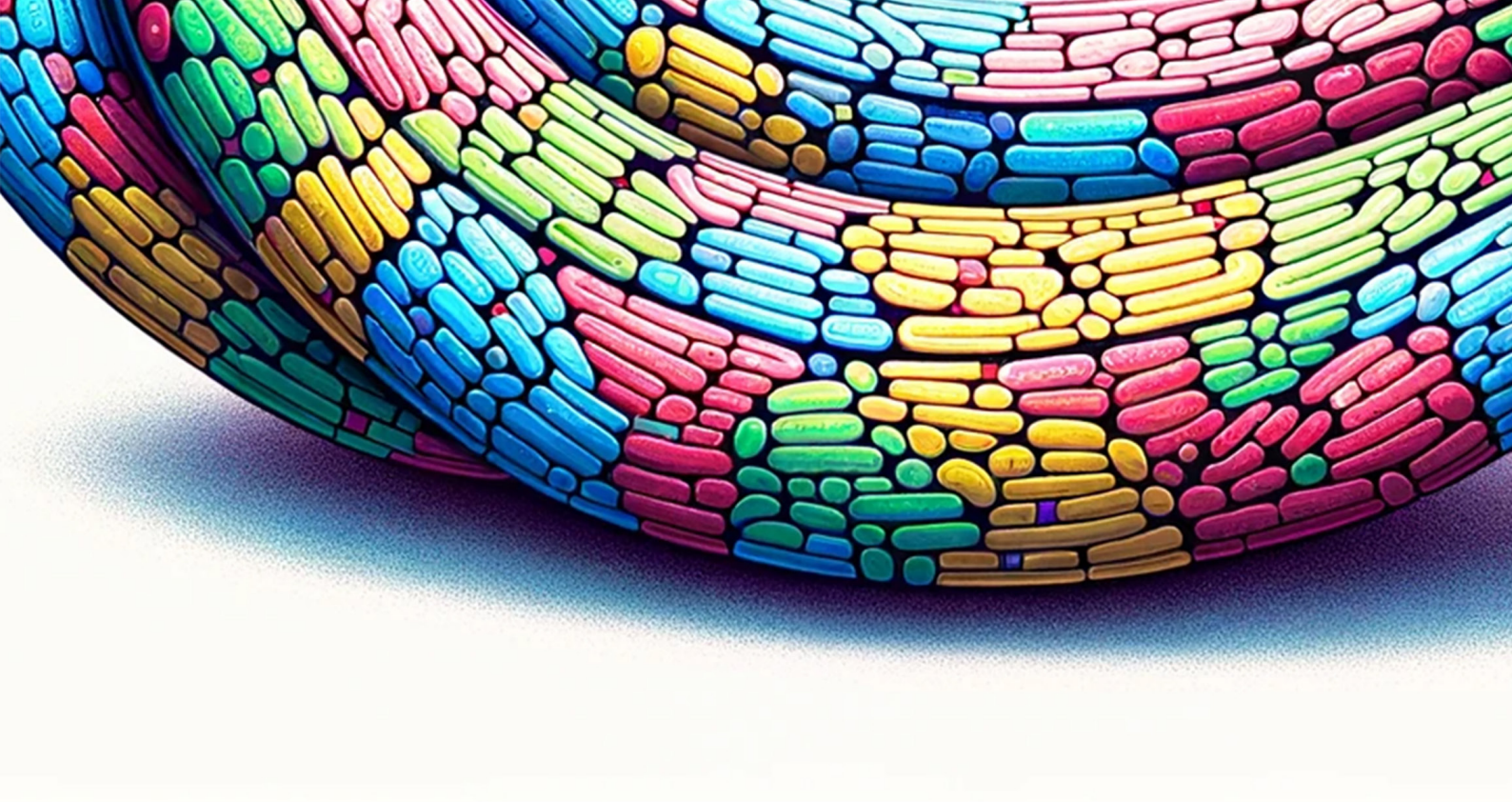


Introduction

Banana is an important food crop cultivated in many tropical and subtropical regions around the world. With the recent advances in genomics, a new powerful tool was developed enabling the fine-scale characterization of banana's ancestry along chromosomes, i.e. chromosome painting.

This catalogue, although not exhaustive, aims at providing an efficient tool to support the banana research and worker community in the classification of cultivars. It can be used as a tool to support the management of banana collections, which is a much faster way to classify them than with morphological characterization.

Methodology

We applied this method to a high-throughput genotyping data set obtained from 317 banana accessions spanning most of the known cultivar groups. This set included both genebank and new uncharacterized materials. By comparing curated morphological assignation to the chromosome painting results, we were able to compile a catalogue referencing the chromosome painting patterns of most of the described cultivar groups. In this approach, chromosome segments are colored according to their inferred ancestral genome contribution. The colors of segments correspond to the following ancestral contributors: black: *M. balbisiana* (B genome), pale-blue: *M. schizocarpa* (S genome), green: *M. acuminata* ssp. *banksii* / *M. acuminata* ssp. *errans* (A genome); blue: *M. a. malaccensis* (A genome) red: *M. a.* ssp. *zebrina* (A genome), pink: uncharacterized genepools, and purple: *M. a.* ssp. *halabanensis*, Orange: *Musa a.* ssp. *burmannica*/*Musa a.* ssp. *siamea*, Yellow: *Australimusa* (T genome) (new Callimusa section).

Disclaimer: The genome ancestry mosaics method proved to be extremely useful but is not exempted of methodological bias. The size of segments is approximate since it was calculated with high density markers and their arrangement established on parsimony and may not reflect the real haplotypes.

CULTIVAR GROUPS

AA genomic composition

Mchare group

Passport Data

Classification Mchare (AA)

Biological status Cultivated

Ploidy Diploid (2x = 22)

Main distribution area East Africa

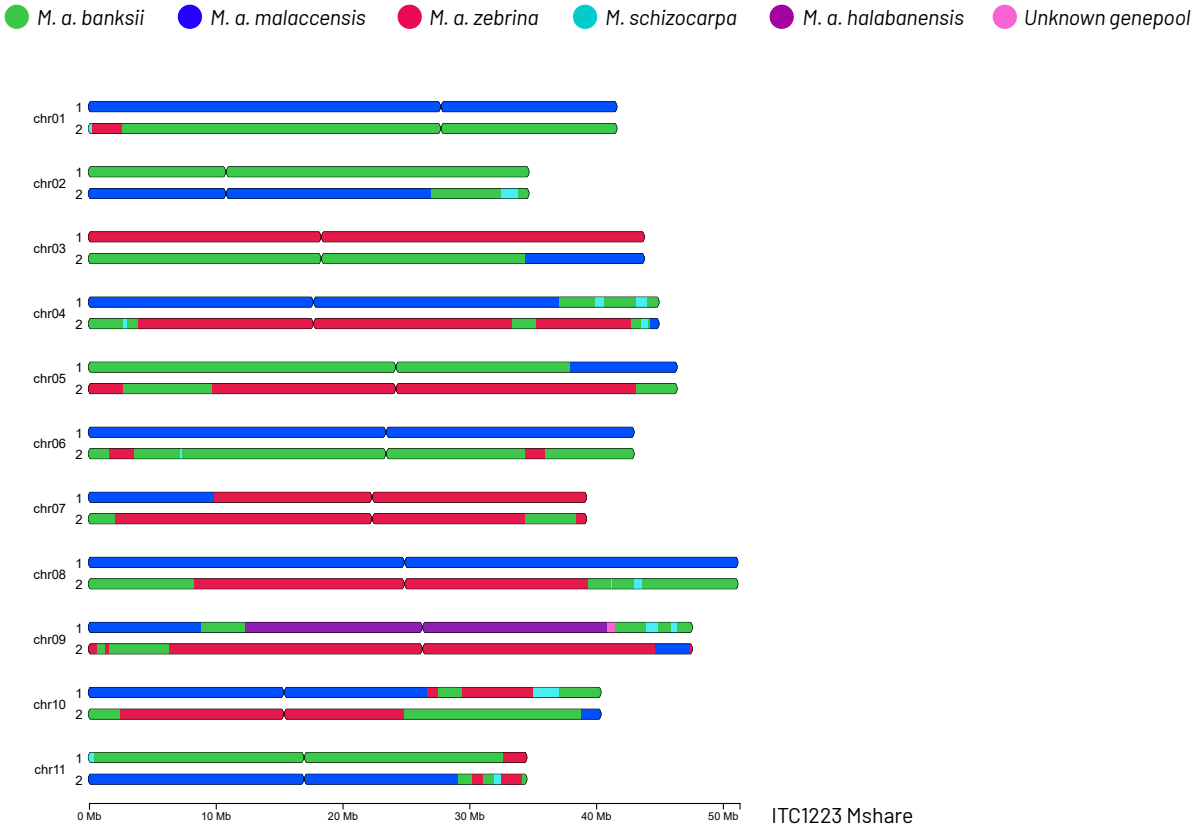
Uses Cooking, breeding

Notes
- Morphologically diversified with French, false-horn, and horn types like plantain
- Pollen reported scarce
- Synonym: Mlali

Genomic features
- 2x and 1x gamete donor of many cultivars, including Gros Michel, Cavendish, Pome and Pisang Ambon, Paka

Morphological Characterization Pictures

Molecular Characterization



ITC1223 Mshare

AA genomic composition

Pisang Jari Buaya group

Passport Data

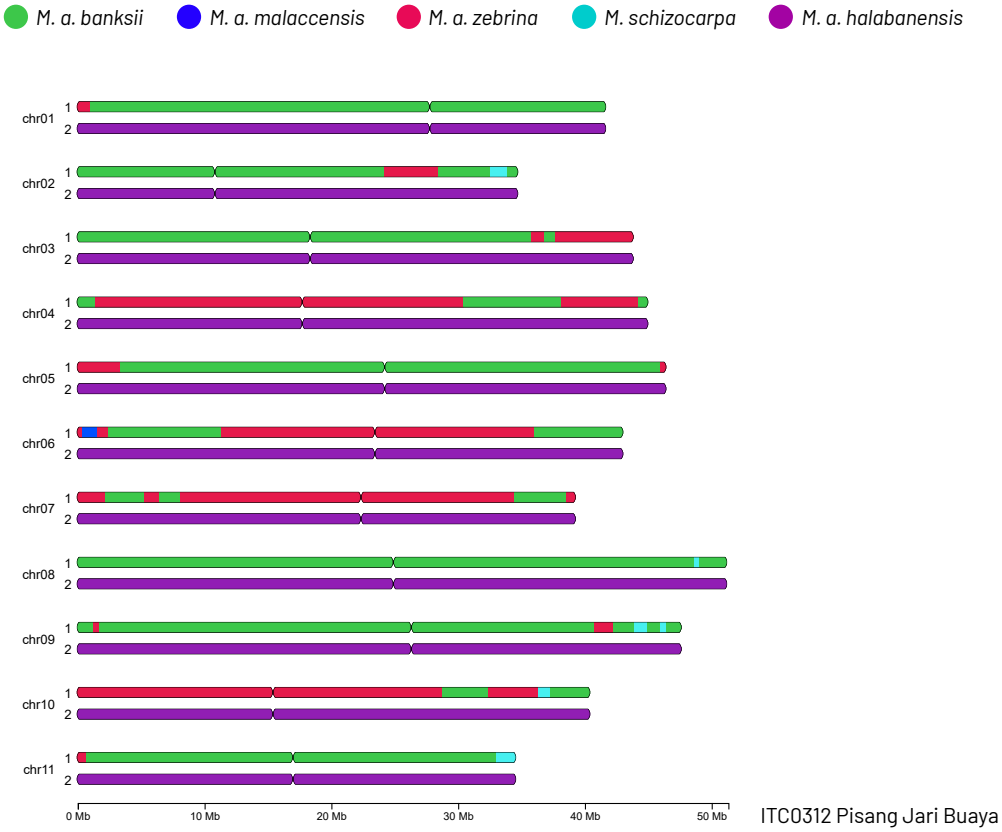
Classification	Pisang Jari Buaya (AA)
Biological status	Cultivated
Ploidy	Diploid (2x = 22)
Main distribution area	Asia and Pacific
Uses	Dessert, breeding

Notes
- Shape of bananas reminding crocodile's fingers. Rachis is full of neutral flowers with persistent bracts above the male bud. No pollen and seedless bunches.
- Resistance to burrowing nematodes

Genomic features
- One haplotype from *M. a. halabanensis*

Morphological Characterization Pictures

Molecular Characterization



ITC0312 Pisang Jari Buaya

AA genomic composition

Pisang Lilin group

Passport Data

Classification Pisang Lilin (AA)

Biological status Cultivated

Ploidy Diploid (2x = 22)

Main distribution area Asia

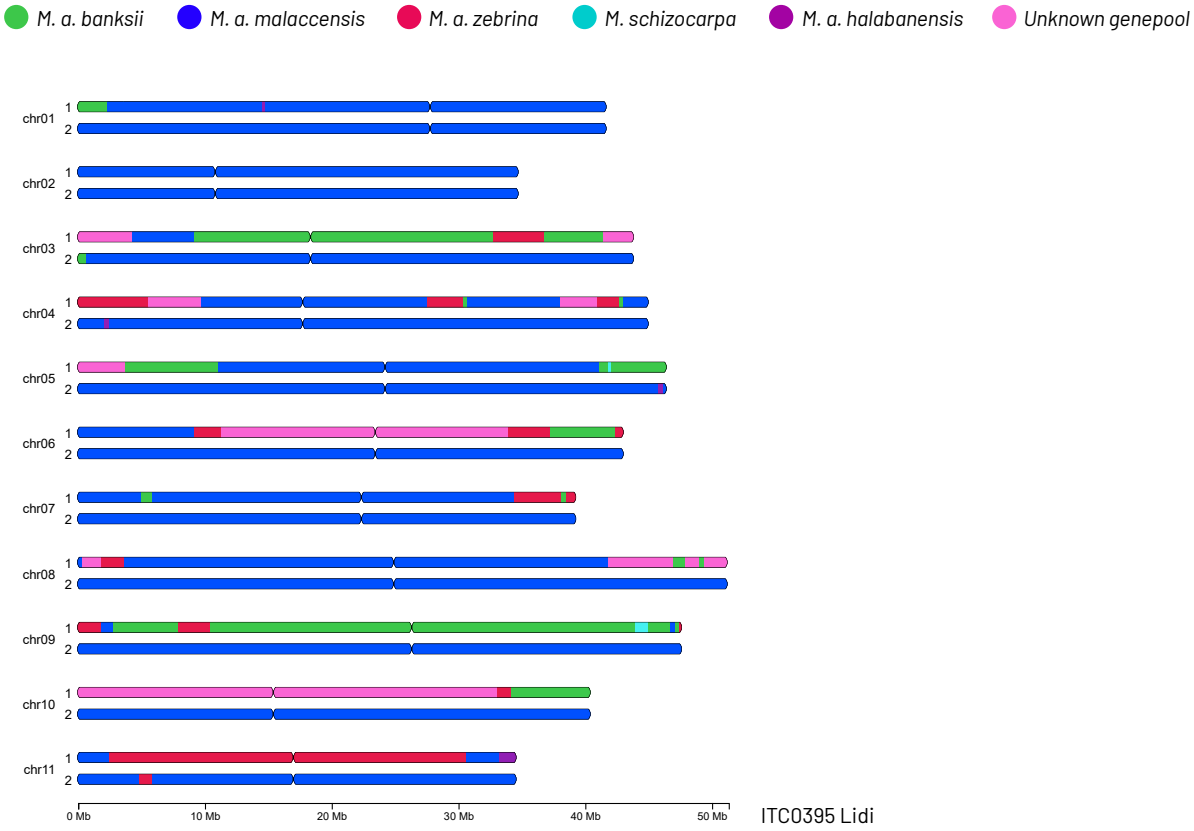
Uses Dessert, breeding

Notes
- Synonym: Lidi
- Accession widely used in FHIA hybrids

Genomic features
- Predominant malaccensis background

Morphological Characterization Pictures

Molecular Characterization



ITC0395 Lidi

AA genomic composition

Sucrier group

Passport Data

Classification	Sucrier (AA)
Biological status	Cultivated
Ploidy	Diploid (2x = 22)
Main distribution area	Tropics and subtropics
Uses	Dessert

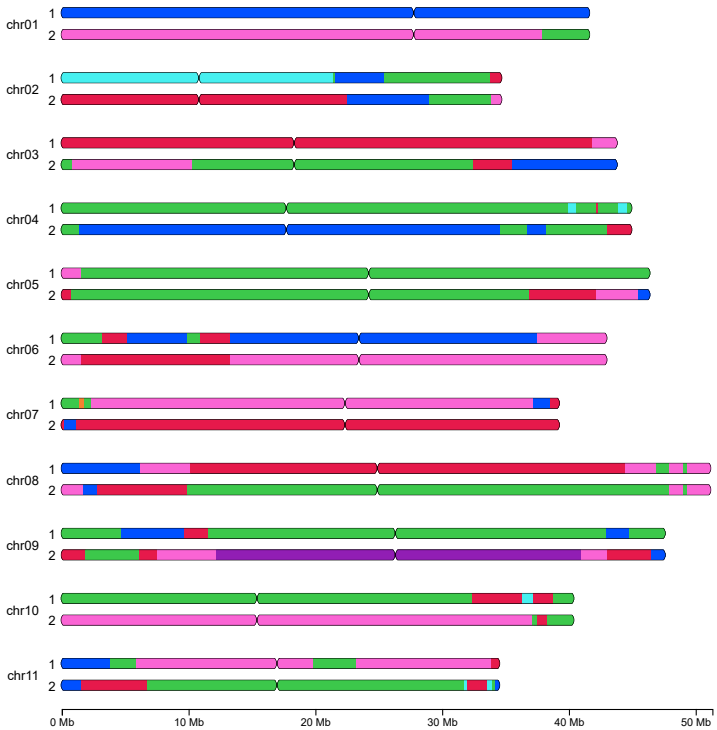
Notes
- Very common diploid dessert banana
  Synonym: Pisang Mas
- Compact bunch with small, thin skinned, and sweet fruits, typical colors of neck blotches

Genomic features
- Presence of most genepools

Morphological Characterization Pictures

Molecular Characterization

M. a. banksii *M. a. malaccensis* *M. a. zebrina* *M. schizocarpa* *M. a. halabanensis* *Unknown genepool*



ITC0653 Pisang Mas

AAA genomic composition

Cavendish group

Passport Data

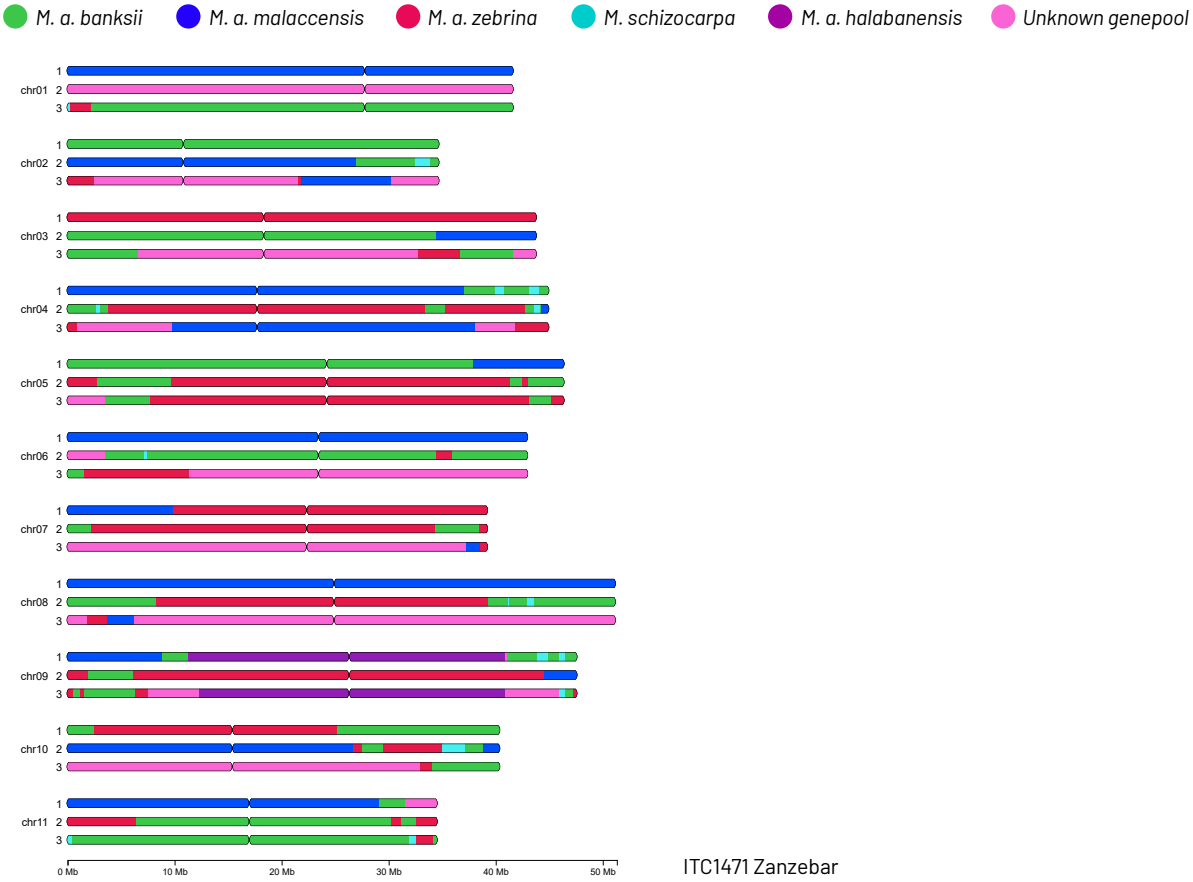
Classification	Cavendish (AAA)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	Tropics and subtropics
Uses	Dessert, most of the time International trade

Notes
- Major commercial dessert banana
- Can be cooked when unripe (Asia and the Pacific)

Genomic features
- Signifiant contribution of unknown genepool and *M. a. halabanensis*
- Contains 2n gamete from Mchare

Morphological Characterization Pictures

Molecular Characterization



ITC1471 Zanzebar

AAA genomic composition

Gros Michel group

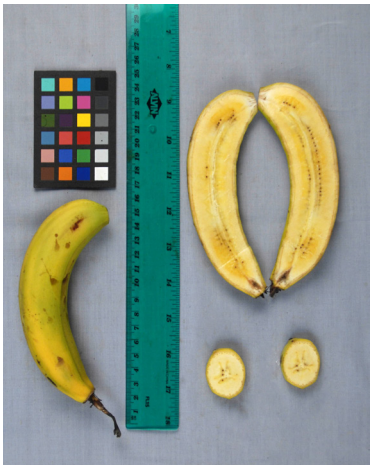
Passport Data

Classification	Gros Michel (AAA)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	Latin America
Uses	Dessert

Notes
- Can be easily confused with Cavendish
- Green or pale pink colour of pseudostem
- Extremely susceptible to Fusarium wilt race 1

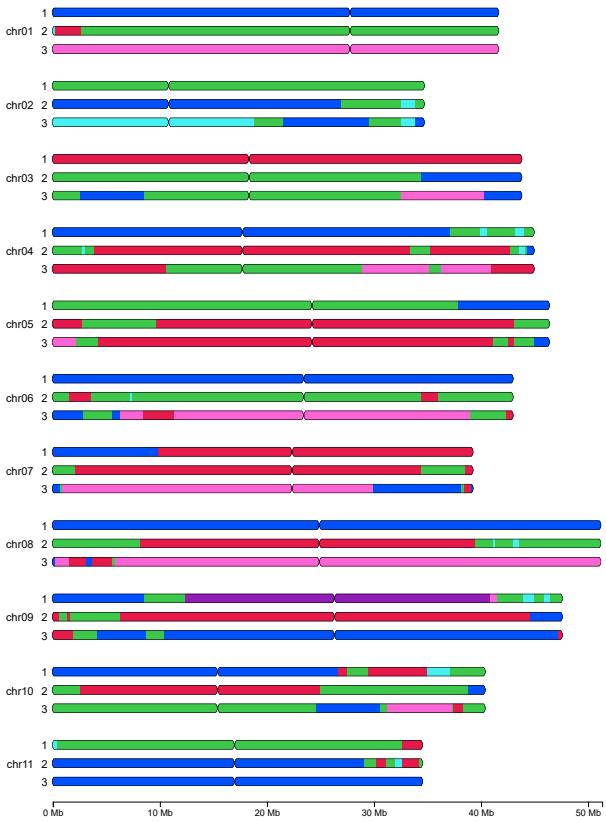
Genomic features
- Signifiant contribution of unknown genepool and *M. a. halabanensis*
- Contains 2n gamete from Mchare and n gamete from Khai Na On

Morphological Characterization Pictures



Molecular Characterization

M. a. banksii *M. a. malaccensis* *M. a. zebrina* *M. schizocarpa* *M. a. halabanensis* *Unknown genepool*



ITC0724 Cocos

AAA genomic composition

Red group

Passport Data

Classification Red (AAA)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area Tropics and subtropics

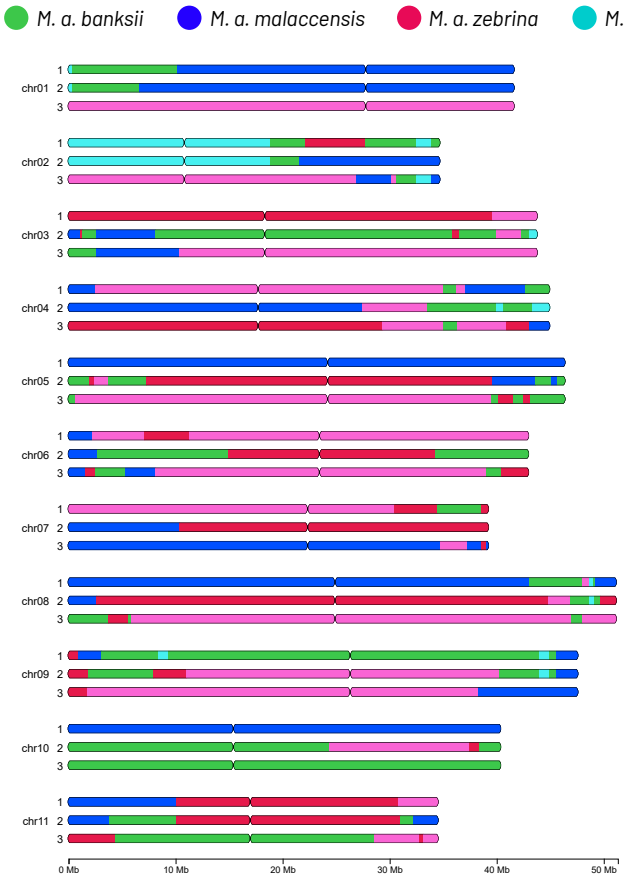
Uses Dessert

Notes
- Most of the plant is red
- A green variant of Red exists, it is named Green Red
- Synonym: Figue rose

Genomic features
- Two schizocarpa centromeres on chromosome 2, like Ibota and Maia Maoli Popoulou
- High contribution of unknown genepool

Morphological Characterization Pictures

Molecular Characterization



ITC1833 Shwe Ni

AAA genomic composition

Mutika/Lujugira group

Passport Data

Classification Mutika/Lujugira (AAA)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area East and Central Africa

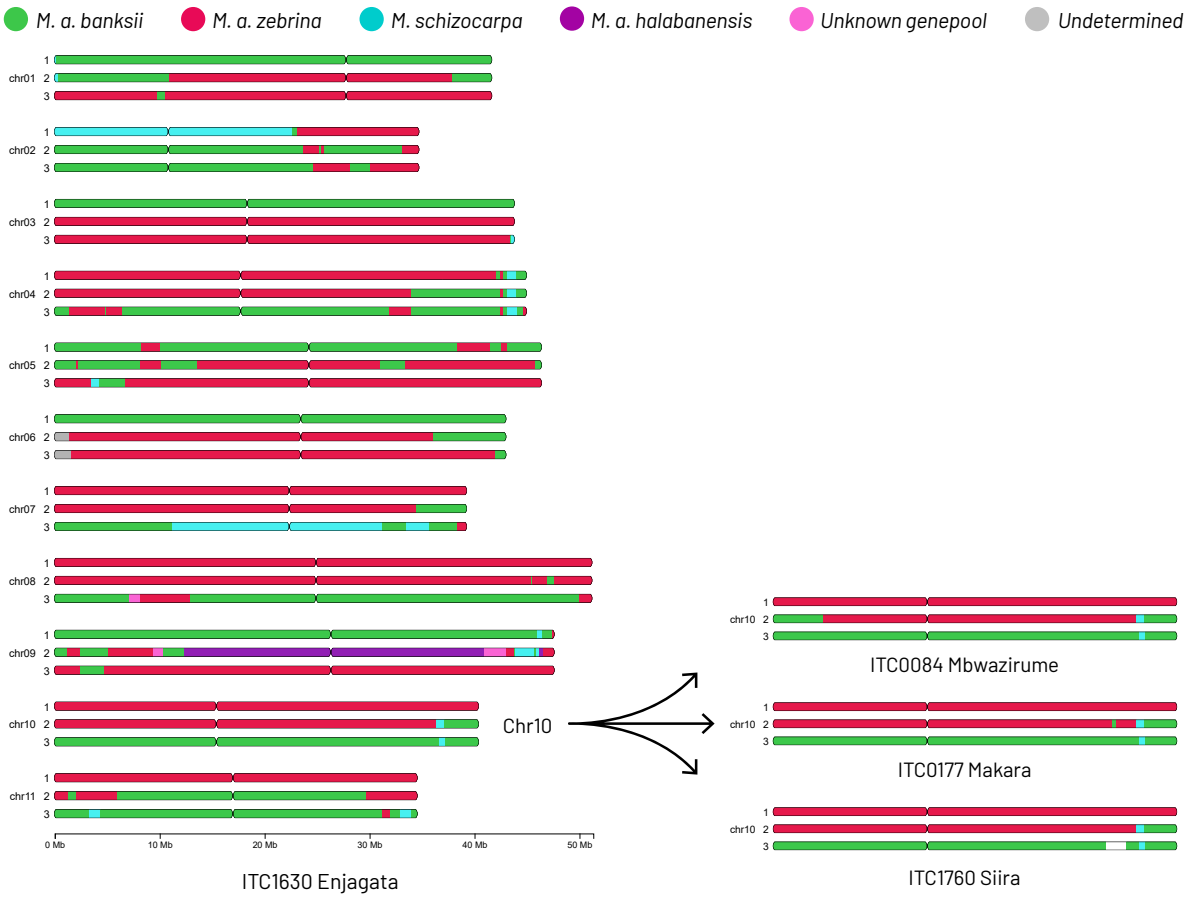
Uses Cooking and beer

Notes
- Cultivated in altitude; dark bronze, black or brown blotches on pseudostems
- Cooking cultivars with pulp turning yellow when cooked; beer cultivars with pulp turning pink when cooked

Genomic features
- Two first telomeres of chr. 6 seem of undetermined origin
- A small variation in the banksii/zebrina ratio can be observed on a reduced number of accession

Morphological Characterization Pictures

Molecular Characterization



AAA genomic composition

Ilalyi group

Passport Data

Classification Ilalyi (AAA)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area East Africa (N.E. of Tanzania)

Uses Mostly cooking, beer and some cultivars as dessert

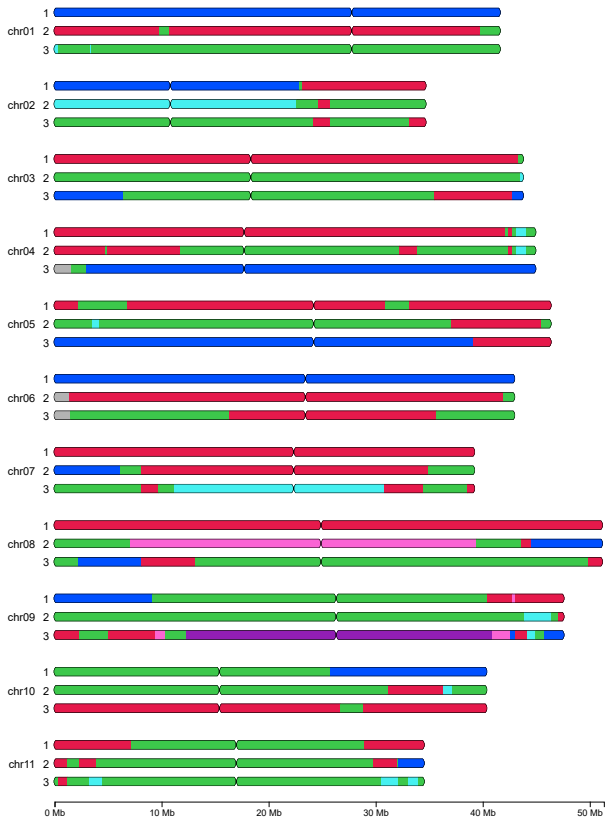
Notes
- Cultivated in altitude, particularly on the humid slopes of Kilimanjaro and of mounts Usambara and Pare
- Slender bud and blunt fingers (when compared to Mutika/Lujugira)

Genomic features
- Genomic background related to Mutika/Lujugira but with additional *M. acuminata* ssp. *malaccensis* contribution

Morphological Characterization Pictures

Molecular Characterization

M. a. banksii *M. a. malaccensis* *M. a. zebrina* *M. schizocarpa* *M. a. halabanensis* *Unknown genepool*



ITC1451 Kitarasa

AAA genomic composition

Ambon group

Passport Data

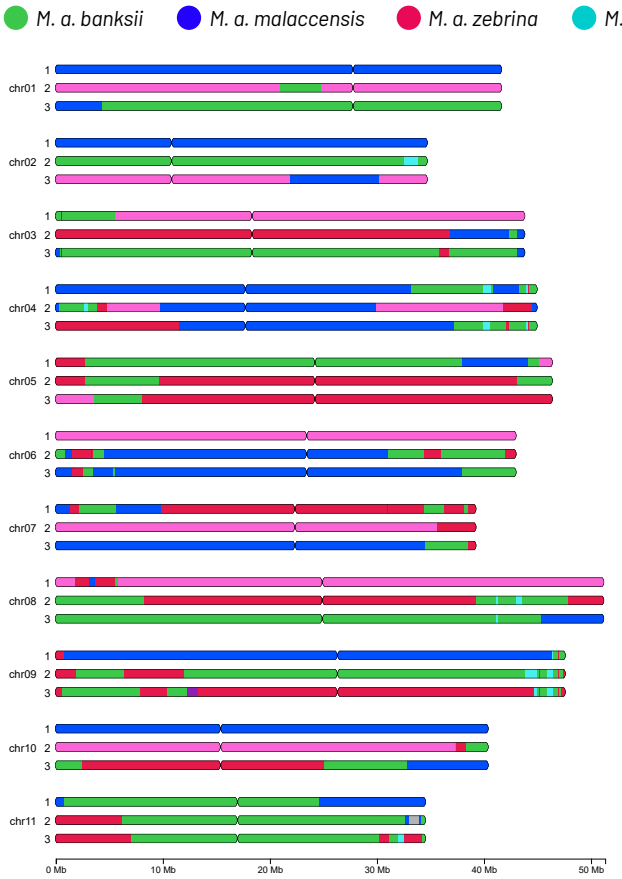
Classification	Ambon (AAA)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	South-East Asia
Uses	Dessert

Notes
- Large fruits, good flavor and high yields
- Important cultivars in Indonesia and Malaysia
- Introduced in Latin America for trade but became susceptible to Fusarium wilt

Genomic features
- Significant presence of the malaccensis (8 centromeres) and the unknown genepool (6 centromeres)

Morphological Characterization Pictures

Molecular Characterization



DYN122 Hom Thong Mokho

AAA genomic composition

Orotava group

Passport Data

Classification Orotava (AAA)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area South-East Asia

Uses Dessert

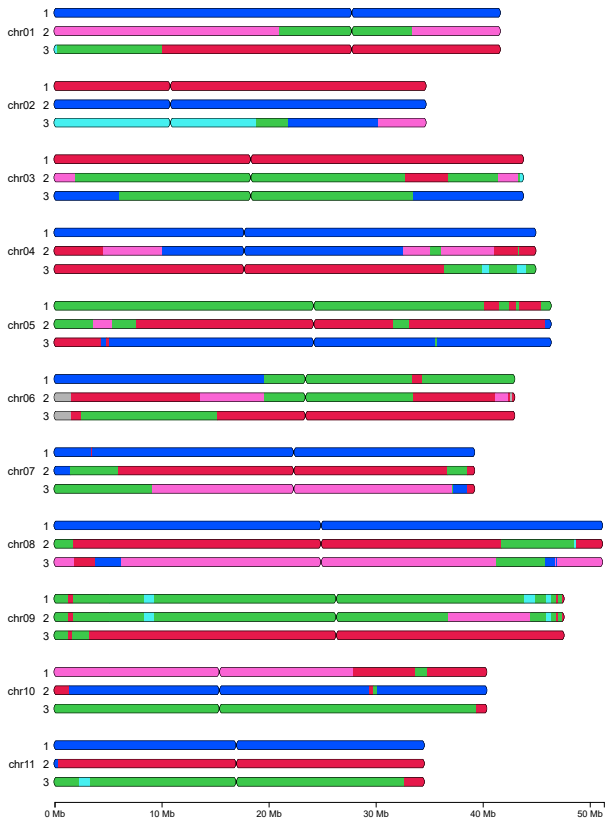
Notes
- Not very well described in literature

Genomic features
- Significant presence of the malaccensis (8 centromeres)

Morphological Characterization Pictures

Molecular Characterization

M. a. banksii *M. a. malaccensis* *M. a. zebrina* *M. schizocarpa* *Unknown genepool*



PT-BA-00121 Hom Sakhon Nakhon

AAA genomic composition

Rio group

Passport Data

Classification	Rio (AAA)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	South-East Asia, Latin America
Uses	Dessert

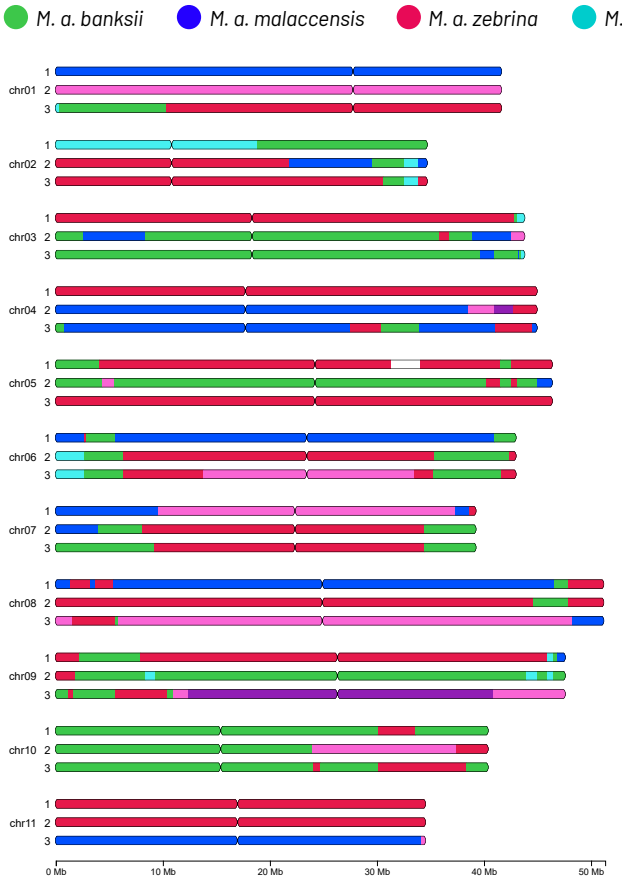
Notes

Genomic features

- Second zebrina-rich cultivar (14 centromeres) after Mutika/Lujugira group

Morphological Characterization Pictures

Molecular Characterization



ITC0277 Leite

AAA genomic composition

Ibota group

Passport Data

Classification Ibota (AAA)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area South-East Asia and Africa

Uses Dessert

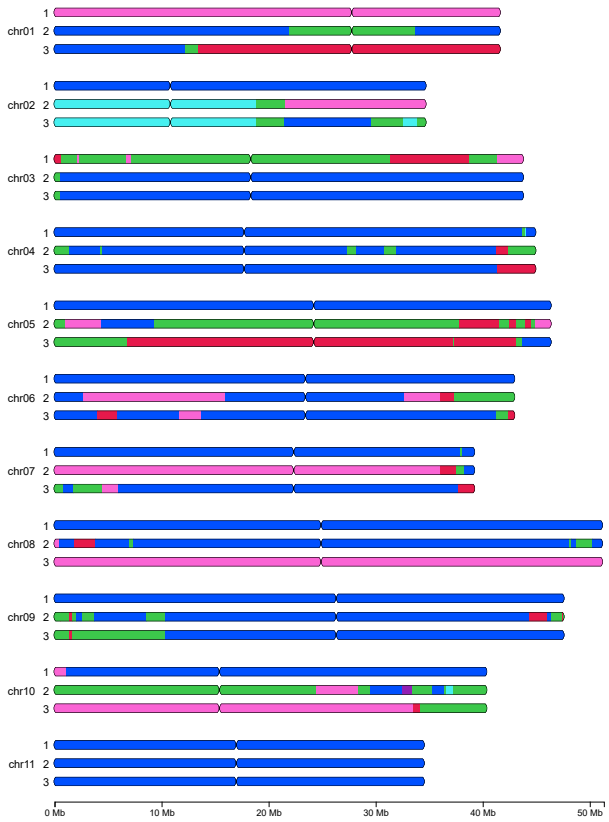
Notes
- The widely studied accession 'Yangambi km 5' is part of this group

Genomic features
- High contribution of *M. a. malaccensis* (22 centromeres)

Morphological Characterization Pictures

Molecular Characterization

M. a. banksii *M. a. malaccensis* *M. a. zebrina* *M. schizocarpa* *M. a. halabanensis* *Unknown genepool*



ITC0662 Khai Thong Ruang

AB genomic composition

Ney Poovan

Passport Data

Classification Ney Poovan (AB)

Biological status Cultivated

Ploidy Diploid (2x = 22)

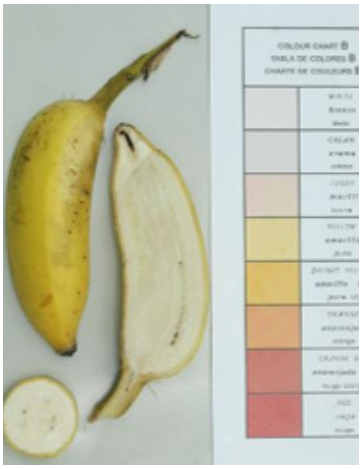
Main distribution area India

Uses Dessert

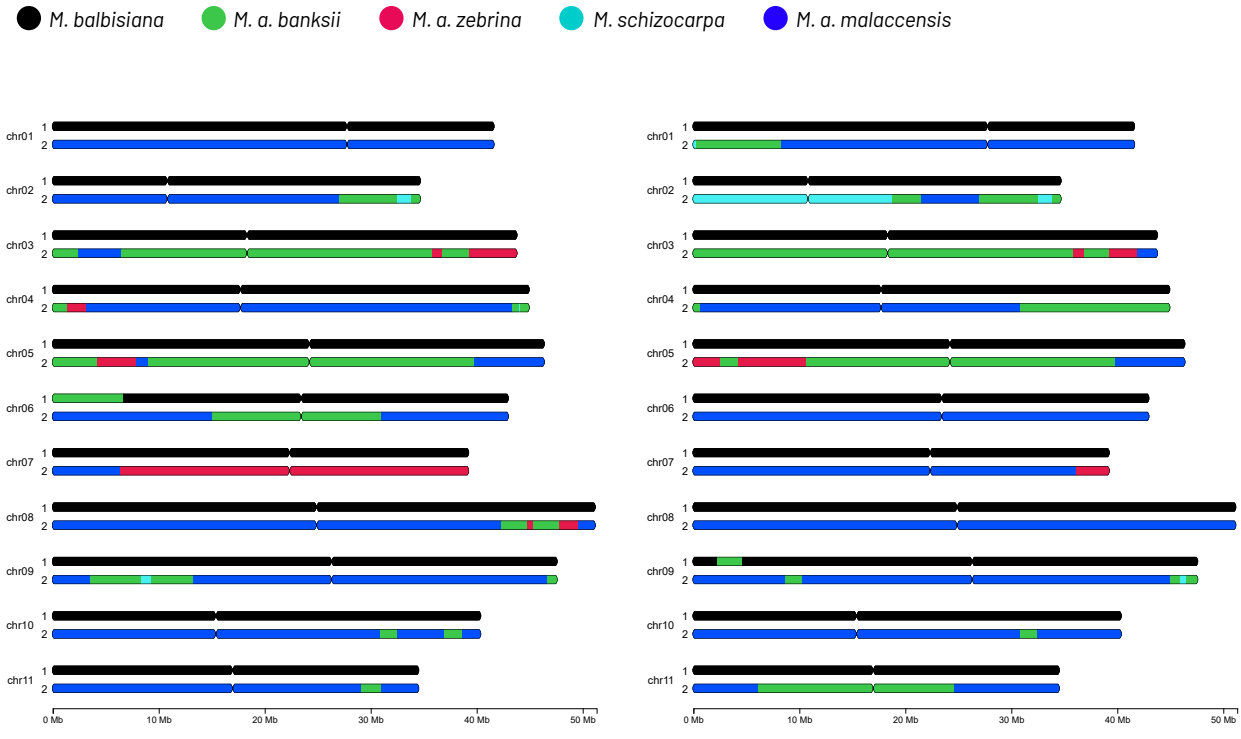
Notes
- AB bananas are rare
- Difficult to distinguish with Kunnan

Genomic features
- Malaccensis ancestry dominance as A-donor genome

Morphological Characterization Pictures



Molecular Characterization



ITC0245 Safet Velchi

ITC1751 Adukka Kunnan

AB genomic composition

Kunnan

Passport Data

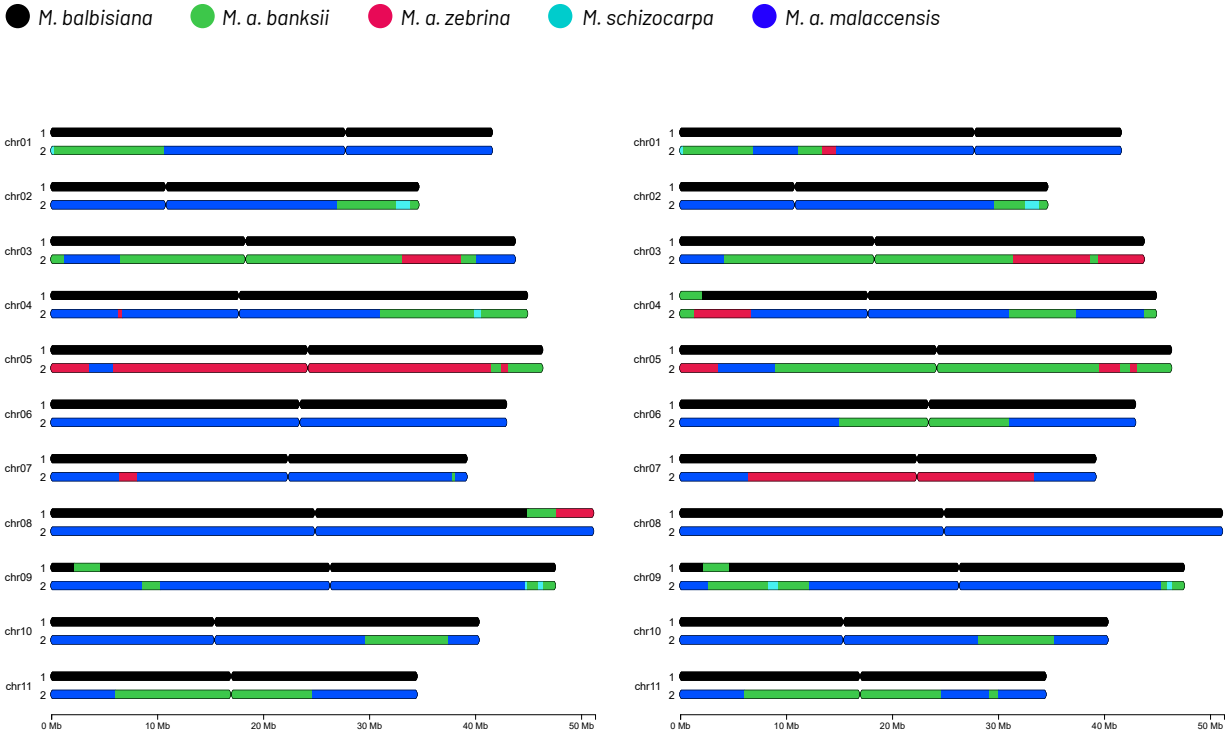
Classification	Kunnan (AB)
Biological status	Cultivated
Ploidy	Diploid (2x = 22)
Main distribution area	South India
Uses	Dessert

Notes
- AB bananas are rare
- Difficult to distinguish with Ney poovan

Genomic features
- Malaccensis ancestry dominance as A-donor genome

Morphological Characterization Pictures

Molecular Characterization



ITC1034 Kunnan

ITC1752 Poovila Chundan

AAB genomic composition

Plantain group

Passport Data

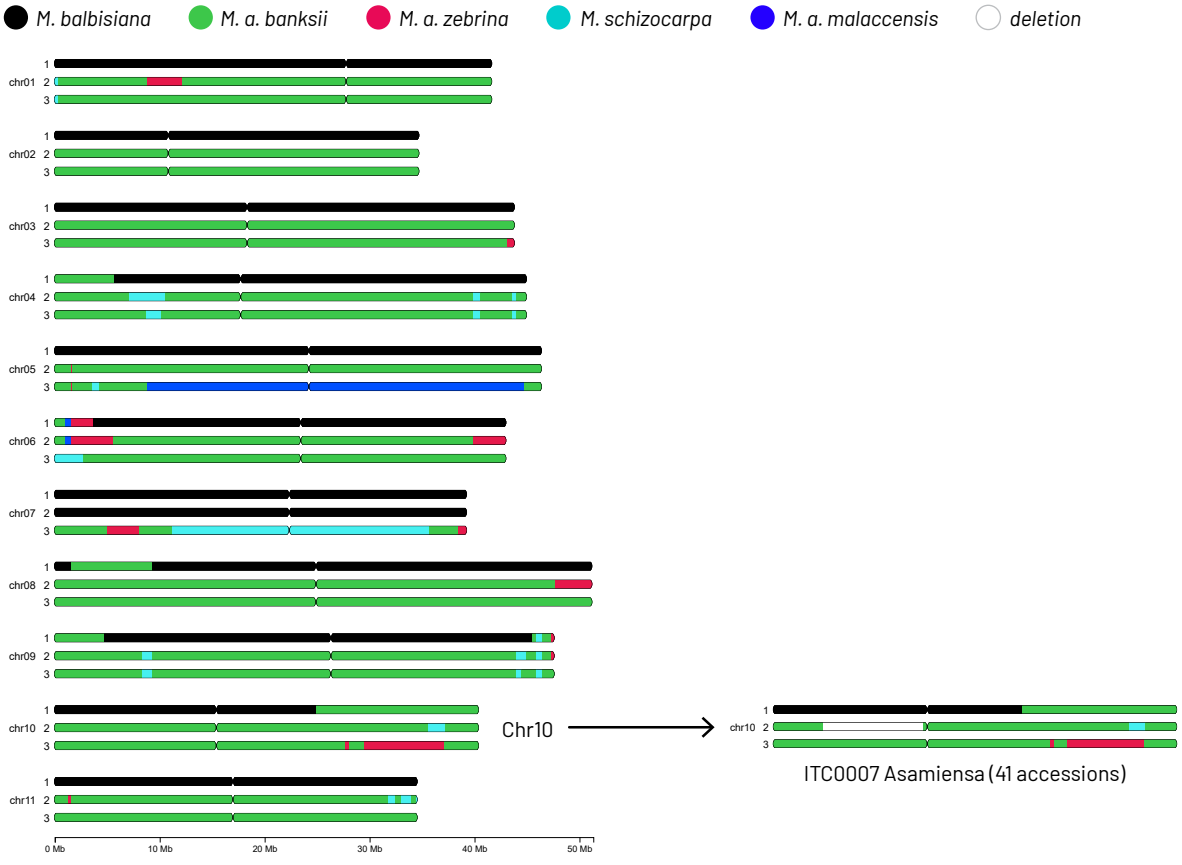
Classification	Plantain (AAB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	West and Central Africa, and Latin America
Uses	Cooking (fries, mashed)

Notes
- Wide morphological diversity
- Several phenotypic clusters (French, true horn, false horn) & (small, medium or giant)

Genomic features
- 2 B chromosomes on chromosome 7
- 2 profiles (the most common profile with interstitial deletion on chr10)

Morphological Characterization Pictures

Molecular Characterization



ITC0033 Bungaoisan

ITC0007 Asamiensa (41 accessions)

AAB genomic composition

Maia Maoli/Popoulu group

Passport Data

Classification Maia Maoli-popoulu (AAB)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area Pacific region

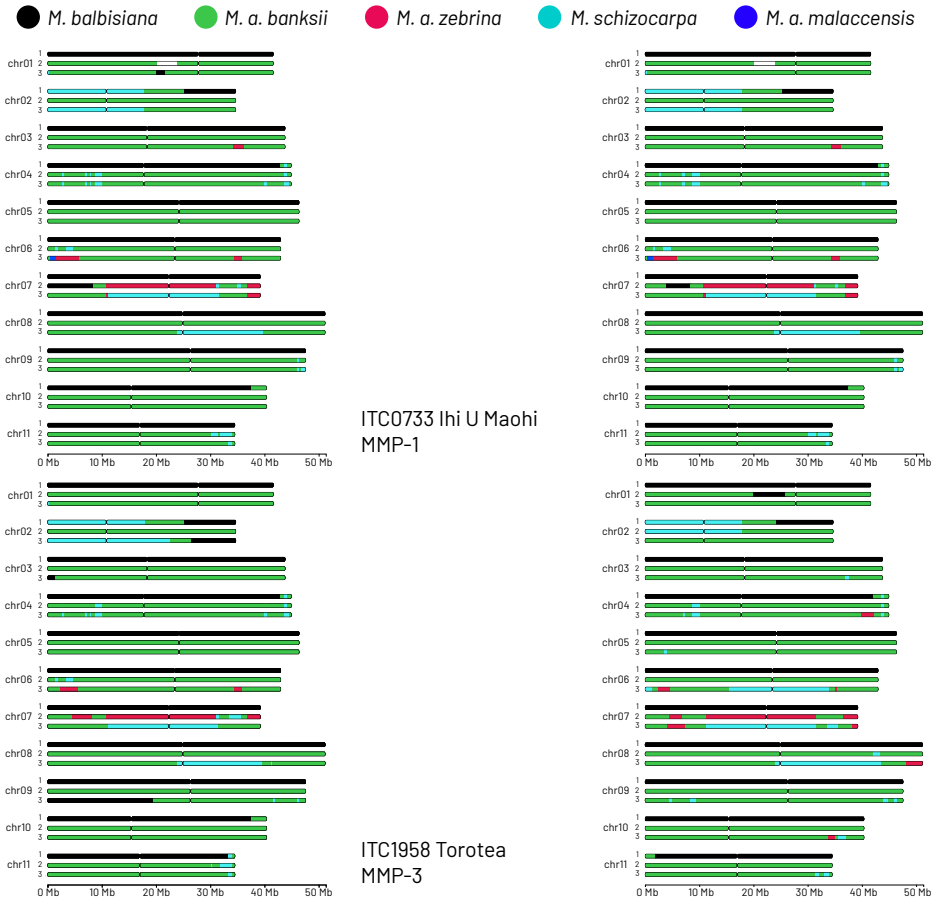
Uses Cooking

Notes
- Sausage-shaped fruits
- Pōpōulu have shorter and fatter fruits

Genomic features
- At least 4 profiles, not all clonally derived
- 2 *M. schizocarpa* centromeres in chr. 02 and 1 *M. a. zebrina* centromere on chr. 07
- Small duplicated region in the centromeric zone of chr. 8 (not shown)

Morphological Characterization Pictures

Molecular Characterization



ITC0733 Ihi U Maohi
MMP-1

ITC1135 Pōpōulu
MMP-2

ITC1958 Torotea
MMP-3

ITC1988 Lavugi
MMP-4

AAB genomic composition

Iholena group

Passport Data

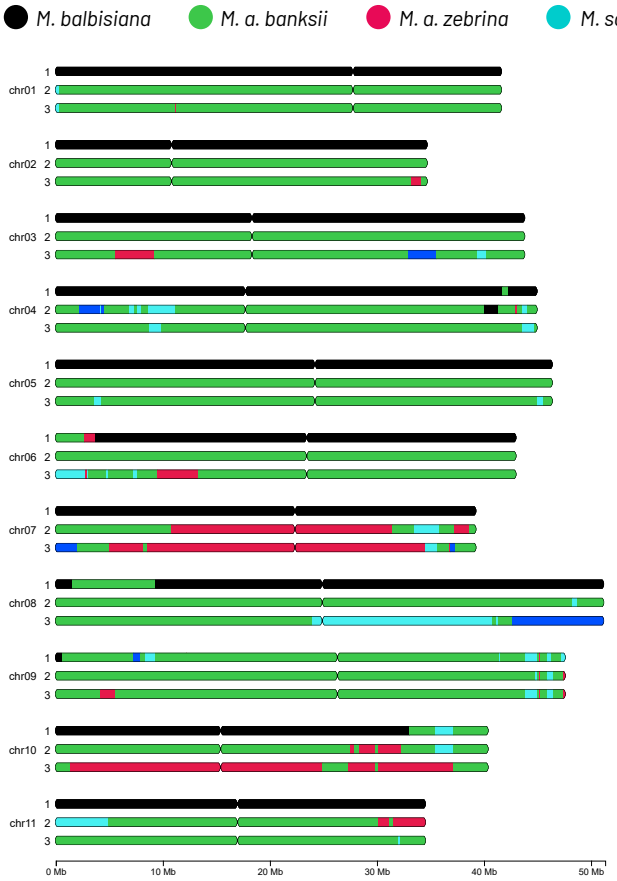
Classification	Iholena (AAB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	Pacific region
Uses	Cooking

Notes
- Tall plant, young leaf with light purple underside
- Fruits turn yellow before being ripe, pulp is «salmon orange»
- Typical bunch shape

Genomic features
- *M. balbisiana* centromere is absent on chr. 09
- In Papua New Guinea, different clones sharing features with Iholena exist
- Small duplicated region in the centromeric zone of chr. 8 (not shown)

Morphological Characterization Pictures

Molecular Characterization



ITC0825 Uzakan

Laknau group

Passport Data

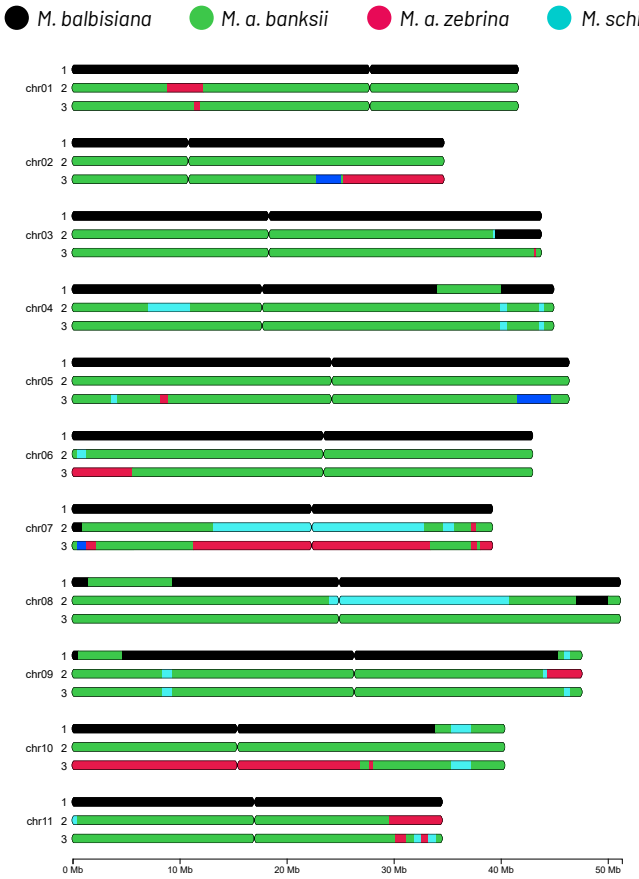
Classification	Musa Laknao (AAB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	South-East Asia and the Pacific
Uses	Cooking

Notes
- Popular in the Phillipines
- Slender and large fruits remaining starchy when fully ripe
- Synonym: laknao

Genomic features
- Background similar to Maoli-Popoulu and Iholena, very few contribution of *M. a. malaccensis*
- Small duplicated region in the centromeric zone of chr. 8 (not shown)

Morphological Characterization Pictures

Molecular Characterization



ITC0332 Laknao

AAB genomic composition

Pome group

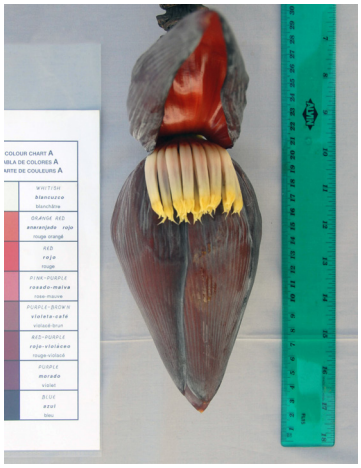
Passport Data

Classification	Pome (AAB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	Tropics and subtropics
Uses	Dessert

Notes
- Synonym: Prata (Brazil)
- Sub-acid and apple-like taste

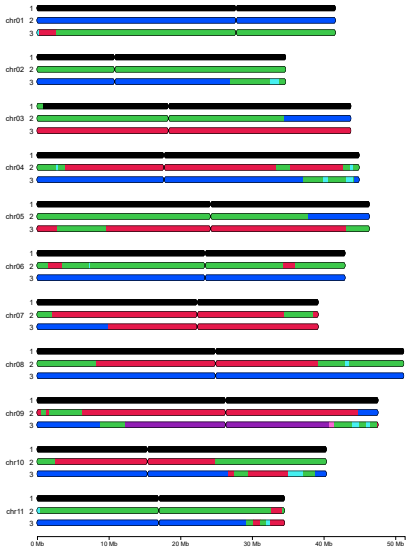
Genomic features
- Most diverse in contributors
- Three patterns from at least two sexual events (Pome-1 and Pome-2), Pome-3 is likely derived from Pome-2

Morphological Characterization Pictures

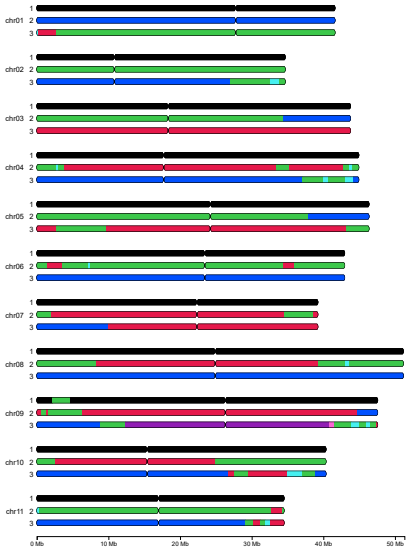


Molecular Characterization

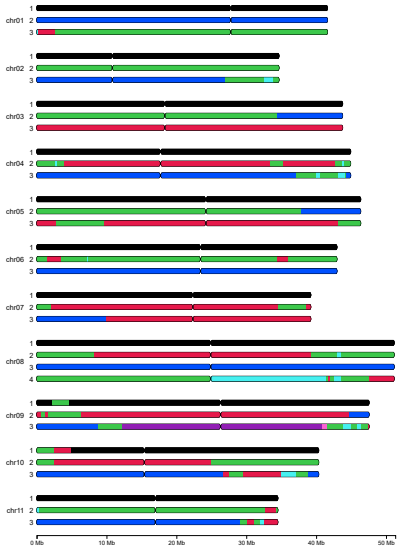
M. balbisiana *M. a. banksii* *M. a. malaccensis* *M. a. zebrina* *M. schizocarpa* *M. a. halabanensis* *Unknown genepool*



ITC0649 Foconah Pome-1



ITC1723 Ladies Finger Pome-2



ITC0582 Lady Finger Pome-3

AAB genomic composition

Mysore group

Passport Data

Classification Mysore (AAB)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area India, Thailand, West Indies, Oceania

Uses Dessert, shade for cocoa trees

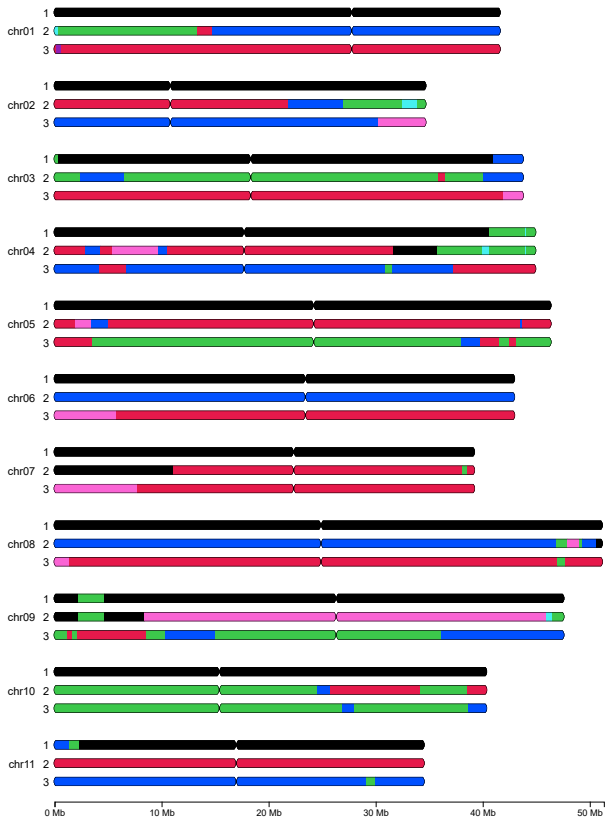
Notes
- Big and vigorous plant
- Large cylindrical bunches

Genomic features
- Significant presence of malaccensis (6 centromeres)

Morphological Characterization Pictures

Molecular Characterization

M. balbisiana *M. a. banksii* *M. a. zebrina* *M. schizocarpa* *M. a. malaccensis* *Unknown genepool*



ITC1613 Karpura Chakkrakeli

AAB genomic composition

Silk group

Passport Data

Classification Silk (AAB)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area Tropics and subtropics

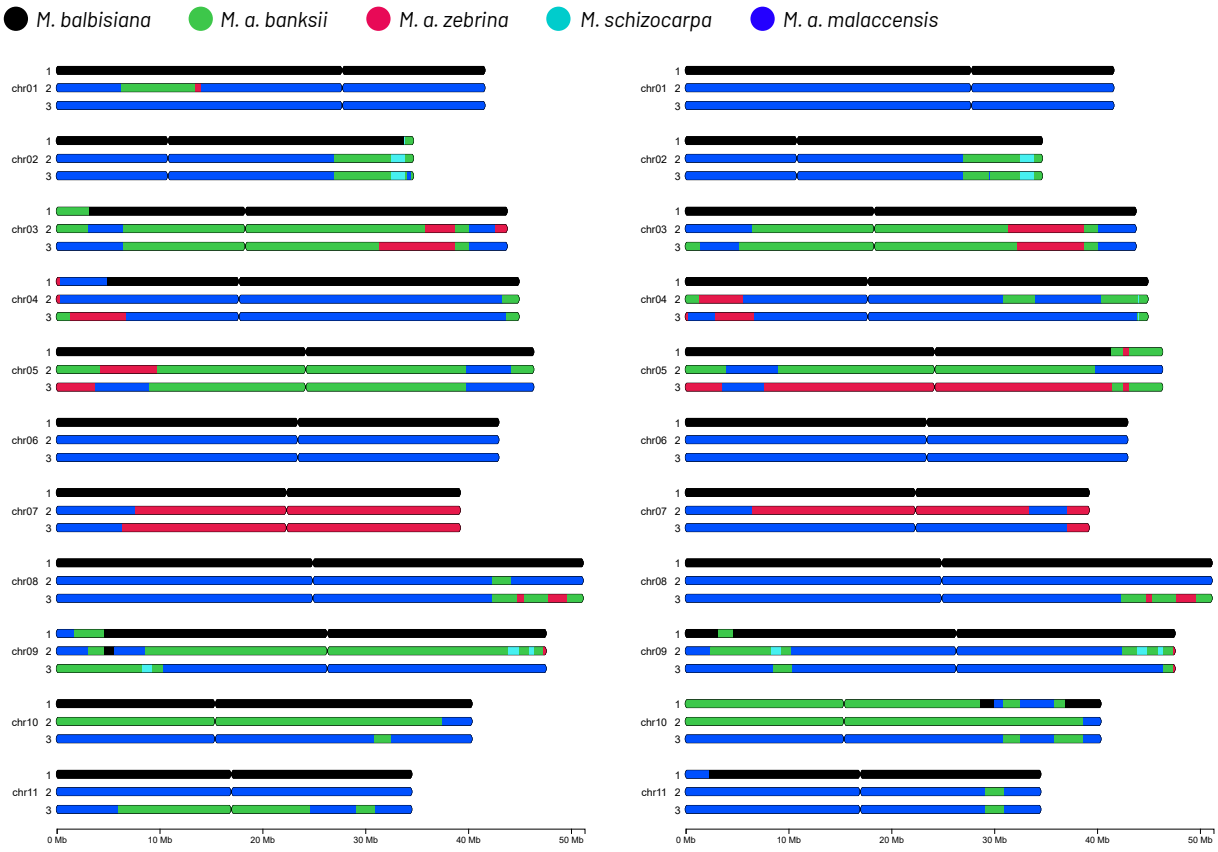
Uses Dessert

Notes
- Sweet-acid fruits, flavour reminiscent of apples
- Synonyms: Apple, Manzana and Figue Pome
- Can be easily confused with Pome

Genomic features
- Strong *M. a. malaccensis* contribution
- Two profiles from two distinct sexual events

Morphological Characterization Pictures

Molecular Characterization



ITC0348 Silk

ITC0737 Kingala N°1

AAB genomic composition

Pisang Raja group

Passport Data

Classification Pisang Raja (AAB)

Biological status Cultivated

Ploidy Triploid (3x = 33)

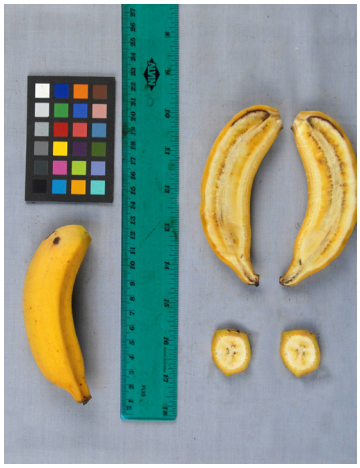
Main distribution area South-East Asia

Uses Cooking and dessert

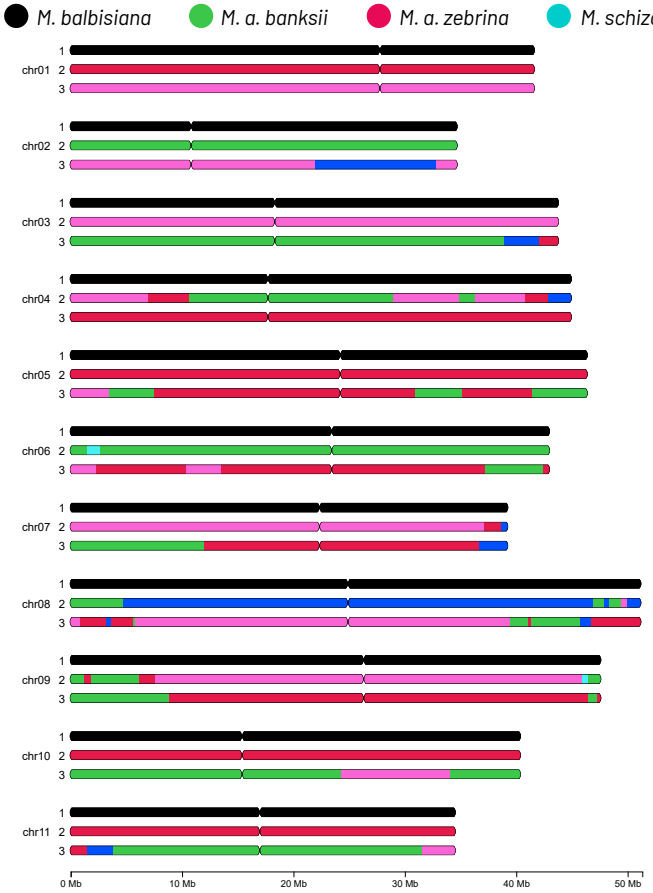
Notes
- Large fruit that becomes orange when ripe
- Fruits are very sweet but coarse in texture

Genomic features
- Important contribution from *M. a. zebrina* and from the unknown genepool

Morphological Characterization Pictures



Molecular Characterization



ITC0587 Pisang Raja

ABB genomic composition

Pisang Awak group (3x)

Passport Data

Classification Pisang Awak (ABB/ABBB)

Biological status Cultivated

Ploidy Polyploid (3x = 33 or 4x = 44)

Main distribution area Tropics and subtropics

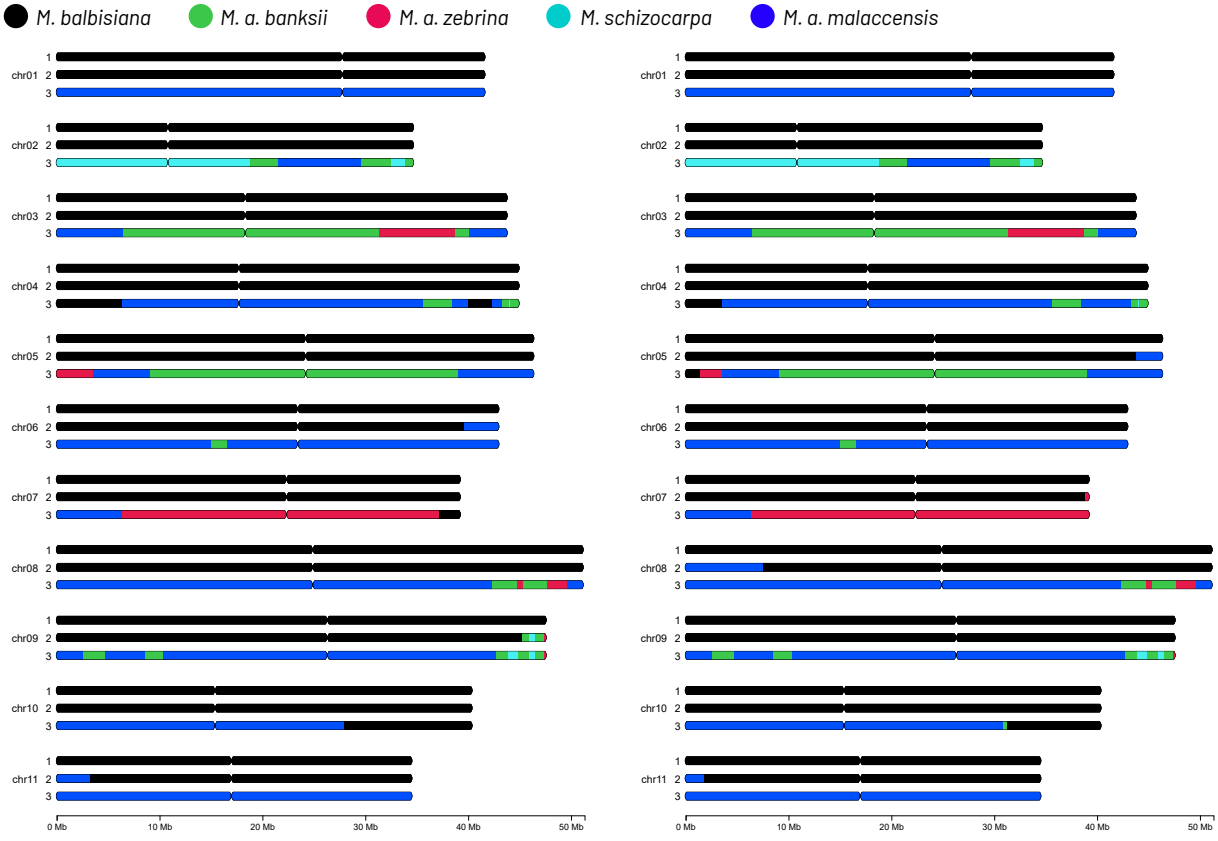
Uses Dessert, cooking (unripe), alcoholic production

Notes
- A diversity of cultivars with striking morphological features in common exists
- One of the most vigorous group of cultivars

Genomic features
- At least 5 closely related profiles: 2 triploids and 3 derivated tetraploids

Morphological Characterization Pictures

Molecular Characterization



ITC0659 Namwa Khom (PA-1)

ITC1719 Chinia (PA-2)

ABB genomic composition

Pisang Awak group (4x)

Passport Data

Classification Pisang Awak (ABB/ABBB)

Biological status Cultivated

Ploidy Polyploid (3x = 33 or 4x = 44)

Main distribution area Tropics and subtropics

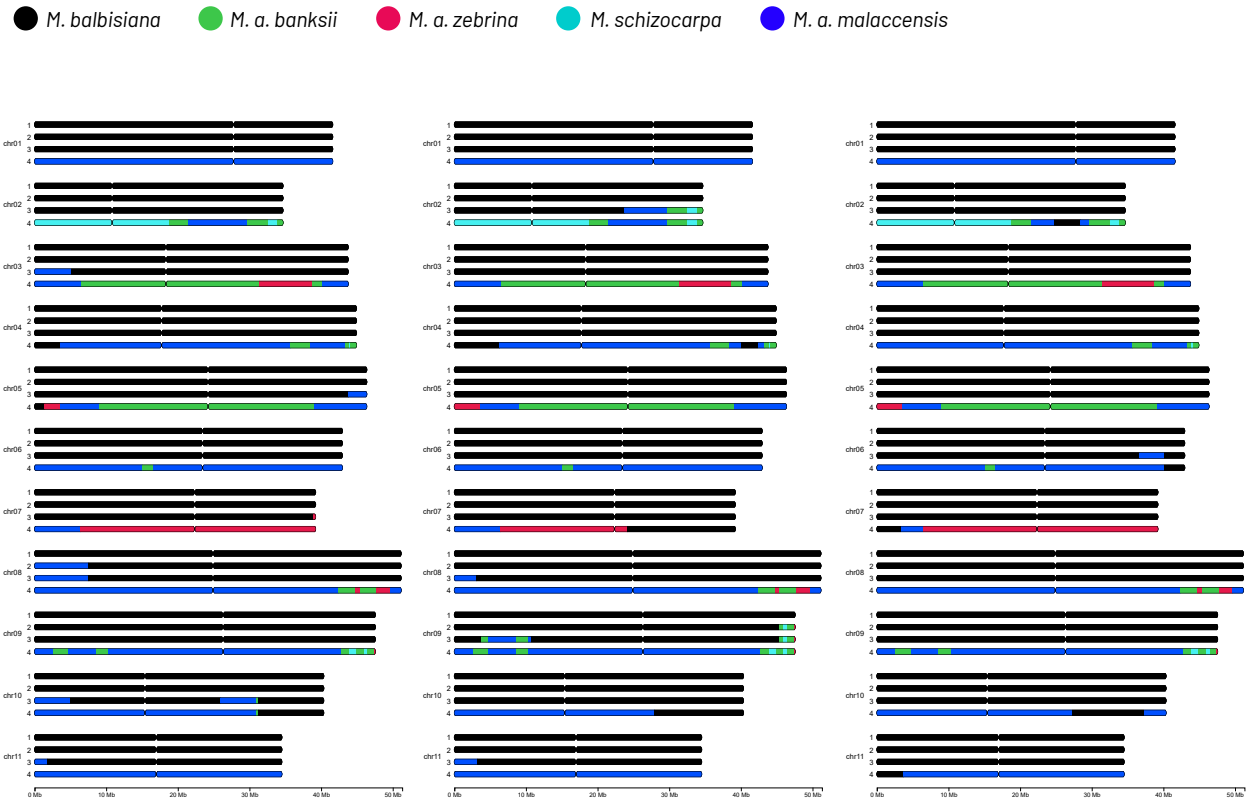
Uses Dessert, cooking (unripe), alcoholic production

Notes
- A diversity of cultivars with striking morphological features in common exists

Genomic features
- At least 5 closely related profiles (2 triploids and 3 derivated tetraploids)

Morphological Characterization Pictures

Molecular Characterization



ITC0213 Pisang Awak (PA-4x-2) | Ramu Yawa (PA-4x-1) | ITC0334 Nzizi (PA-4x-3)

ABB genomic composition

Bluggoe group

Passport Data

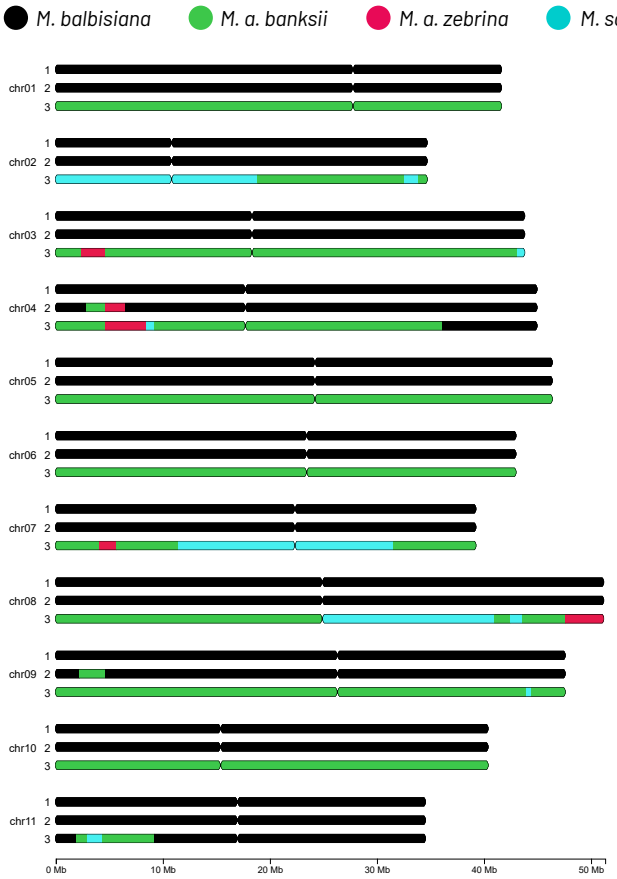
Classification	Bluggoe (ABB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	Tropics and subtropics
Uses	Cooking and dessert

Notes
- Fruits are mostly straights and stay in a horizontal position
- Bunch holds a maximum of 7/8 hands
- Highly susceptible to Fusarium wilt

Genomic features
- Mosaic pattern identical to Monthan
- Small duplicated region in the centromeric zone of chr. 8 (not shown)

Morphological Characterization Pictures

Molecular Characterization



ITC0643 Cachaco

ABB genomic composition

Monthan group

Passport Data

Classification	Monthan (ABB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	Northeast part of India
Uses	Cooking and dessert

Notes

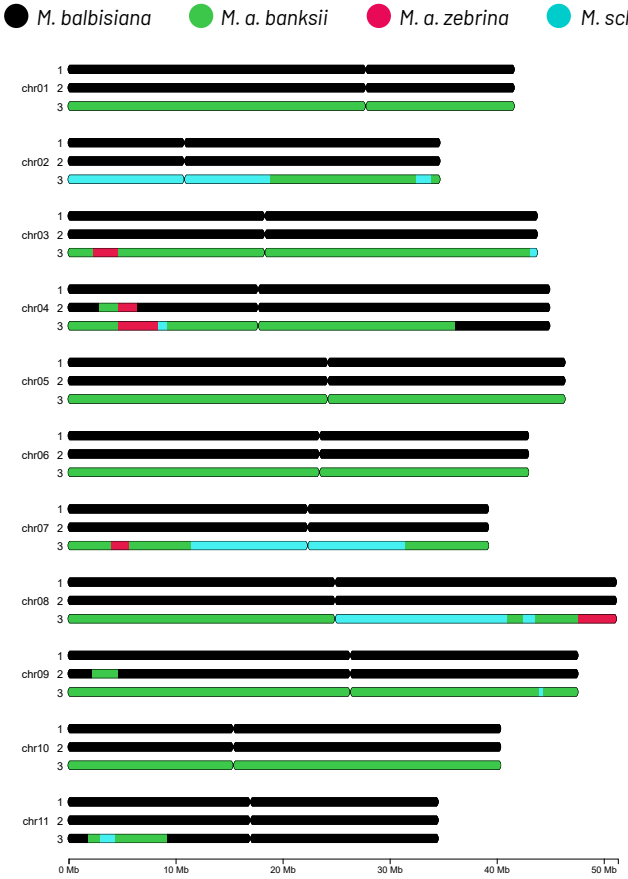
- Fruits are turned upward
- Bunch holds 15 to 20 hands, a second small bunch can develop on the male part

Genomic features

- Mosaic identical to bluggoe
- Small duplicated region in the centromeric zone of chr. 8 due to unbalanced crossing-over (not shown)

Morphological Characterization Pictures

Molecular Characterization



ITC1483 Monthan

ABB genomic composition

Ney Mannan group

Passport Data

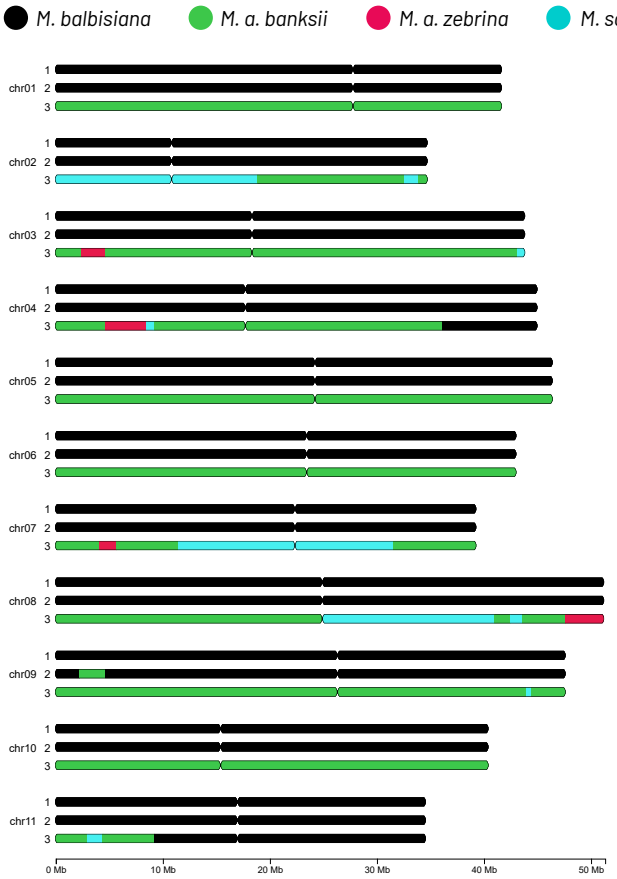
Classification	Ney Mannan (ABB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	Tropics and subtropics
Uses	Cooking, dessert and ornamentals

Notes
- Sweet aromatic fruit and vanilla ice cream-like flavor
- Cold-tolerant and wind-resistant because of their strong pseudostems and root systems

Genomic features
- Similar to Peyan but with slight differences of diversity pattern in the B genomes
- Small duplicated region in the centromeric zone of chr. 8 (not shown)

Morphological Characterization Pictures

Molecular Characterization



ITC0361 Blue Java

ABB genomic composition

Peyan group

Passport Data

Classification Peyan (ABB)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area India

Uses Dessert

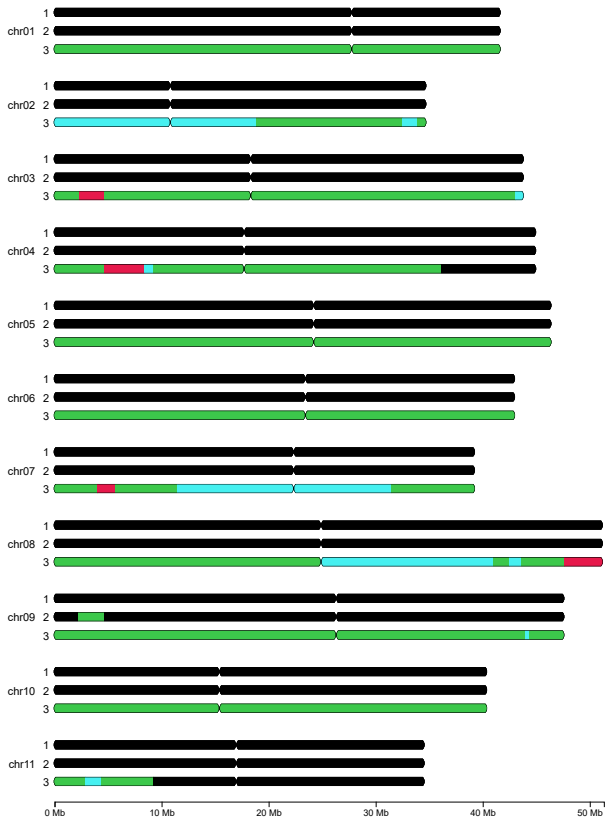
Notes
- Angular fruits and thick skin

Genomic features
- Similar to Ney Mannan but with slight differences of diversity pattern in the B genomes
- Small duplicated region in the centromeric zone of chr. 8 (not shown)

Morphological Characterization Pictures

Molecular Characterization

M. balbisiana *M. a. banksii* *M. a. zebrina* *M. schizocarpa*



ITC0123 Simili Radjah

ABB genomic composition

Kalapua group

Passport Data

Classification	Kalapua (ABB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	Papua New Guinea
Uses	Cooked by boiling or roasting

Notes
- Very common in Papua New Guinea
- Tolerant to drought and Black Leaf Streak resistant
- Susceptible to Banana Wilt Associated Phytoplasma

Genomic features
- Two patterns identified: Dwarf Kalapua have two full *M. balbisiana* haplotypes on first arms of chr. 4 and chr. 8.; first telomere of chr. 9 has three B copies
- Common small duplicated region in the centromeric zone of chr. 8 (not shown)

Morphological Characterization Pictures

Molecular Characterization

ITC2017 Tukuru round

ITC1937 Gana Auf

ABB genomic composition

Klue Tiparod group

Passport Data

Classification Klue Tiparod (ABB)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area South-East Asia

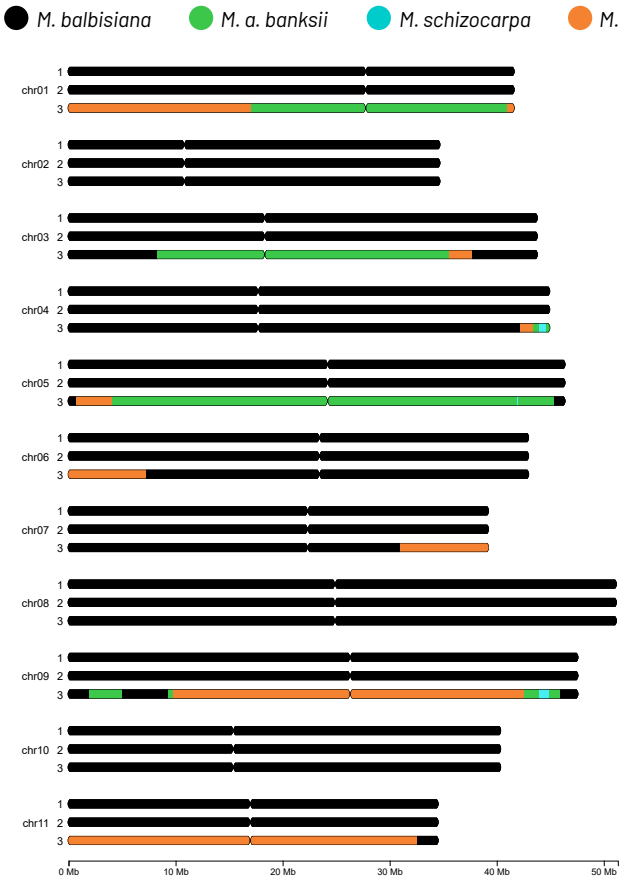
Uses Cooking

Notes
- Vigorous plant with massive fruits
- Very close to *M. balbisiana*
- Two forms: complete bunch and horn. Can appear on the same plant, depending on the cycles. Instability of the inflorescence.

Genomic features
- High proportion of B genome
- The only group with *M. a. burmanicca/ siamea* contribution

Morphological Characterization Pictures

Molecular Characterization



ITC0652 Kluai Tiparot

ABB genomic composition

Pelipita group

Passport Data

Classification	Pelipita (ABB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	South-East Asia
Uses	Cooking

Notes
- Reached Latin America where it gained popularity due to resistance to pest and diseases

Genomic features
- Three *M. balbisiana* haplotypes for chromosome 2 and chromosome 11
- Three *M. balbisiana* centromeres for chromosome 7

Morphological Characterization Pictures

Molecular Characterization

ITC0472 Pelipita

MORPHOLOGICALLY SIMILAR TO CULTIVAR GROUPS

Similar to Mutika/Lujugira

Kikundi cluster

Passport Data

Classification Mutika/Lujugira related (AAA)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area Tanzania

Uses Cooking and dessert

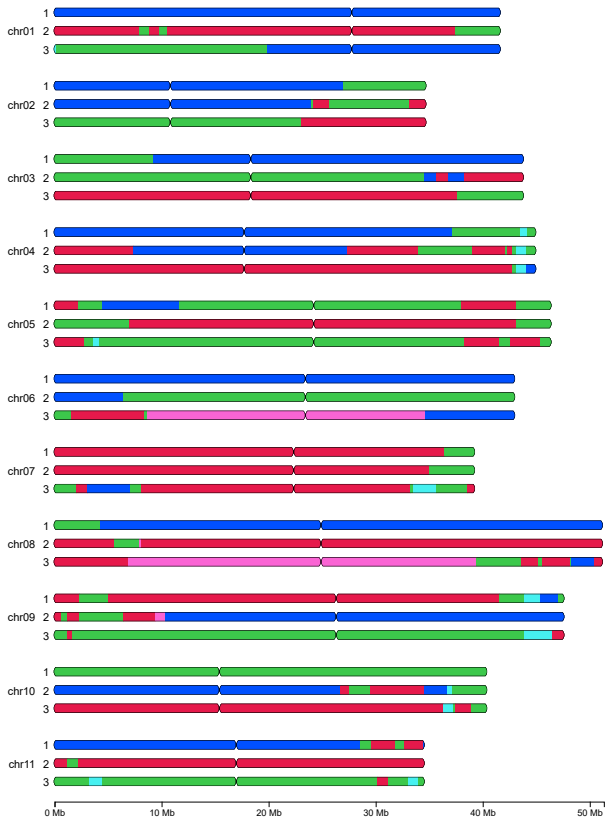
Notes
- Morphologically similar to Mutika/Lujugira
- Ntebwa and Ntindii I are 2 cultivars from the Usambara region with different usages
- Kikundi's underlying colour of the pseudostem is pinkish instead of green

Genomic features
- Common genetic background with Mutika/Lujugira but with a strong malaccensis component (12 centromeres)

Morphological Characterization Pictures

Molecular Characterization

M. a. banksii *M. a. malaccensis* *M. a. zebrina* *M. schizocarpa* *Unknown genepool*



ITC1224 Kikundi

Similar to Mutika/Lujugira

Luhololе cluster

Passport Data

Classification Mutika/Lujugira related (AAA)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area Tanzania (Morogoro region)

Uses Dessert

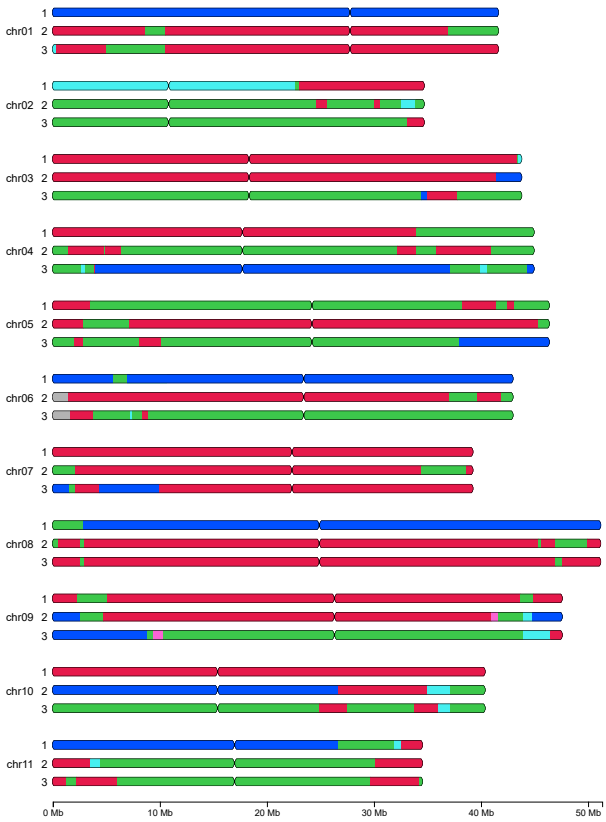
Notes
- Named after chief Luhorore who found it in this area when he arrived approx. 100 years ago (from collecting report)
- Degenerating male bud observed in some plants

Genomic features
- Common genetic background with Mutika, Ilalyi and Kikundi but with 6 *M. a. malaccensis* centromeres

Morphological Characterization Pictures

Molecular Characterization

M. a. banksii *M. a. malaccensis* *M. a. zebrina* *M. schizocarpa* *Unknown genepool*



ITC1593 Luhulole

Similar to Plantain

Kupulik cluster

Passport Data

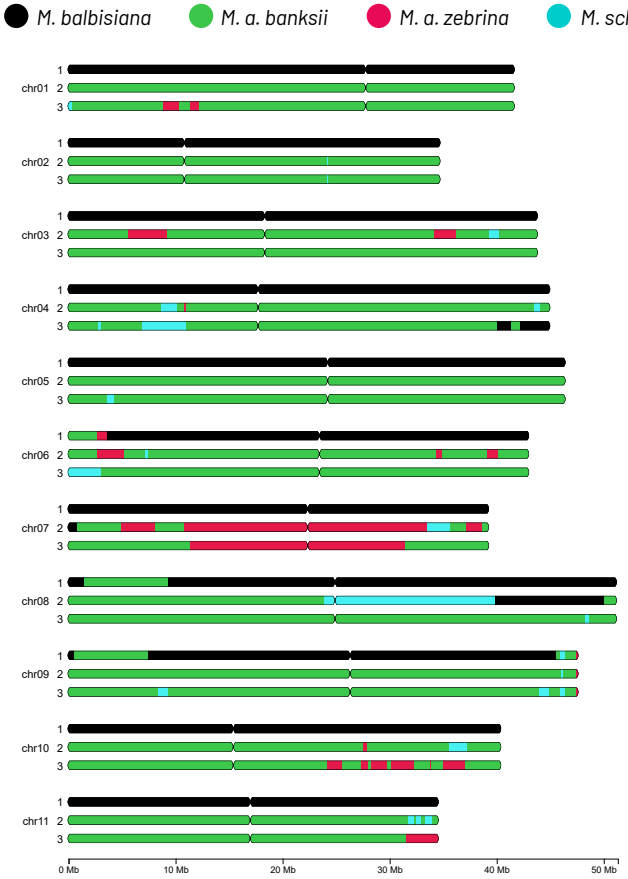
Classification	Plantain related (AAB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	Papua New Guinea
Uses	Cooking

Notes
- Morphologically similar to plantain
- Collected as plantain
- Kupulik and Navente 2 with degenerating bud, unlike Bubun

Genomic features
- Differs from plantain mosaic by 4 centromeres and the absence of *M. a.* ssp. *malaccensis*
- Small duplicated region in the centromeric zone of chr. 8 (not shown)

Morphological Characterization Pictures

Molecular Characterization



ITC0909 Kupulik

Similar to Plantain

Mnalouki

Passport Data

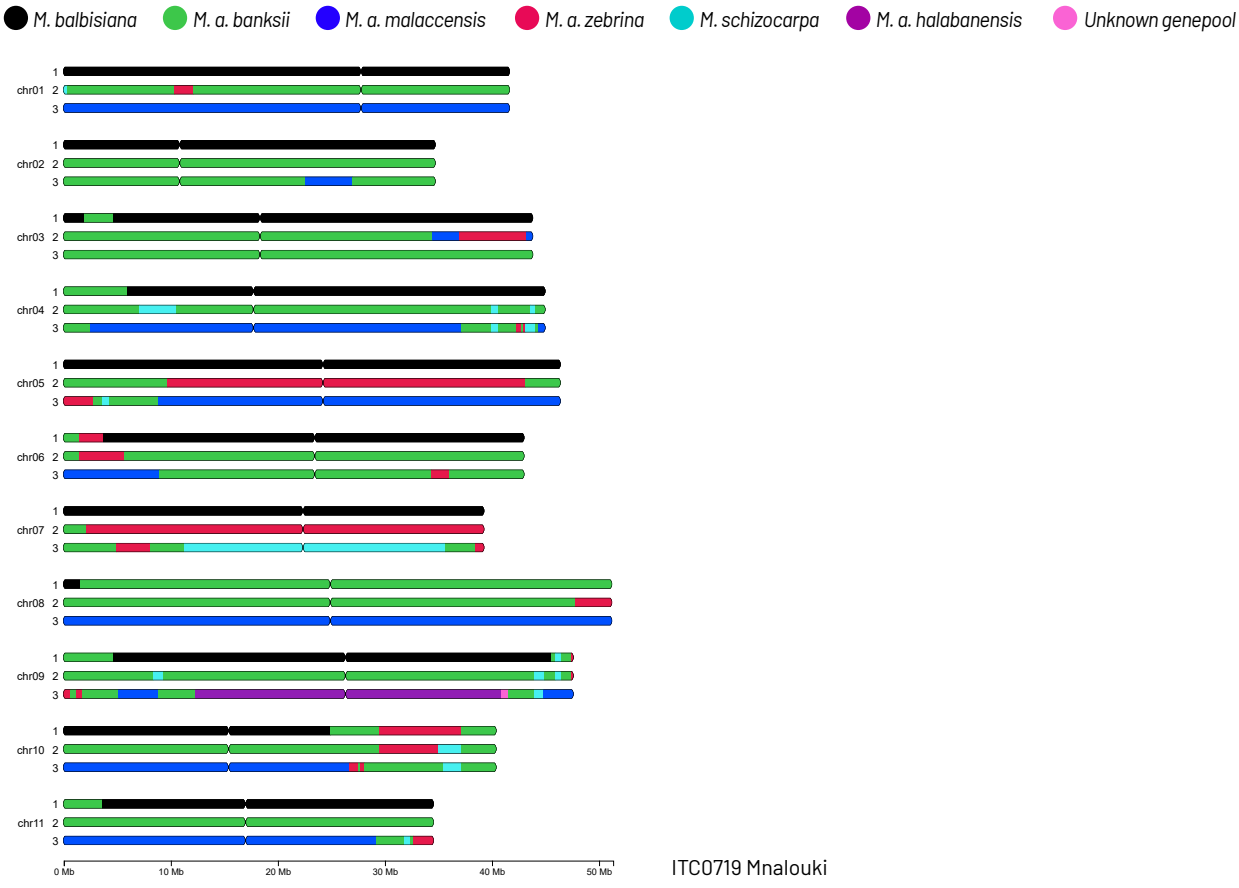
Classification	Plantain related (AAB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	Comores
Uses	Dessert

Notes
- Morphologically similar to plantain
- Only AAB known today in the Comoros

Genomic features
- Possibly derived from plantain (2n gamete) and Mchare (n gamete)

Morphological Characterization Pictures

Molecular Characterization



ITC0719 Mnalouki

Similar to Maoli-Popoulu

Wan Gevi cluster

Passport Data

Classification	Maia Maoli-Popoulu related (AAB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	New Britain island (PNG)
Uses	Cooking

Notes	• Morphologically similar to Maia Maoli-Popoulu
Genomic features	• Genomic background similar to Maia Maoli-Popoulu

Morphological Characterization Pictures

Molecular Characterization

ITC2022 Wan Gevi

Similar to Maoli-Popoulu

Buka Kiakiau

Passport Data

Classification Maia Maoli-Popoulu related (AAB)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area New Britain island (PNG)

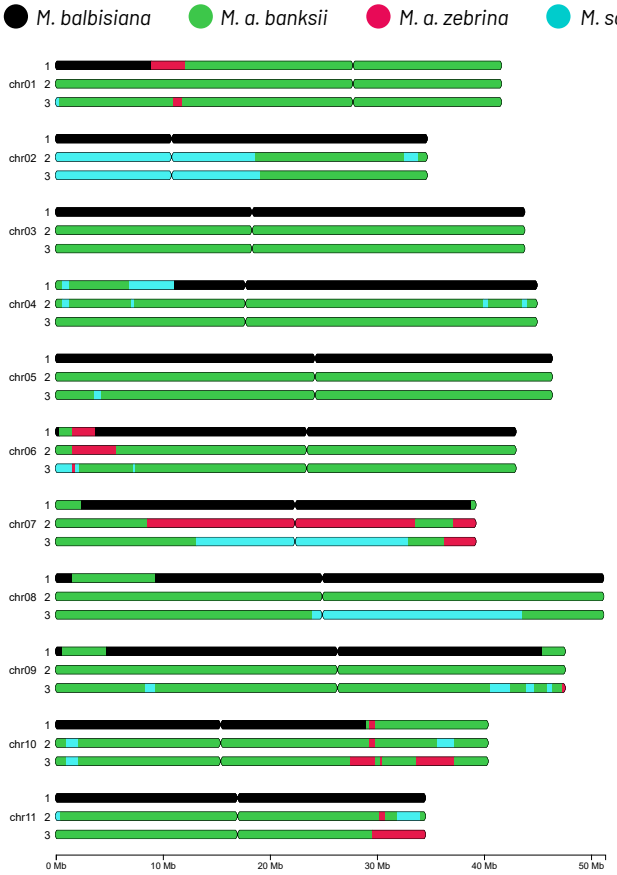
Uses Cooking

Notes
- Morphologically similar to Maia Maoli-Popoulu

Genomic features
- Genomic background similar to Maia Maoli-Popoulu
- Small duplicated region in the centromeric zone of chr. 8 (not shown)

Morphological Characterization Pictures

Molecular Characterization



WNB049 Buka Kiakiau

Similar to Maoli-Popoulu

Ruango Block cluster

Passport Data

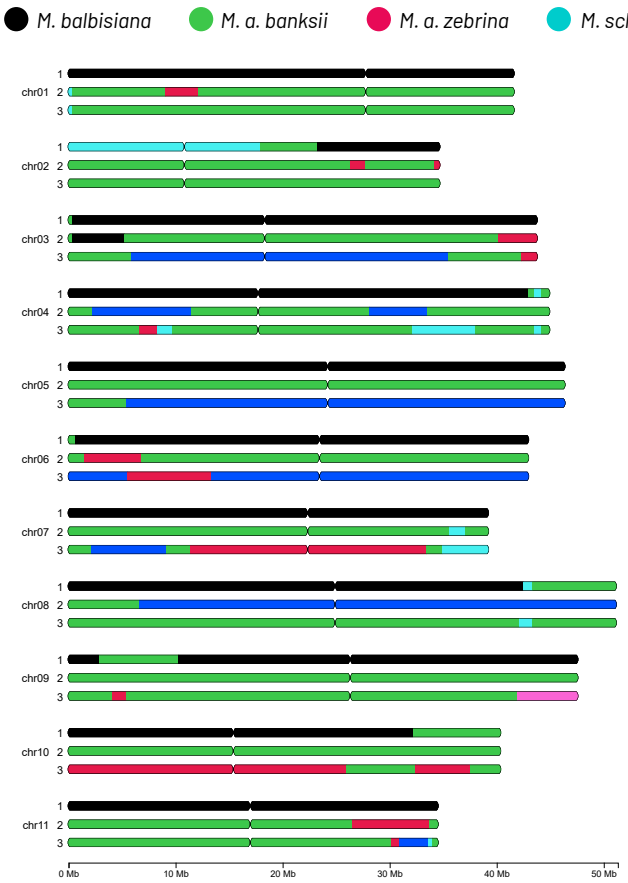
Classification	Maia Maoli-Popoulu related (AAB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	New Britain island (PNG)
Uses	Cooking

Notes
- Morphologically similar to Maia Maoli-Popoulu

Genomic features
- Substantial contribution of *M.a.* ssp. *malaccensis*

Morphological Characterization Pictures

Molecular Characterization



ITC0920 Dimaemamosi

Similar to Iholena

Rukumamb Tambey cluster

Passport Data

Classification Iholena related (AAB)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area Papua New Guinea and Samoa

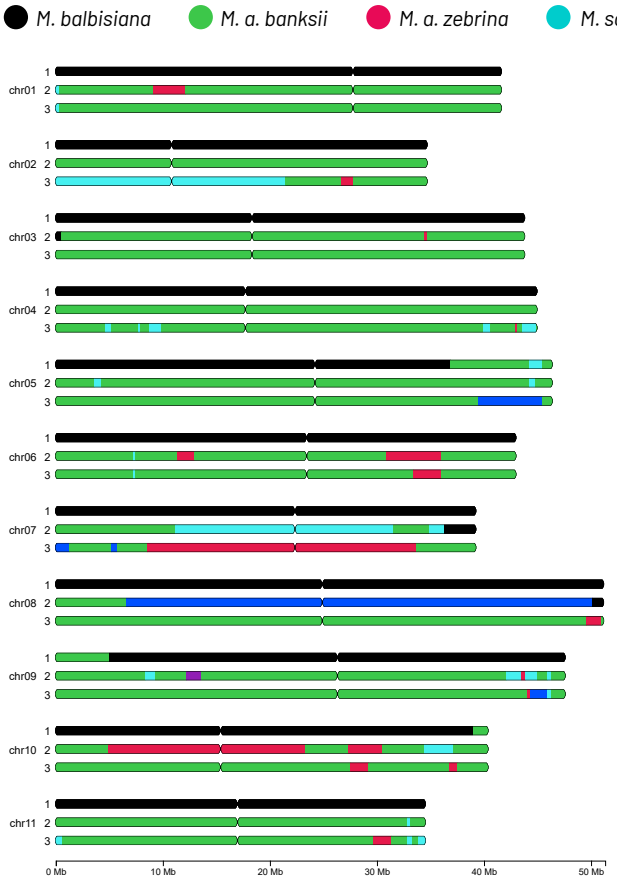
Uses Cooking

Notes
- Morphologically similar to Iholena
- Fruits stay green

Genomic features
- Mosaics with 4 centromeres differing from Iholena

Morphological Characterization Pictures

Molecular Characterization



ITC0830 Rukumamb Tambey

Similar to Iholena

Arawa cluster

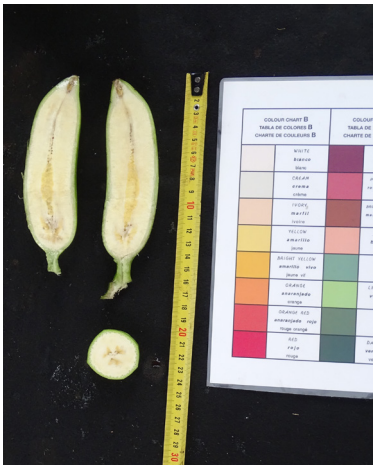
Passport Data

Classification	Iholena related (AAB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	Papua New Guinea and Samoa
Uses	Cooking

Notes
- Morphologically similar to Iholena
- Flesh is yellow instead of salmon-orange

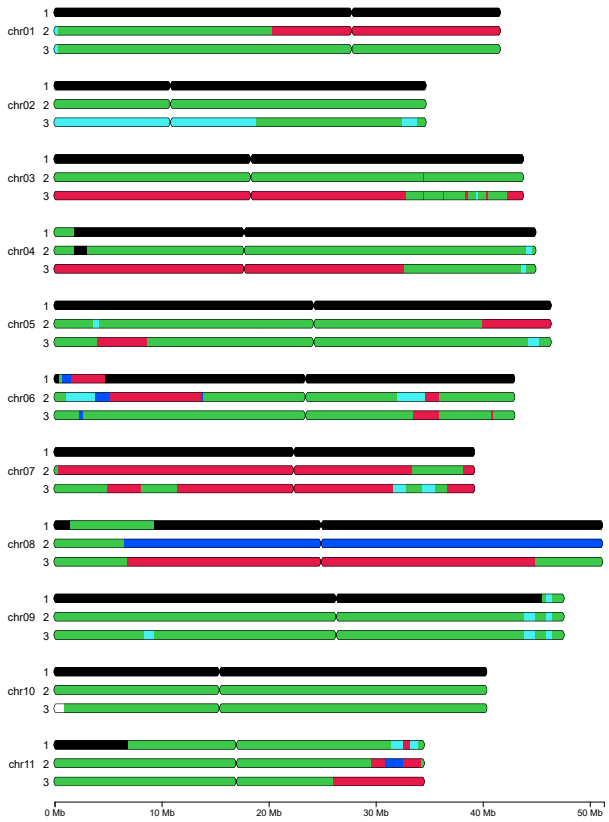
Genomic features
- Mosaics with 8 centromeres differing from Iholena
- Stronger *M. a. zebrina* component (6 centromeres)

Morphological Characterization Pictures



Molecular Characterization

M. balbisiana *M. a. banksii* *M. a. zebrina* *M. schizocarpa* *M. a. malaccensis*



ITC1910 Arawa

MORPHOLOGICALLY DISTINCT CLUSTERS

AA genomic composition

Bata Bata cluster

Passport Data

Classification	Bata Bata (AA)
Biological status	Cultivated
Ploidy	Diploid (2n = 2x = 22)
Main distribution area	The Philippines
Uses	Dessert

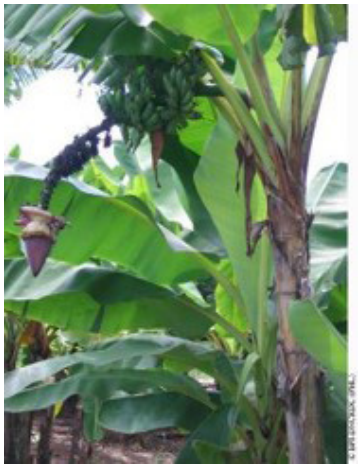
Notes

- Racadag (from the Philippines) and Pisang Mas Ayer (from Malaysia) also with this pattern

Genomic features

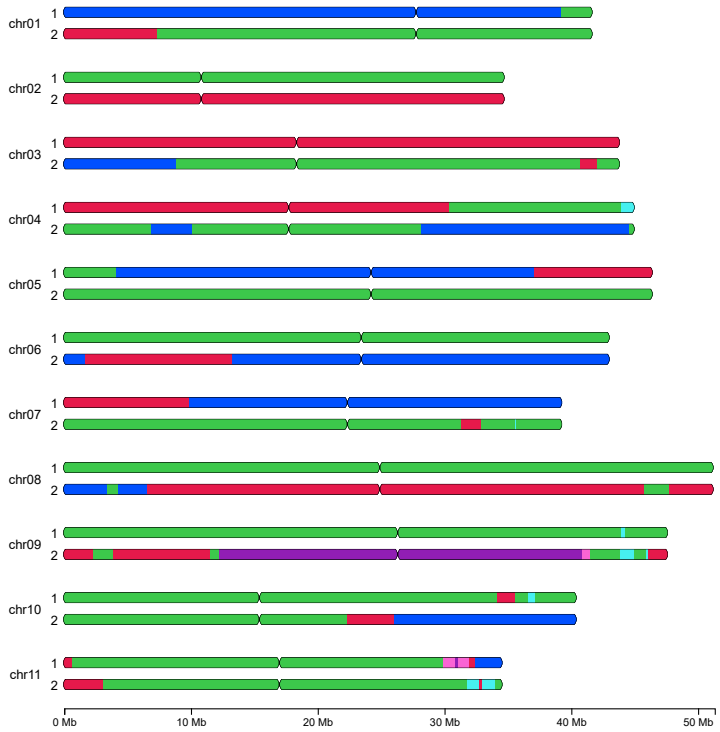
- *M. a.* ssp. *banksii*, *M. schizocarpa*, *M. a.* ssp. *malaccensis*, *M. a. zebrina* and *M. a. halabanensis*

Morphological Characterization Pictures



Molecular Characterization

M. a. banksii *M. a. malaccensis* *M. a. zebrina* *M. schizocarpa* *M. a. halabanensis* *Unknown genepool*



ITC0974 Bata Bata

AA genomic composition

Talasea cluster

Passport Data

Classification	Talasea (AA)
Biological status	Cultivated
Ploidy	Diploid (2x = 22)
Main distribution area	Papua New Guinea outer islands (very common in West New Britain)
Uses	Cooking

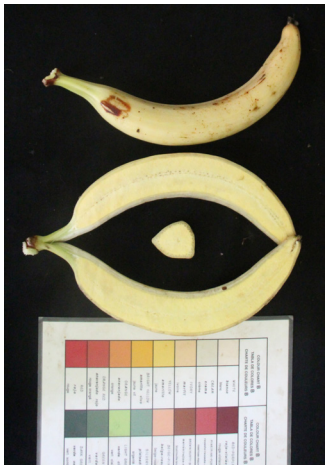
Notes

- Named after a district of New Britain Island and sold in markets locally
- Synonym: Misis
- Very pale fruits' skin, a reddish variant exist

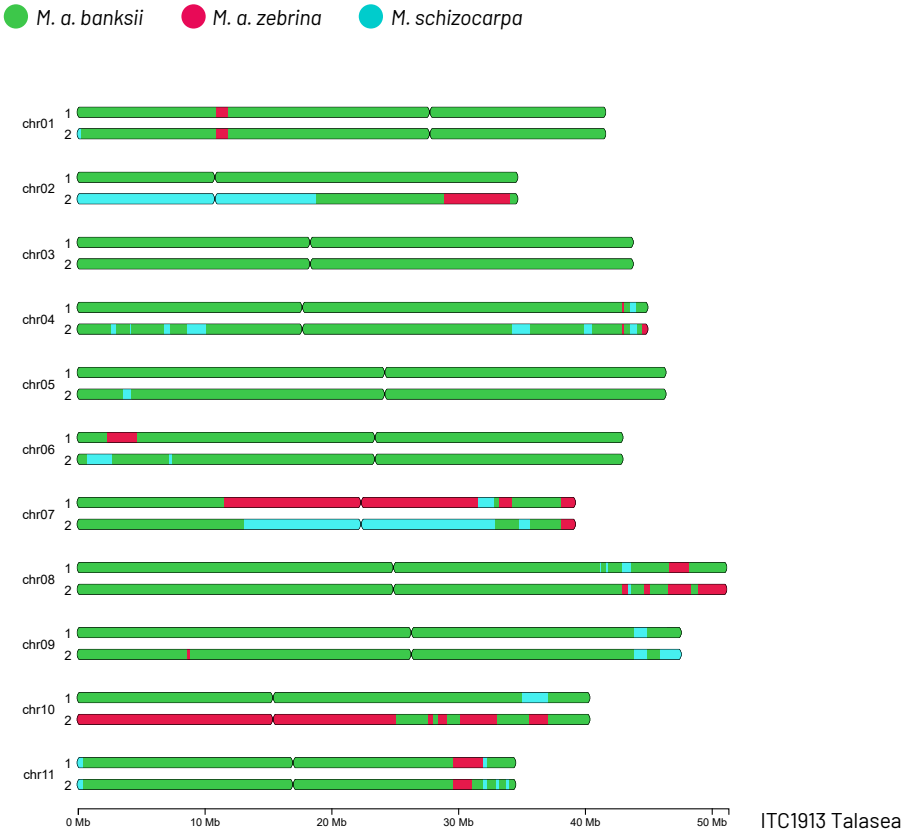
Genomic features

- One of the many diploid landraces of PNG with *M. a. banksii/M. schizocarpa/M. A. zebrina ancestries*

Morphological Characterization Pictures



Molecular Characterization



ITC1913 Talasea

AA genomic composition

Te'engi cluster

Passport Data

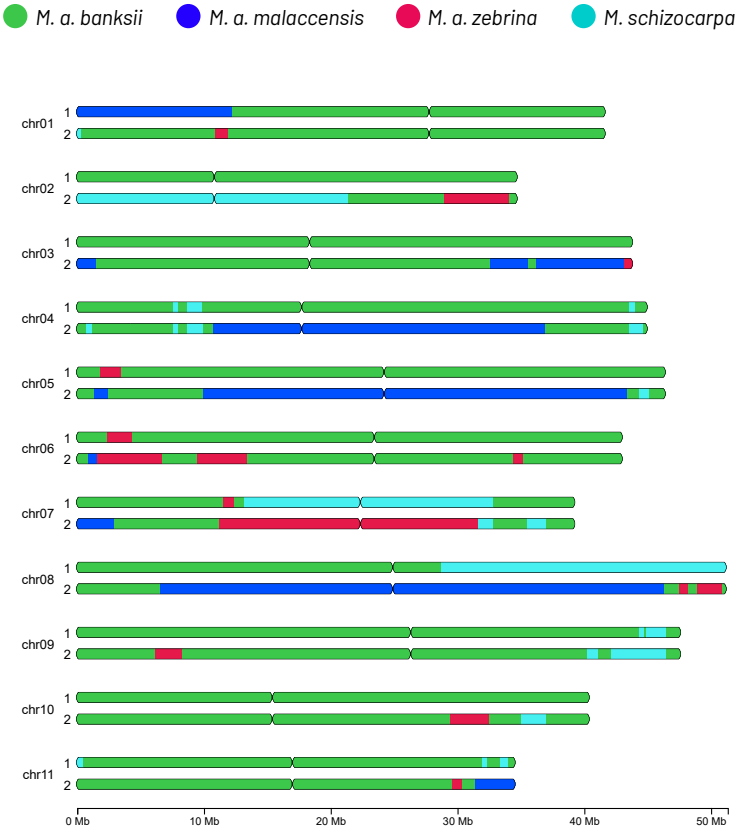
Classification	Te'engi (AA)
Biological status	Cultivated
Ploidy	Diploid (2n = 2x = 22)
Main distribution area	Papua New Guinea
Uses	Cooking and dessert

Notes
- Four different cultivars collected in the 1980's in Papua New Guinea (ITC0797 'Pama'; ITC0951 'Te'engi'; ITC1015 'Meinje' and ITC1211 'Vudu Beo')

Genomic features
- Holds a common small duplicated region in the centromeric zone of chr. 8 due to unbalanced crossing-over between *banksii* and *M. schizocarpa* (not shown)

Morphological Characterization Pictures

Molecular Characterization



ITC0951 'Te'engi'

ABBT genomic composition

Buka cluster

Passport Data

Classification Buka (ABBT)

Biological status Cultivated

Ploidy Tetraploid (4x = 44)

Main distribution area Papua New Guinea

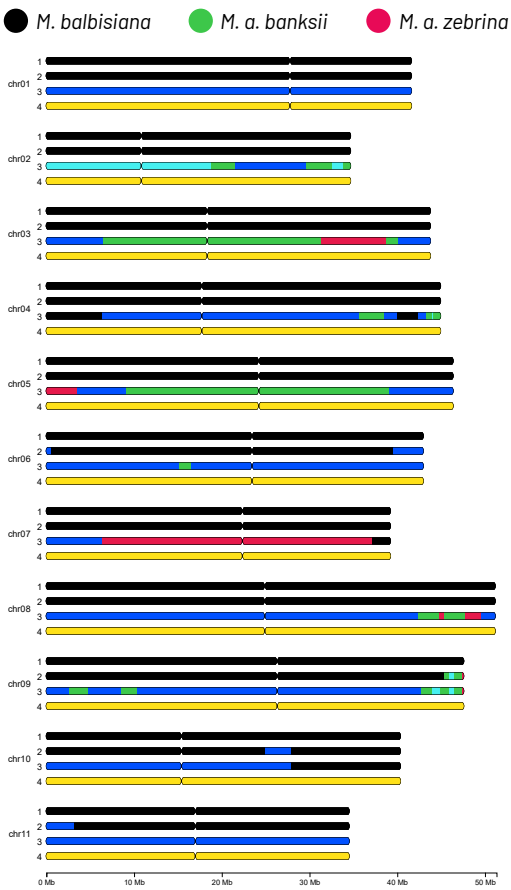
Uses Dessert and cooking

Notes
- Same mosaic than Bukayawa, also from Papua New Guinea, but Buka is a shorter variety

Genomic features
- Progeny of Pisang Awak (P. Awak 1) (3n gamete) and a Australimusa (1n gamete)

Morphological Characterization Pictures

Molecular Characterization



AROB027 Buka

INDIVIDUAL ACCESSIONS OF PARTICULAR INTEREST

AA genomic composition

Khai Na On

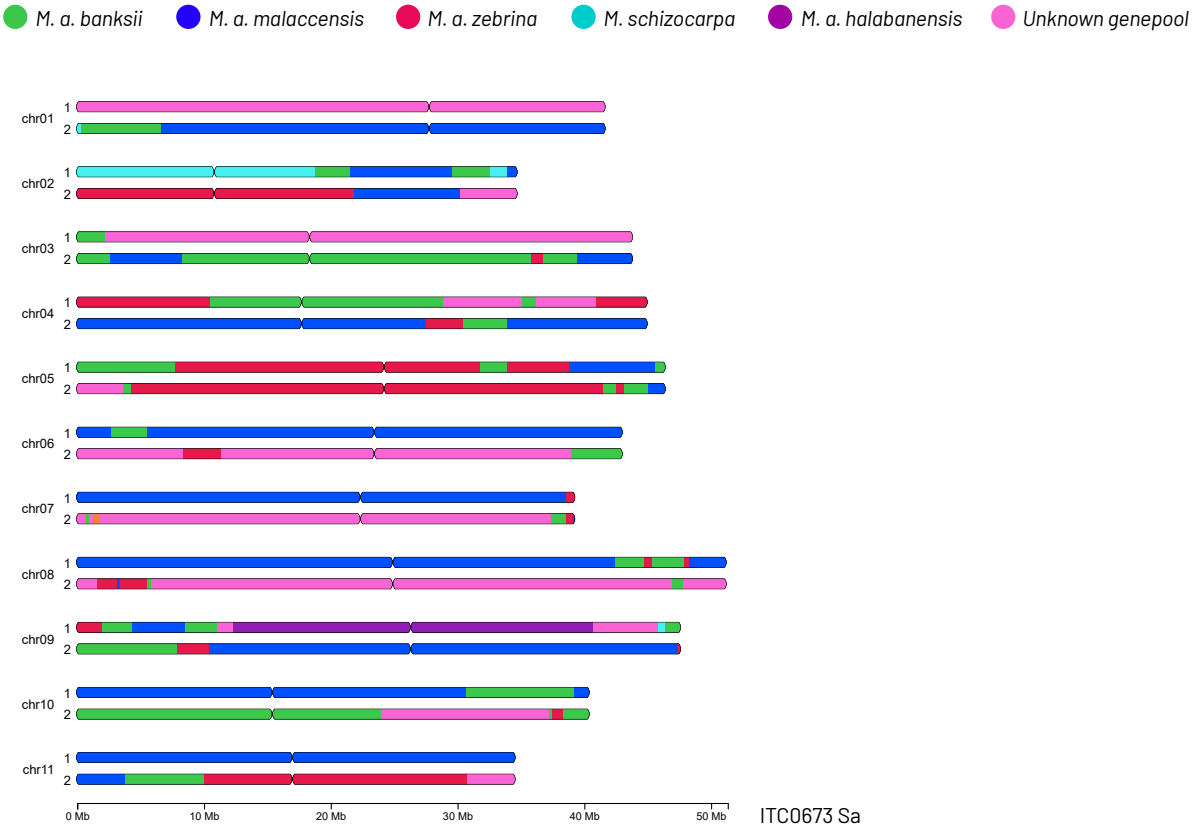
Passport Data

Classification	Musa (AA)
Biological status	Cultivated
Ploidy	Diploid (2x = 22)
Main distribution area	Thailand
Uses	Dessert, breeding

Notes	• Synonym: Sa
Genomic features	• N gamete parent of the Gros Michel

Morphological Characterization Pictures

Molecular Characterization



ITC0673 Sa

AA genomic composition

Manang

Passport Data

Classification Manang (AA)

Biological status Cultivated

Ploidy Diploid (2x = 22)

Main distribution area The Philippines

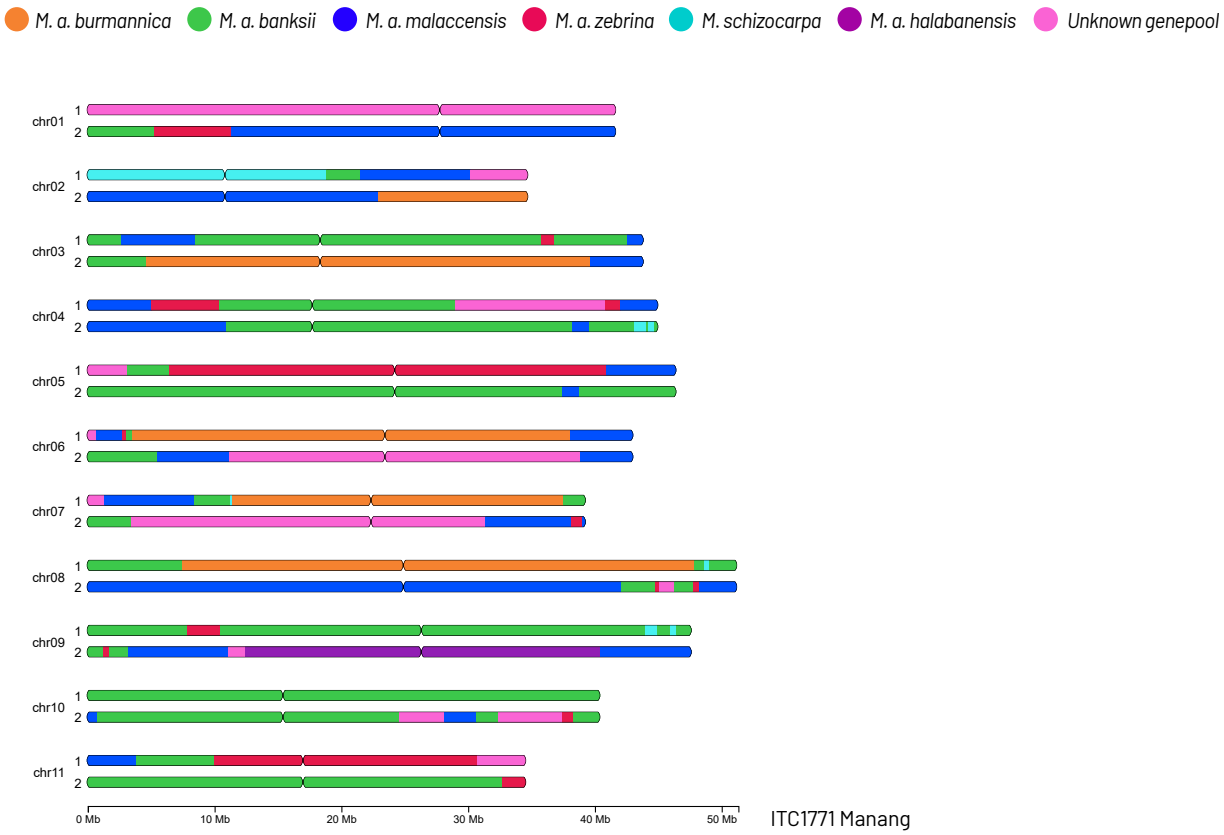
Uses Dessert

Notes
- Orange-yellow peel, reddish cigar leaf
- Said to have sweet and aromatic fruits
- Popular in the Bicol region

Genomic features
- Contribution of *M. a. burmannica/ siamea* (including 4 centromeres)

Morphological Characterization Pictures

Molecular Characterization



ITC1771 Manang

AA genomic composition

Matti

Passport Data

Classification	Matti (AA)
Biological status	Cultivated
Ploidy	Diploid (2x = 22)
Main distribution area	India
Uses	Unknown

Notes

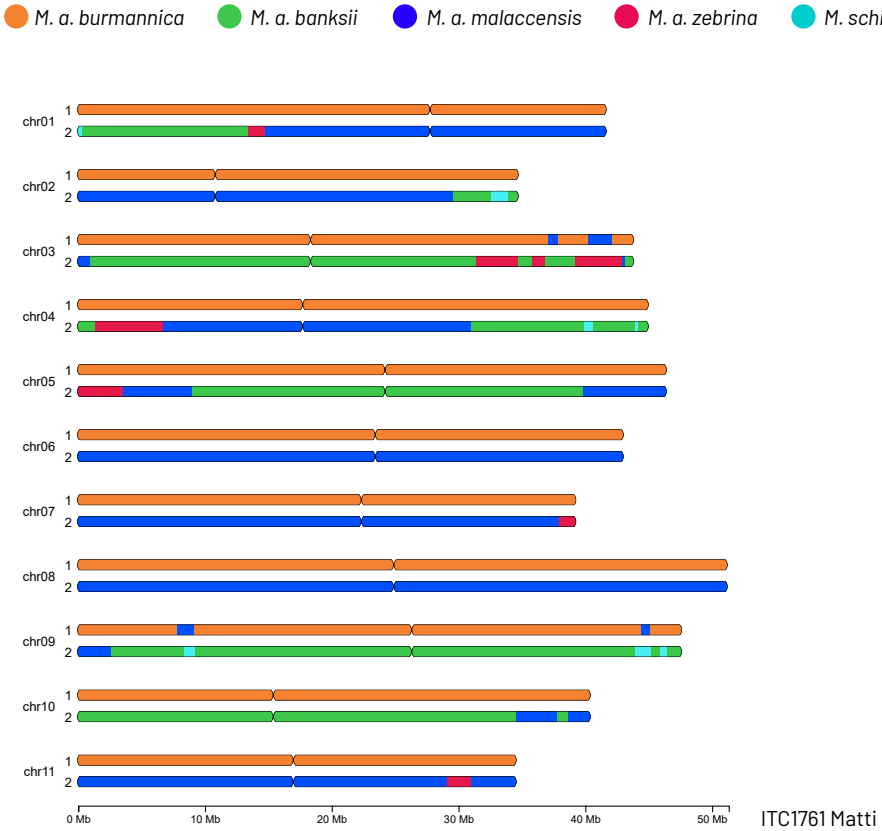
- Described as a rare plant in South India
- 14–15 months from planting to harvest
- Helps with easy digestion and is widely given to the 3–12 months old babies

Genomic features

- With nearly a full haplotype of *M. a. burmannica/ siamea*

Morphological Characterization Pictures

Molecular Characterization



ITC1761 Matti

AA genomic composition

Pisang Madu

Passport Data

Classification Pisang Madu (AA)

Biological status Cultivated

Ploidy Diploid (2x = 22)

Main distribution area South-East Asia

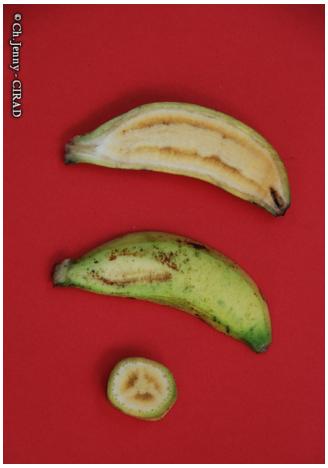
Uses Dessert

Notes

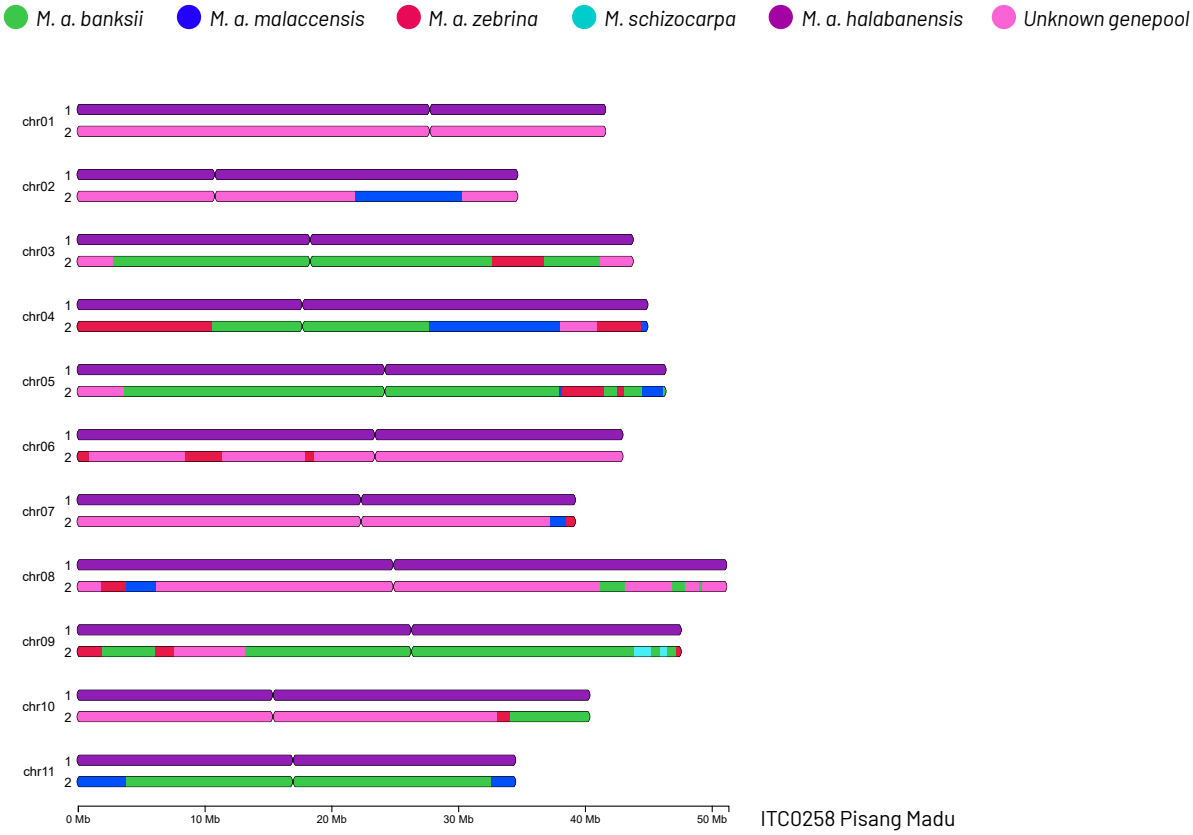
Genomic features

- Two main contributors, *M. a. halabanensis* and the unknown genepool
- Close to 1x gamete donor of Cavendish

Morphological Characterization Pictures



Molecular Characterization



ITC0258 Pisang Madu

AA genomic composition

Pisang Pipit

Passport Data

Classification	Pisang Pipit (AA)
Biological status	Cultivated
Ploidy	Diploid (2x = 22)
Main distribution area	South-East Asia
Uses	Unknown

Notes

Genomic features

- High contribution of *M. a. zebrina* and of the unknown genepool
- Close to 1x gamete donor of Cavendish

Morphological Characterization Pictures

Molecular Characterization

M. a. banksii *M. a. malaccensis* *M. a. zebrina* *M. schizocarpa* *M. a. halabanensis* *Unknown genepool*

ITC0685 Pisang pipit

AAS genomic composition

ToiToi

Passport Data

Classification ToiToi (AAS)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area Bougainville (Papua New Guinea)

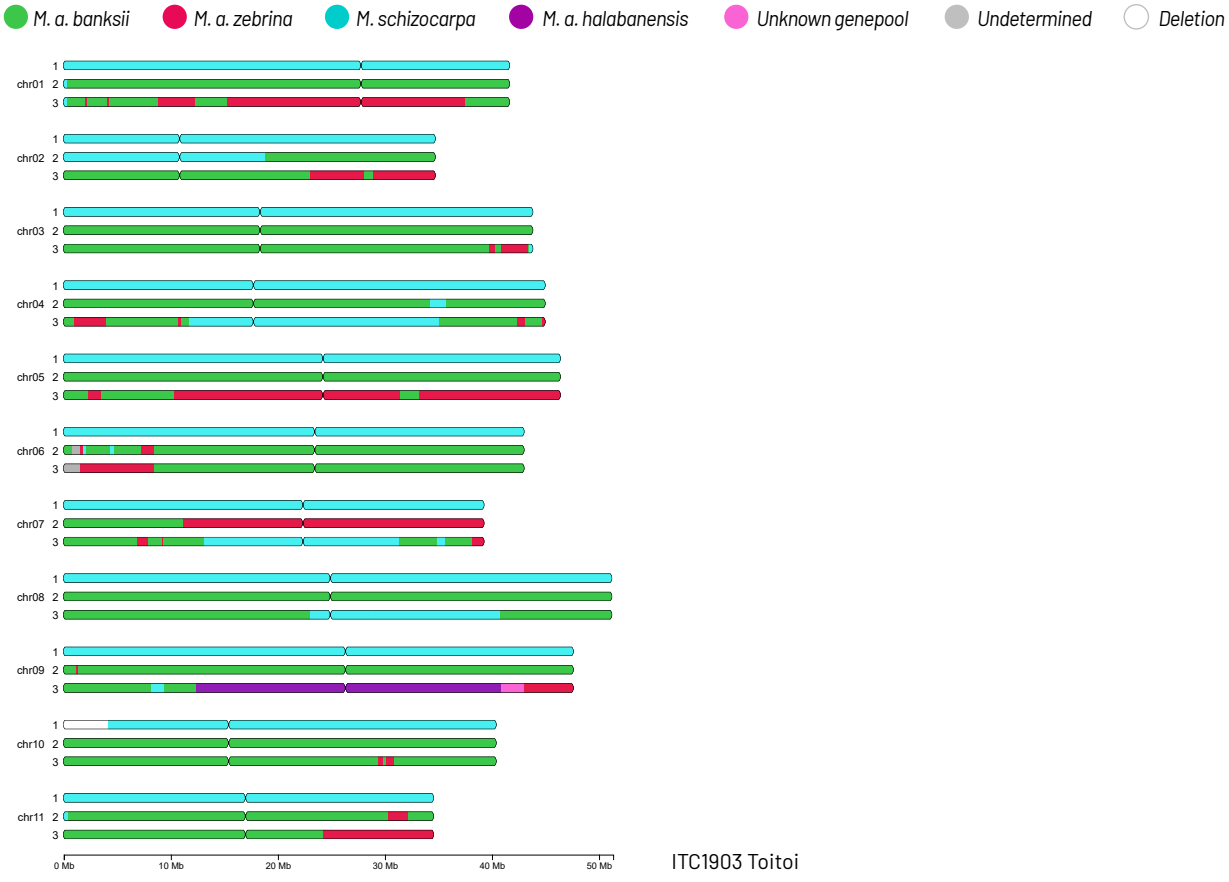
Uses Unknown

Notes
- Only two known cultivars with a AAS genomic composition, both found in Papua New Guinea

Genomic features
- It is composed of two haplotypes cultivated AA-like and one *M. schizocarpa* haplotype with a deletion on chromosome 10

Morphological Characterization Pictures

Molecular Characterization



ITC1903 Toitoi

La

Passport Data

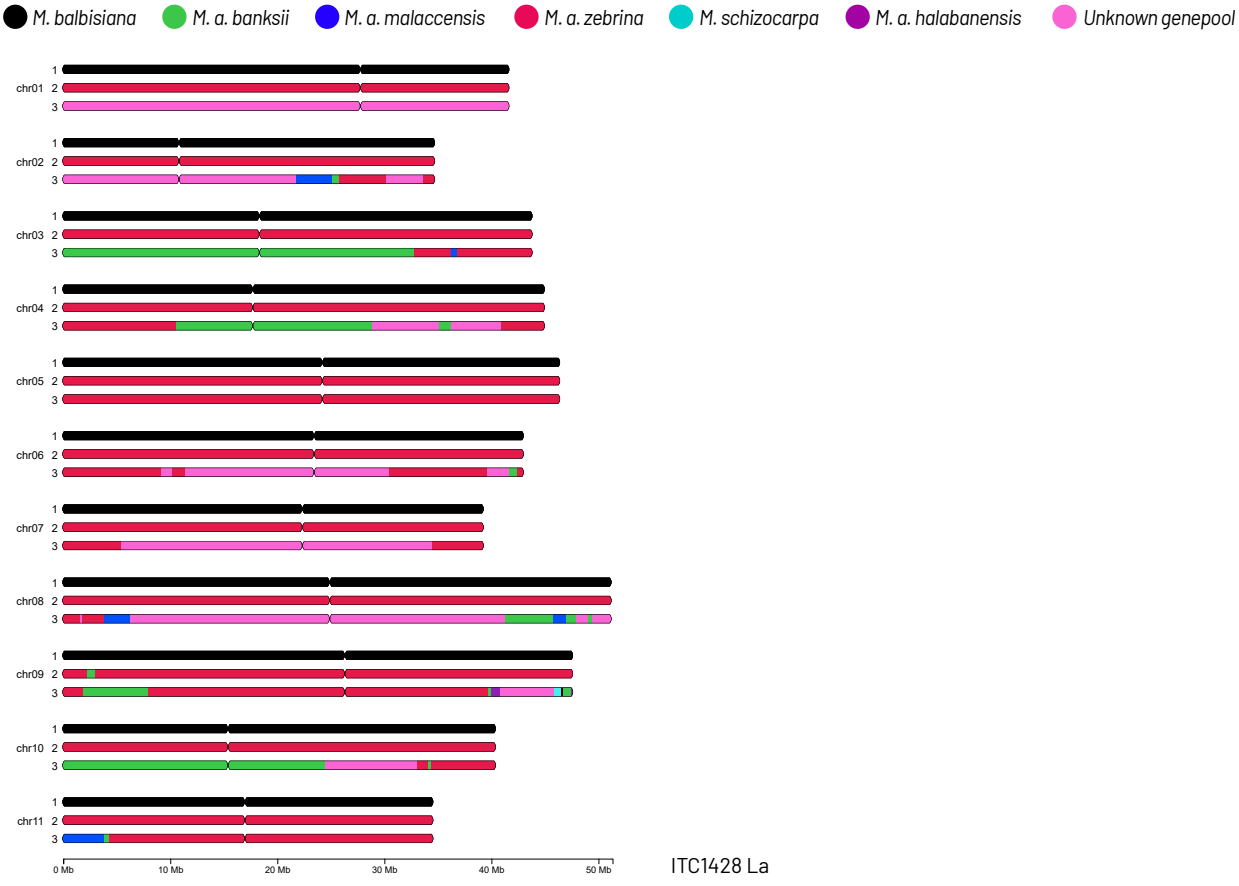
Classification	La (AAB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	Vietnam
Uses	Unknown

Notes
- Possibly Pisang Kelat

Genomic features
- One haplotype is full B
- A main contribution from *M. a. zebrina* and the unknown ancestor

Morphological Characterization Pictures

Molecular Characterization



ITC1428 La

AAB genomic composition

Pisang Slendang

Passport Data

Classification	Pisang Slendang (AAB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	Indonesia
Uses	Unknown

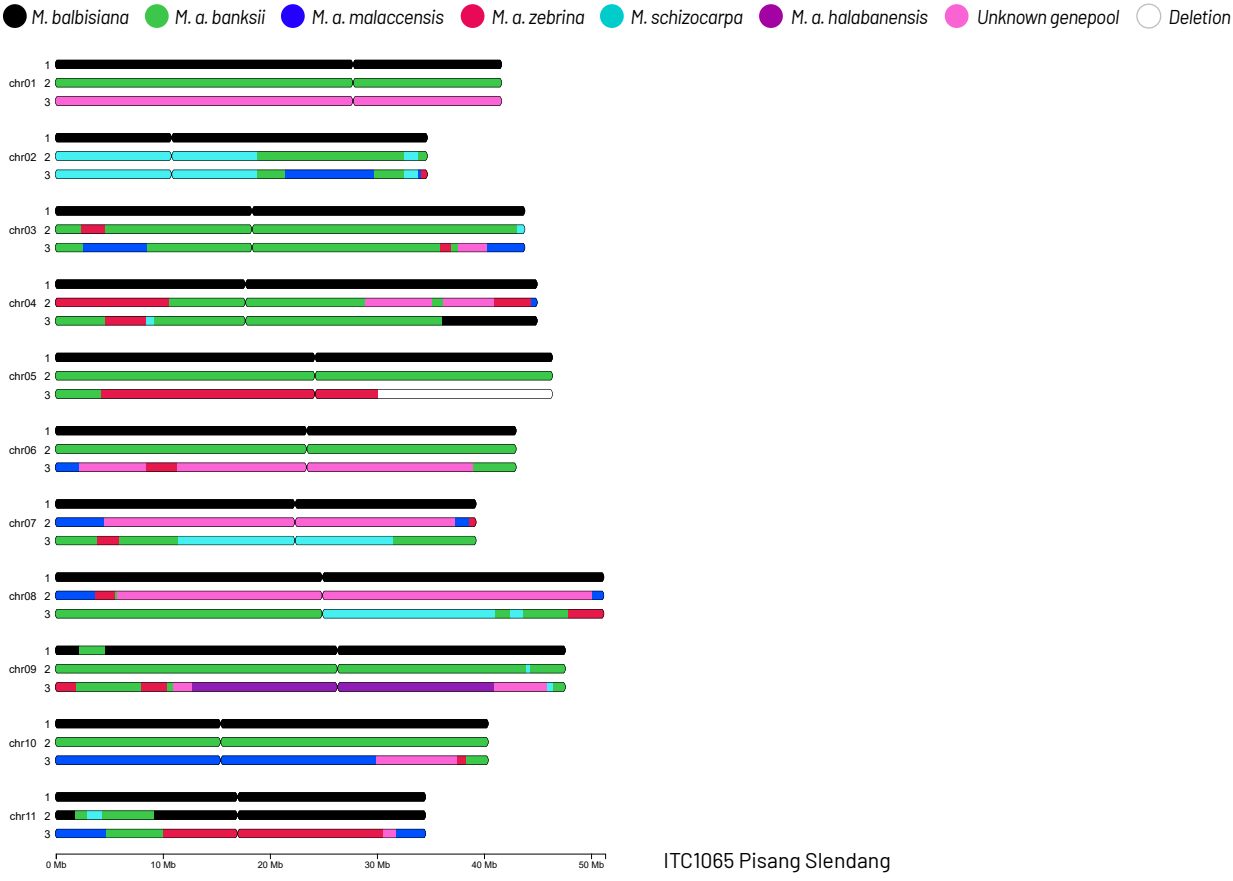
Notes

Genomic features

- Small duplicated region in the centromeric zone of chr. 8 (not shown)

Morphological Characterization Pictures

Molecular Characterization



ITC1065 Pisang Slendang

ABB genomic composition

Auko

Passport Data

Classification Auko (ABB)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area Papua New Guinea

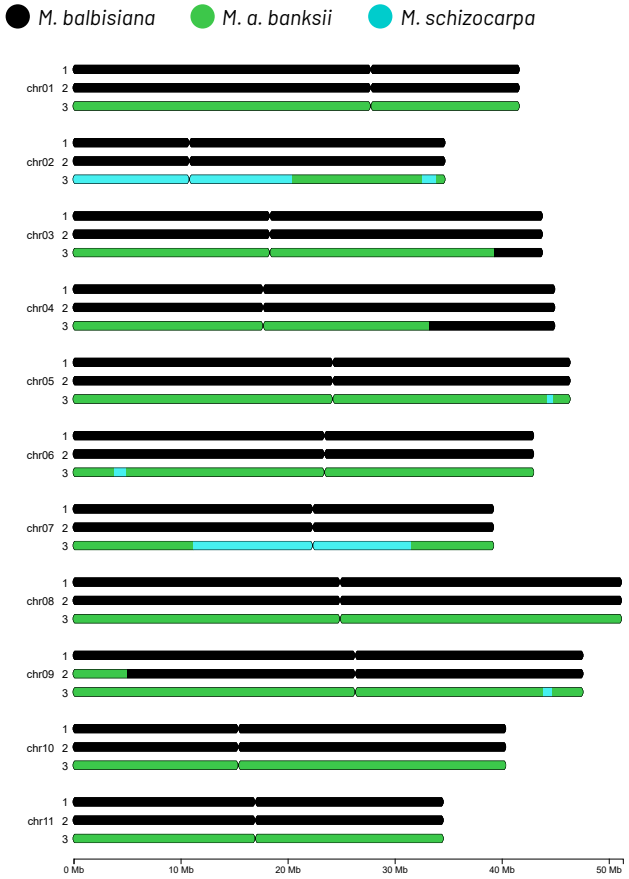
Uses Cooking (Vunapope) and dessert (Auko)

Notes
- Vunapope is a synonym for Auko
- Immune to Black Leaf Streak
- Occasional seeds, no pollen

Genomic features
- The A genome contains only *M. a. banksii* and *M. schizocarpa* (no *zebrina*)
- FLow cytometry indicates 2x and 3x cells: possible mixo-ploid chimera AB/ABB

Morphological Characterization Pictures

Molecular Characterization



ITC0983 Auko

ABB genomic composition

Choi Mit

Passport Data

Classification	Choi Mit (ABB)
Biological status	Cultivated
Ploidy	Triploid (3x = 33)
Main distribution area	Vietnam
Uses	Unknown

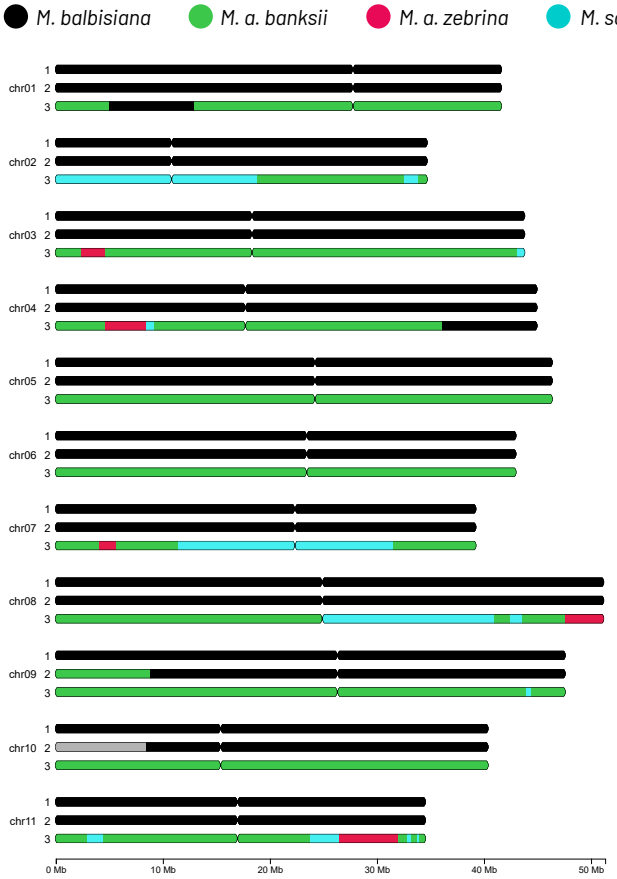
Notes

Genomic features

- A genome similar to the A genome found in the Bluggoe and Monthan patterns
- Small duplicated region in the centromeric zone of chr. 8 due to unbalanced crossing-over between *banksii* and *M. schizocarpa* (not shown)

Morphological Characterization Pictures

Molecular Characterization



ITC1682 Chuoi Mit

ABB genomic composition

Ya Ta Na Thin kha

Passport Data

Classification Ya Ta Na Thin kha (ABB)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area Myanmar

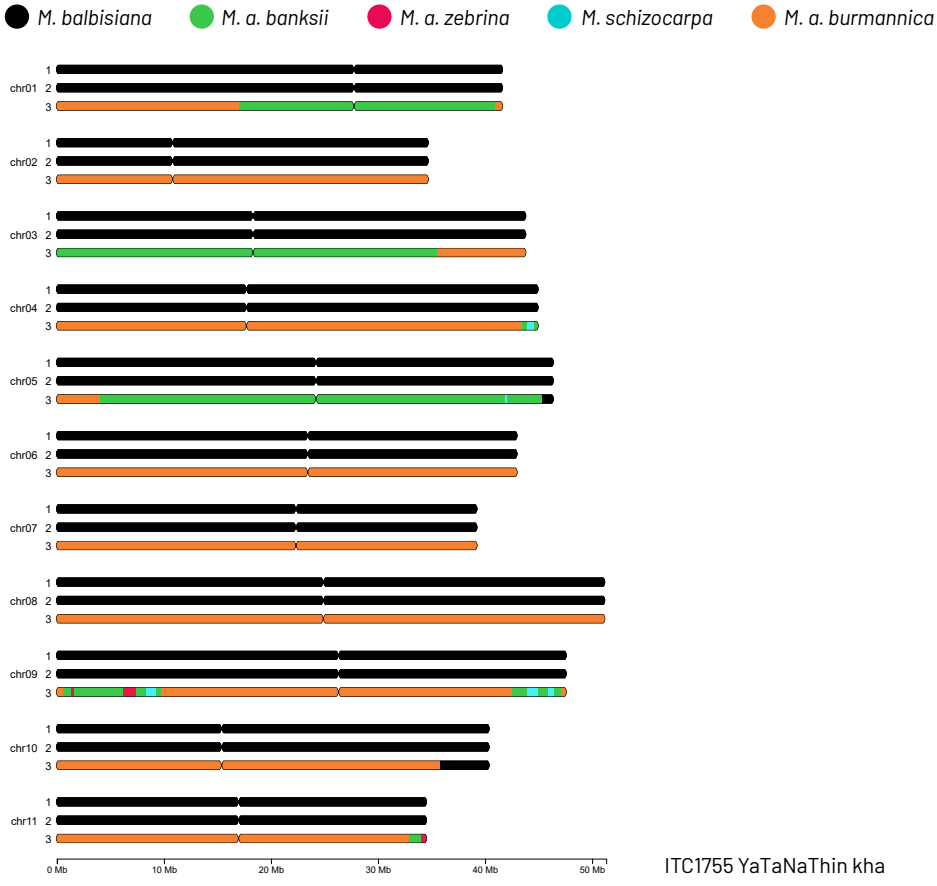
Uses Unknown

Notes
- Obtained from a collecting mission without related information

Genomic features
- High contribution from *M. a.* ssp. *burmanica/ siamea*
- A genome similar to Klue Tiparod A genome (possible pedigree relationship)

Morphological Characterization Pictures

Molecular Characterization



ITC1755 YaTaNaThin kha

ABX genomic composition

Chuoi Xi Mon

Passport Data

Classification Chuoi Xi Mon (ABX)

Biological status Cultivated

Ploidy Triploid (3x = 33)

Main distribution area Vietnam

Uses Unknown

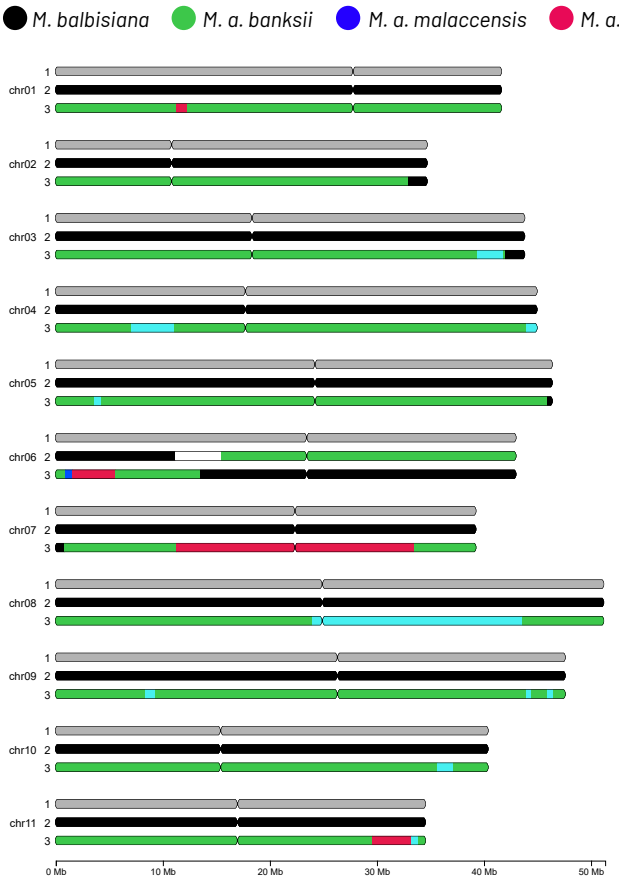
Notes

Genomic features

- Bears an unidentified genome
- Small duplicated region in the centromeric zone of chr. 8 due to unbalanced crossing-over between *banksii* and *M. schizocarpa* (not shown)

Morphological Characterization Pictures

Molecular Characterization



ITC1386 Chuoi Xi Mon

Kalmagol

Passport Data

Classification Kalmagol (AABT)

Biological status Cultivated

Ploidy Tetraploid (4x = 44)

Main distribution area Papua New Guinea (Bougainville Island)

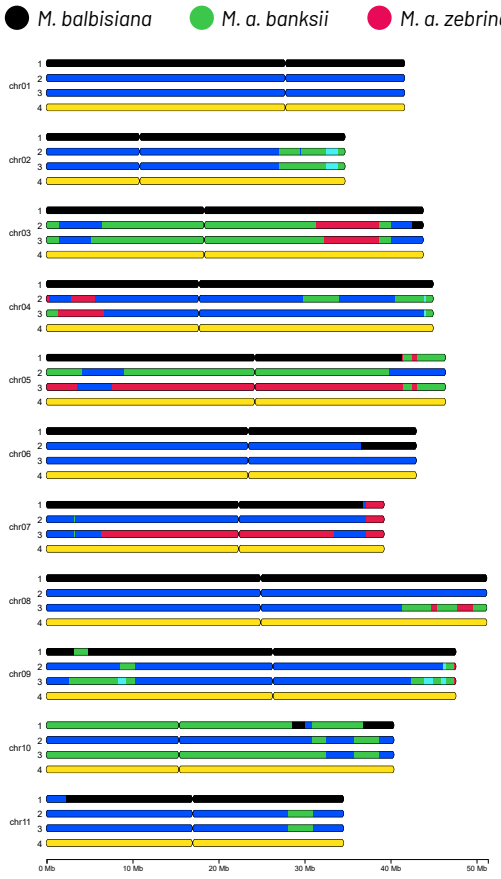
Uses Dessert

Notes
- Silk-like tetraploid hybrid
- First described by P. Allen in the 1960's (as Kalamagol) during his collecting trip to Bougainville island. It was originally classified as AABB.

Genomic features
- It is a progeny from Silk-2 or alternative (3x gamete) and a *Australimusa* (1x gamete)

Morphological Characterization Pictures

Molecular Characterization



ITC1920 Kalmagol

ABBT genomic composition

Bengani

Passport Data

Classification Bengani (ABBT)

Biological status Cultivated

Ploidy Tetraploid (4x = 44)

Main distribution area Papua New Guinea

Uses Cooking

Notes
- Common in Papua New Guinea
- Sold in markets of Port Moresby

Genomic features
- Progeny of Kalapua 2 (3n gamete) and a *Australimusa* (1n gamete)
- Small duplicated region in the centromeric zone of chr. 8 (not shown)

Morphological Characterization Pictures

Molecular Characterization

Bengani

ABBT genomic composition

Rekua

Passport Data

Classification Rekua (ABBT)

Biological status Cultivated

Ploidy Tetraploid (4x = 44)

Main distribution area Cook Islands

Uses Cooking

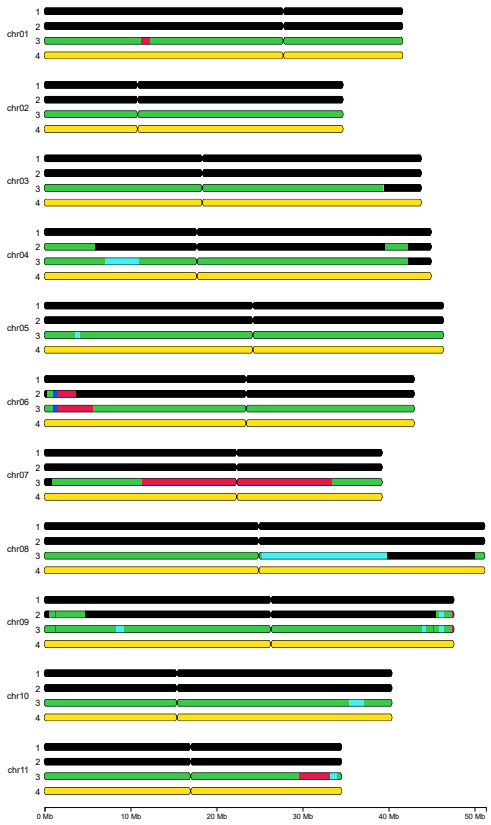
Notes
- Kalapua-derived tetraploid hybrid
- Rare cultivar, only a couple of plants left in Cook Islands
- Linked to a traditional chant about the warrior chief Purekua

Genomic features
- Progeny of Kalapua-1 (3x gamete) and *Australimusa* (1x gamete)
- Small duplicated region in the centromeric zone of chr. 8 (not shown)

Morphological Characterization Pictures

Molecular Characterization

M. balbisiana *M. a. banksii* *M. a. zebrina* *M. schizocarpa* *M. a. malaccensis* *Australimusa*



ITC2025 Rekua

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