Genetic and Epigenetic, diversity in African Plantains

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CIRAD
TAG MEETING 2006
**Messiatso**

Mutant de type French issu de Mbouroukou N°1

**Mbouroukou N°1**

Type Faux Corne

Fruits de couleur vert-jaune avant maturité
The plantain paradox

- African plantain have been classified into the same group but are very diverse for agronomical traits of interest.
- Are they genetically similar? or do they are issued from different origins?
The answers of molecular markers?

- Isozymes, RFLP, SSR and DArT
- DNA methylation studies through MSAP analysis
Isozymes and RFLPs

- No differences within plantain group with isozymes.
- No difference between 5 clones using RFLP with mitochondrial, chloroplastic or nuclear probes. (F. Carreel, PhD 1994)
- Suspect a same origin, but small samples do not allow to conclude
AFLP
- 0 polymorphism/260 markers/4 plantains (Ude et al., 2002)

- 78 polymorphic markers/15 primer pairs, 750? markers /25 plantains (Ude et al., 2003)

- 1 polymorphic marker /8 primer pairs 633 markers /30 plantains (Noyer et al., 2005)

- Needs for technical homogenization but the same genetic background is confirmed
373 DARt markers (PstI/TaqI) 187 banana genotypes.
• Partial view of Neighbor Joining tree based on Sokhal & Michener index calculated from the 373 best DARt markers
- DART markers confirm AFLP results

- African plantains have a very narrow genetic basis

- Fingerprint techniques cannot really distinguish efficiently amongst African plantain group.
SSRs
## Microsatellites Markers

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<th>Primer Name</th>
<th>Polymorphic</th>
<th>Number of alleles $^1$</th>
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<tr>
<td>101-102</td>
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</table>

- **27 plantains**
- **3 plantains**

Plantains are very heterozygous.

Plantains are issued from a single original cross.

Since original cross, no additional sexuality.
Another type of diversity exists: **epigenetic diversity**

This concerns some characters which are transmitted to sexual or vegetative offspring but not in a Mendelian manner.
Very less is known about epigenetic traits but DNA methylation is often tightly linked to epigenetic traits (even if it is not clear if methylation is a cause, a consequence or a « collateral damage »).

In banana, most of methylation pattern is transmitted through vegetative propagation (suckers) or micro propagation.

Do methylation polymorphism exists amongst plantain? Are methylation patterns transmitted in banana progenies?
MSAP

- « Methylation sensitive amplification polymorphism »
- Based on the same principle as AFLP
- Compare the profile obtained from the SAME sample treated with both isoschyzomers (HpaII/MspI)
- Provide information on the methylation status of the internal Cytosine of CCGG sites: $C^mCGG$ or $CGG$
30 plantains have been studied using 8 MSAP primer pairs representing 633 CCGG sites throughout the banana genome.

15 loci were found to be polymorphic
Genetic mapping of tetraploid x diploid banana using SSRs, AFLP and MSAP markers

- Despite technical problems due to ploidy of the cross and size of the population, methylation markers are transmitted through sexual cross in banana.
Conclusion and Prospects

- African plantain originate from an ancestral single cross involving heterozygous parents. No additional cross has been involved.
- Fingerprint techniques are not efficient to differentiate amongst plantains.
- SSR markers due to high mutation rate could help.
Analysis of DNA Methylation polymorphism is an helpful technique for diversity analysis in groups with very low genetic diversity.

Future work could include:
- Study of SSR polymorphism within plantain group.
- Study of the epigenetic diversity under selection pressure.
- Diversity analysis with gene targeted markers.
Acknowledgements

Darts: A.M. Risterrucci, J.-C. Glaszmann, A. Killian
SSRs: A. Bouet, J.L. Noyer
AFLPs and Methylation: S. Causse, J.L. Noyer, G. Noumbissie, D. Bienvenue, T. Palama

And special thanks to CARBAP and Kodjo TOMEKPE