

A cluster of whiteflies (Melanaphis sacchari) is shown on a green leaf. The whiteflies are small, pale insects with long antennae and legs. Some have dark spots on their bodies. They are clustered together, with some appearing to be feeding on the leaf. The background is a solid green color with a slight gradient.

Genetic diversity in *Melanaphis sacchari* and host-plant resistance in sugarcane

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Melanaphis sacchari (Zehnter)



pest of sorghum (feeding damages) and sugarcane (virus vection, ScYLV)

mostly anholocyclic, with known holocycle in Mexico (Peña-Martínez et al. 2016), India (David & Sandhu 1976), China (Zhang & Zhong 1983)



considered by Blackman & Eastop (1990) as a species complex =
M. sacchari (Zehnter)
and *M. sorghi* (Theobald)

Genetic diversity worldwide, 2002-2009

- 1333 specimens
- 57 samples, 42 localities, 15 countries
- two main host plants
- 10 SSR loci
- 658 bp sequence of the mitochondrial COI gene



S. bicolor



Saccharum sp.



S. bicolor subsp.
verticilliflorum



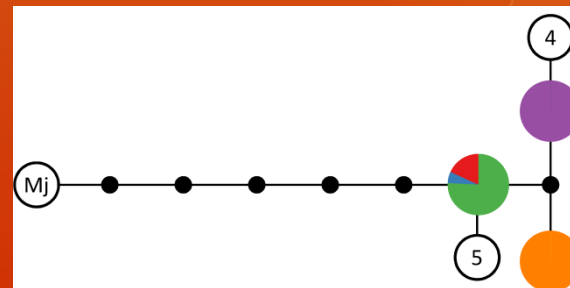
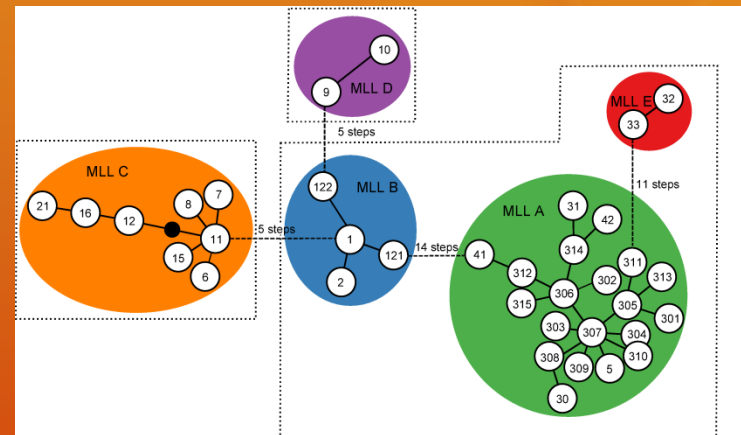
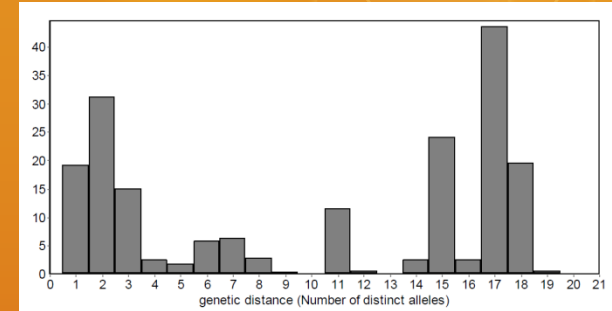
S. halepense



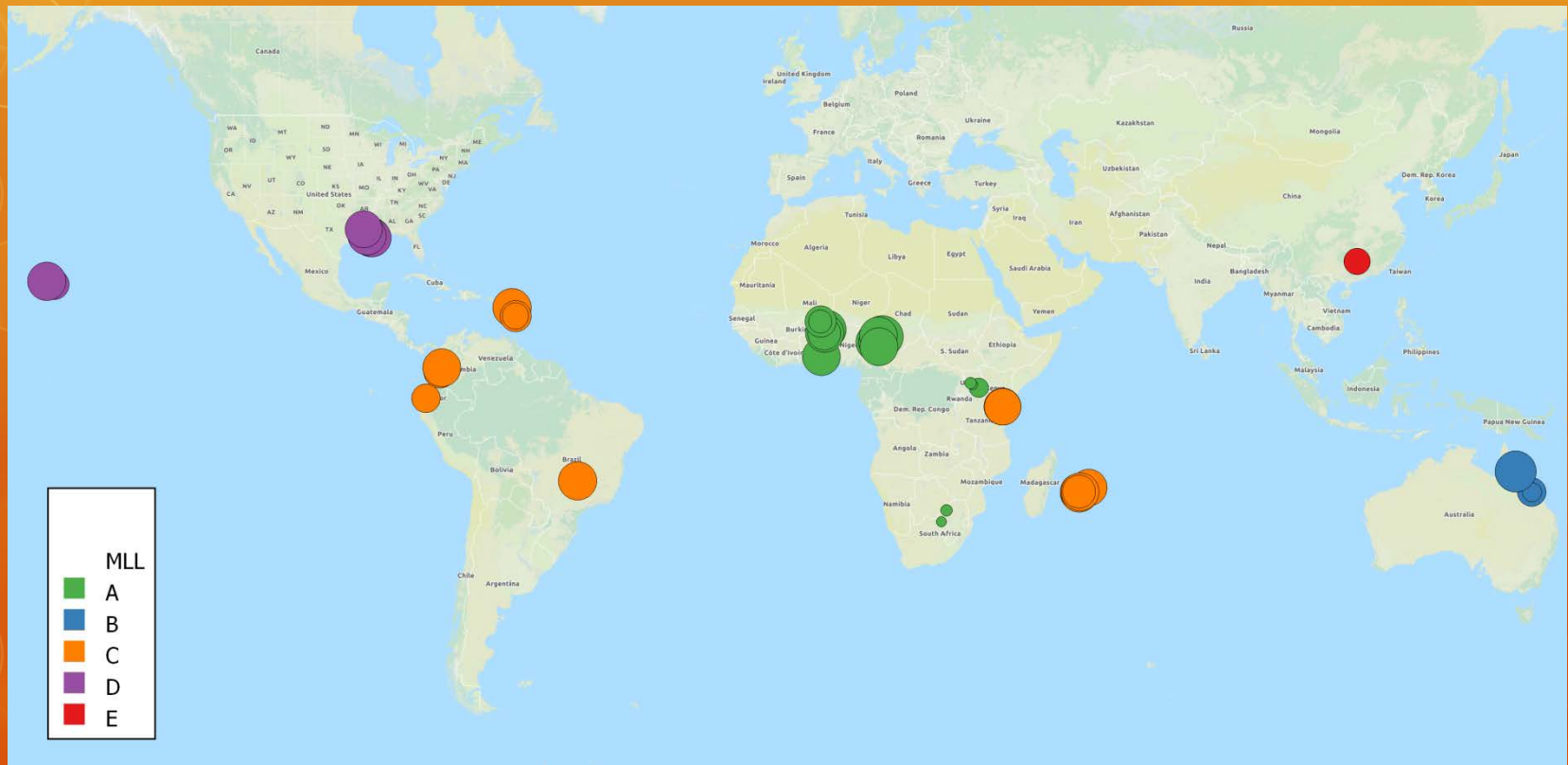
P. glaucum

Clonal diversity and COI sequence variation

- 36 Multi Locus Genotypes (MLG)
- Low clonal richness
 - $R_{MLG} = 0.36$
- No sexual reproduction
 - Genepop : $P_{sex} < 0.01$
- 5 Multilocus Lineages (MLL)
- very low COI variation



Geographic distribution of clonal lineages



Genetic diversity on Réunion, 2009-2010

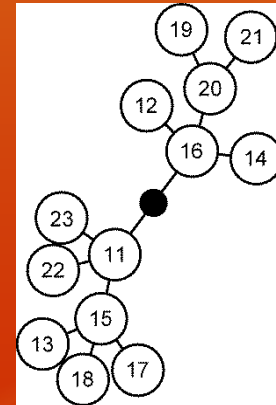
- 855 specimens
 - 31 samples
 - two host plants
 - 10 SSR loci
-
- 13 MLG, all belonging to MLL-C
 - 8 new ones
 - Low clonal richness
 - RMLG = 0.40
 - Identical to the worldwide value



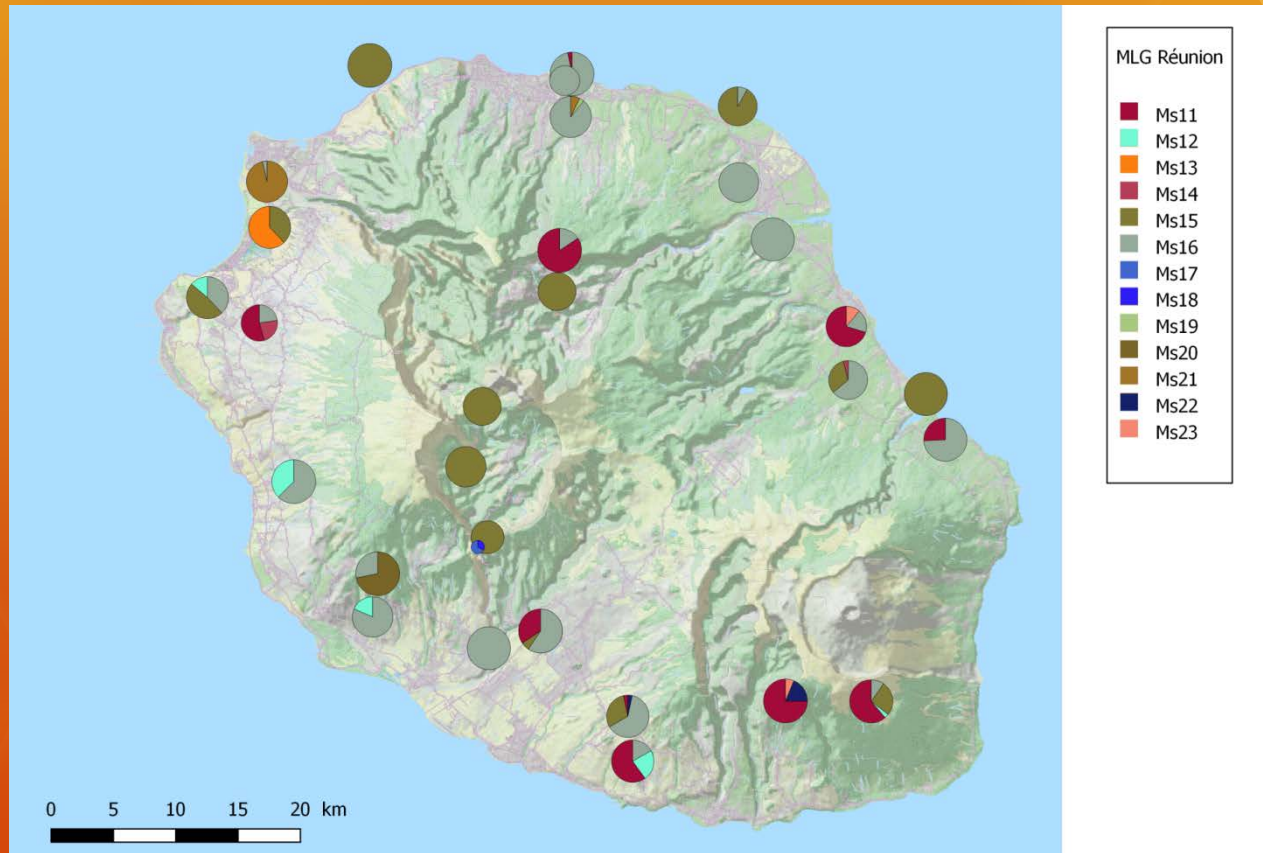
Saccharum
sp.



S. bicolor
subsp.
Verticilliflorum

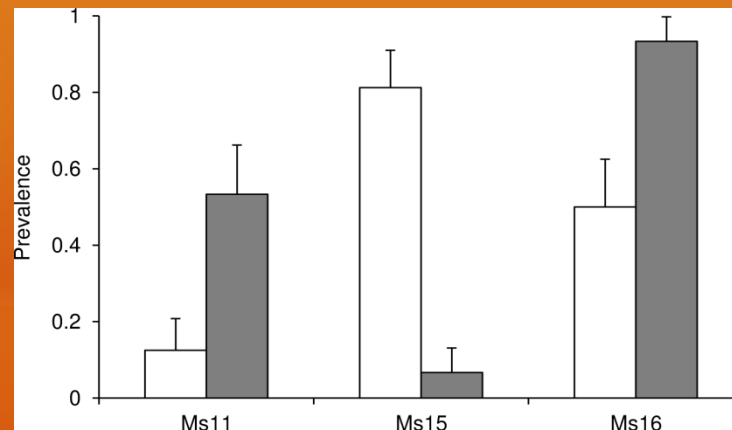


Distribution of MLGs on Réunion

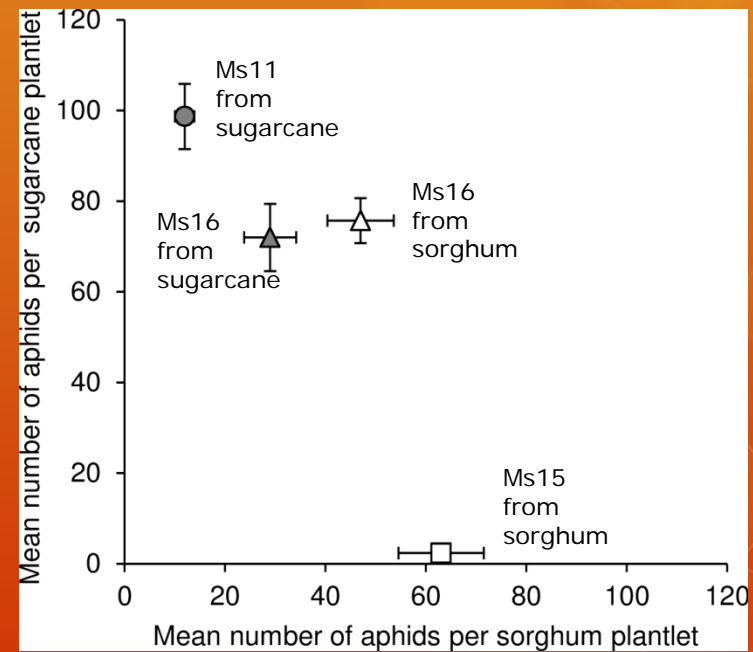


Host plant specialisation of the three most common MLGs

Field prevalence



Artificial transference experiments



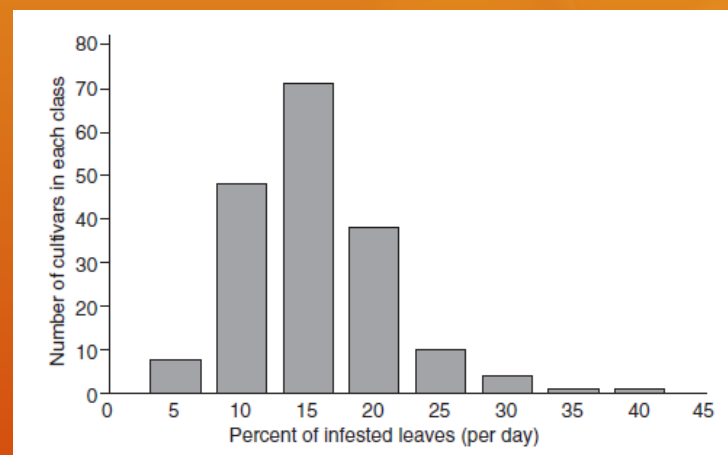
Exploration of the genotypic diversity of SCA resistance in sugarcane germplasm

- Field trial, 3 years
- 181 sugarcane cultivars
- Alpha-lattice design
- Between plots susceptible spreader cv.
- % infested leaves
 - 20 leaves / plot
 - Each 14 days (7 – 12 counts / year)



Exploration of the genotypic diversity of SCA resistance in sugarcane germplasm

- Significant genotypic diversity
 - 22 resistant cv.
 - 20 susceptible cv.
- Good fiability of the indexation method
 - $H^2 = 0.75$
- Spatial heterogeneity of infestations controlled by the alpha lattice
 - No spatial correlation of model residuals
- Resistance to SCA reduced ScYLV incidence
 - 51% vs. 98%

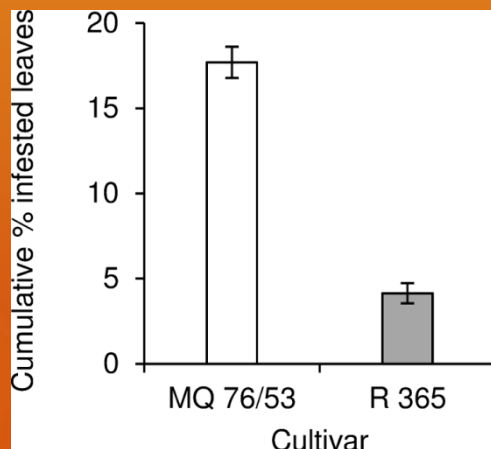


Genome wide association study

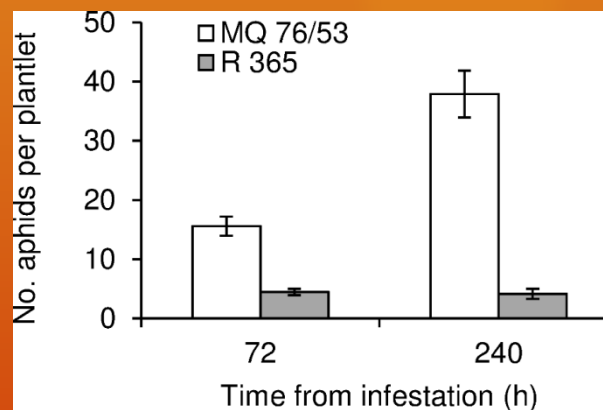
- Searching for QTL for aphid resistance
- Method
 - 181 cultivars / field phenotyping
 - 3.327 molecular markers (AFLP, DArT, SSR)
 - GLM and MLM controlling spurious effects of genetic structure or family relatedness among cultivars
- Result
 - Several QTLs detected for traits of interest (yield components, resistance to diseases)
 - But zero QTL identified for aphid resistance

Resistance to SCA in the sugarcane cv. R575

- R365 (resistant) vs. MQ76/53 (susceptible)

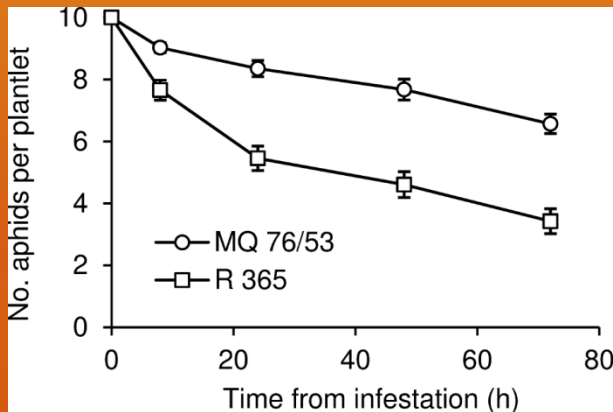


Field comparison



Potted plantlet infestation

antixenosis on potted plantlets



antibiosis on excised leaves

○ r_m on *M. sacchari*

○ R365 = 0.058

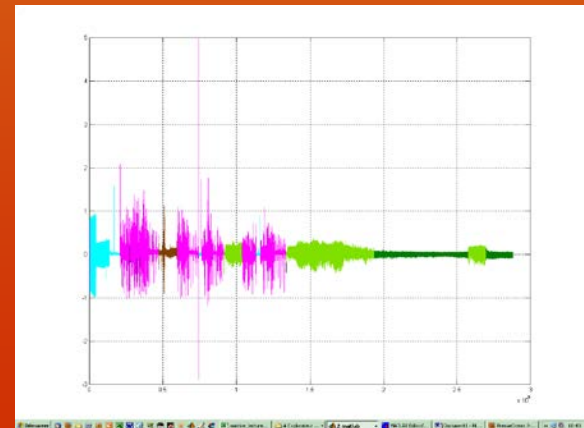
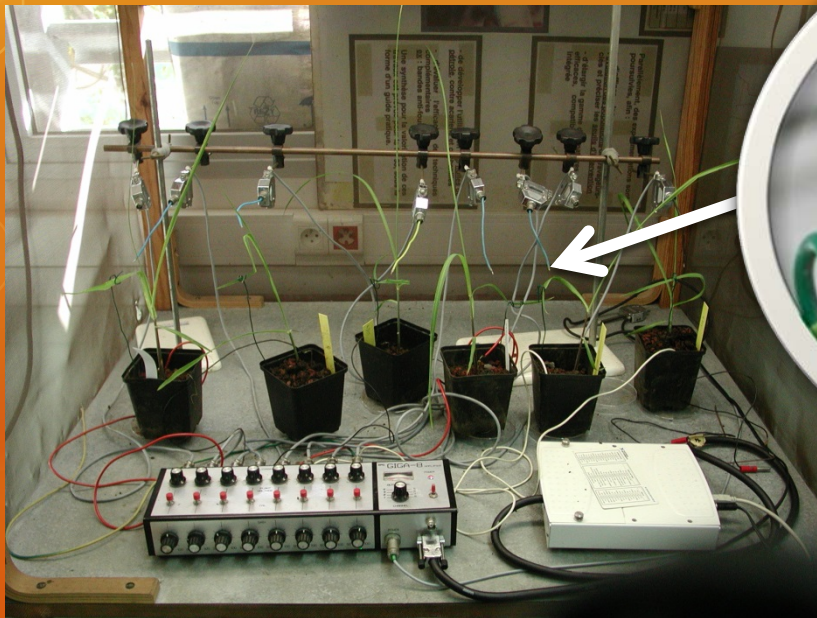
○ MQ76/53 = 0.206

○ r_m on *Rhopalosiphum maidis*

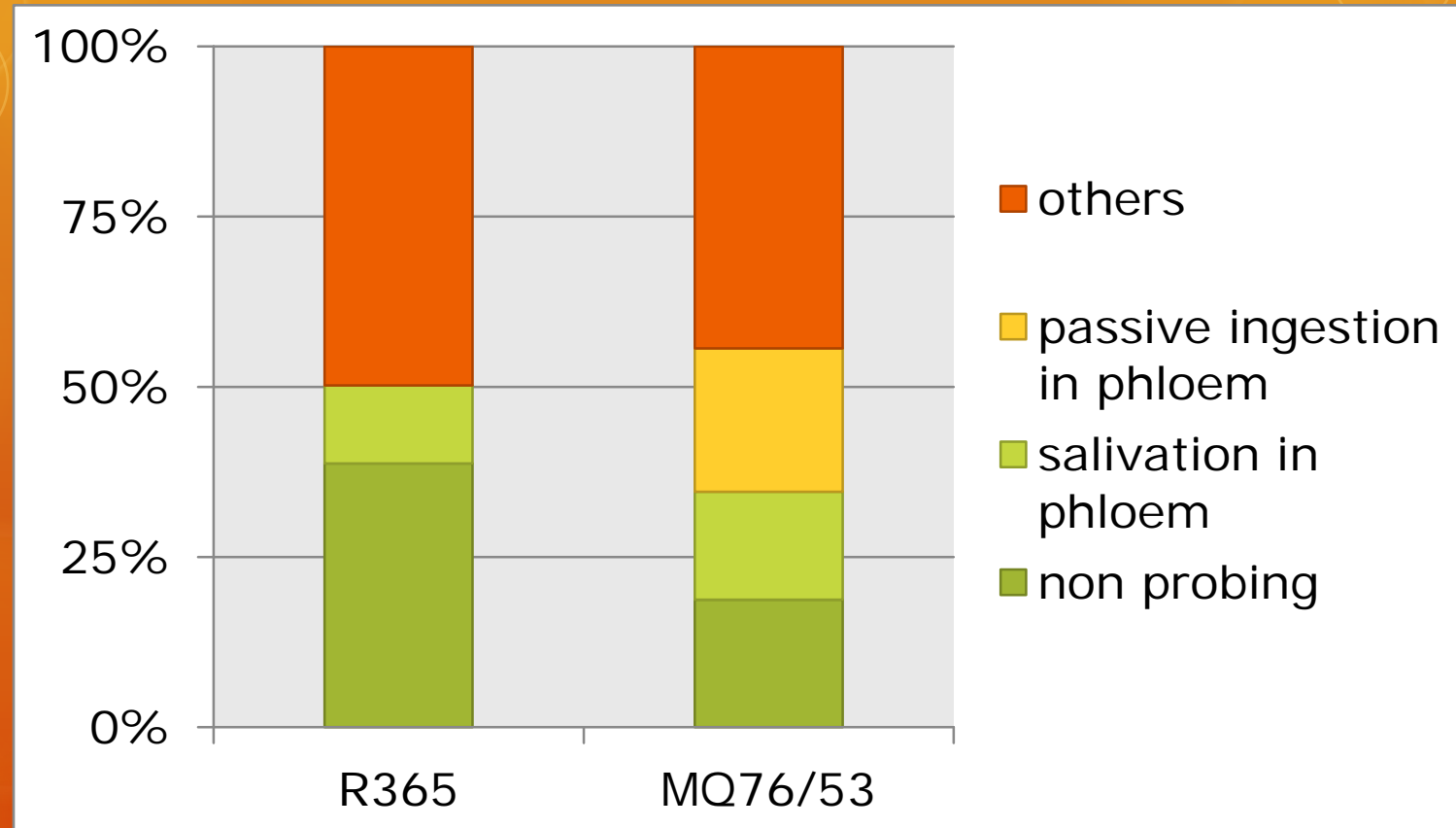
○ R365 = - 0.094

○ MQ76/53 = 0.140

Analysis of feeding behavior with Electrical penetration graph (EPG)



Comparison of feeding behavior



Perspectives

- To resolve the taxonomic ambiguity between *sacchari* and *sorghi*
 - morphometry
 - sequencing other genes (ITS, EF1-alpha, COII...)
- To analyse the evolution of the genetic diversity in the current outbreaks on sorghum in US, Central America and Caribbean
 - host shift or invasion ?

