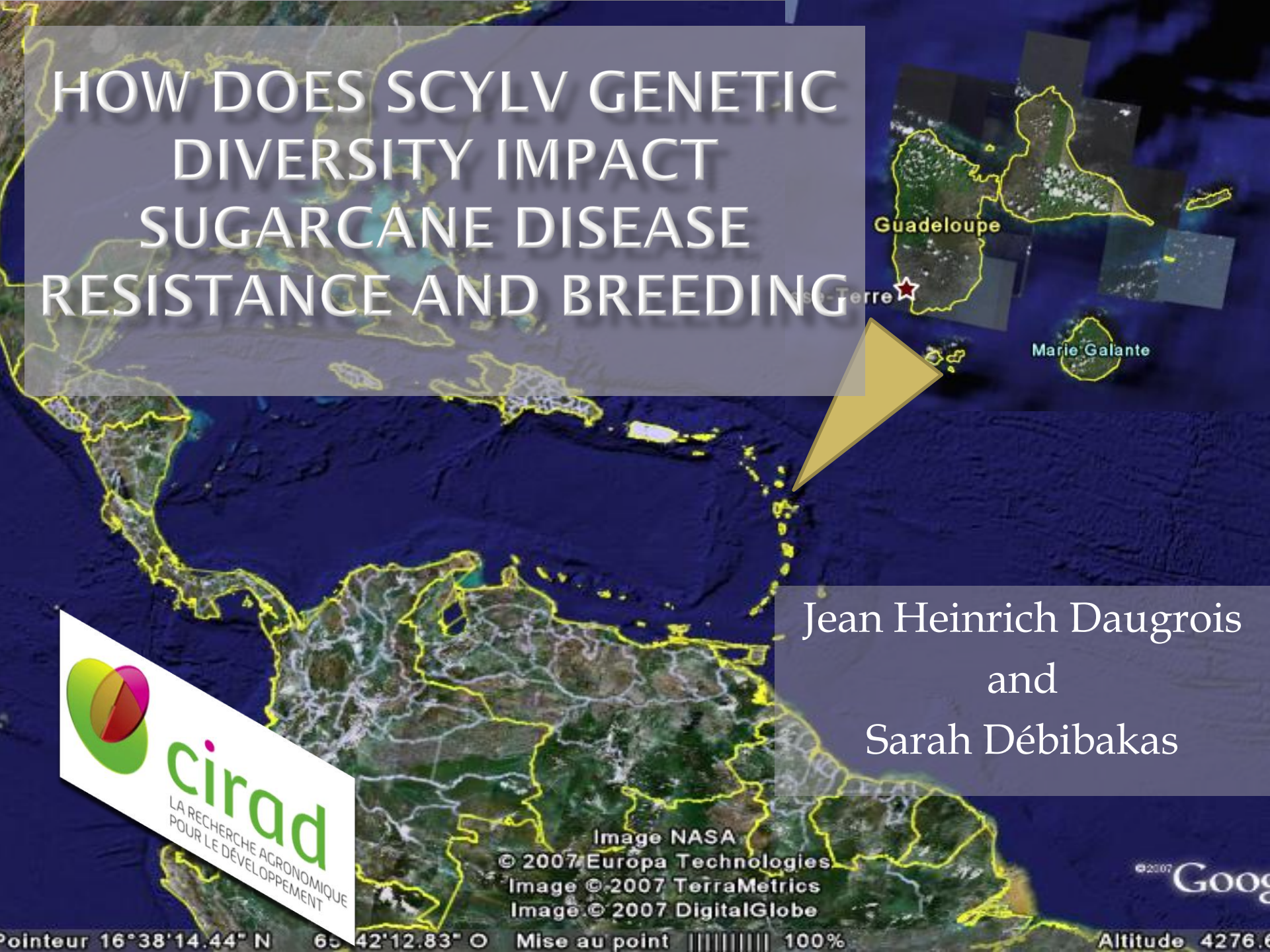
HOW DOES SCYLV GENETIC DIVERSITY IMPACT SUGARCANE DISEASE RESISTANCE AND BREEDING



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and
Sarah Débibakas

cirad
LA RECHERCHE AGRONOMIQUE POUR LE DÉVELOPPEMENT

Yellow leaf, an emerging sugarcane disease in Guadeloupe

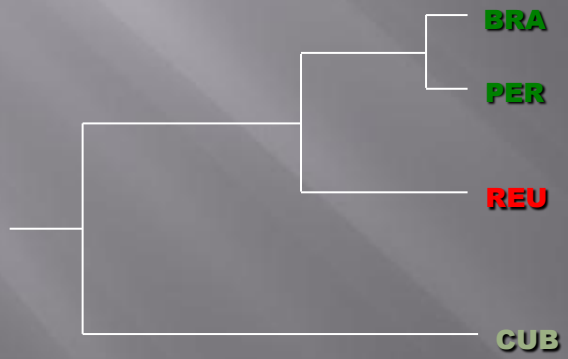
- ✓First identification in Guadeloupe (French Caribbean Islands) in 1996
- ✓Diseased plants show an early leaf yellowing beginning from the midrib of the youngest leaves
- ✓This disease is caused by the *Sugarcane yellow leaf virus* (SCYLV)
- ✓SCYLV was reported from a large number of sugarcane growing areas



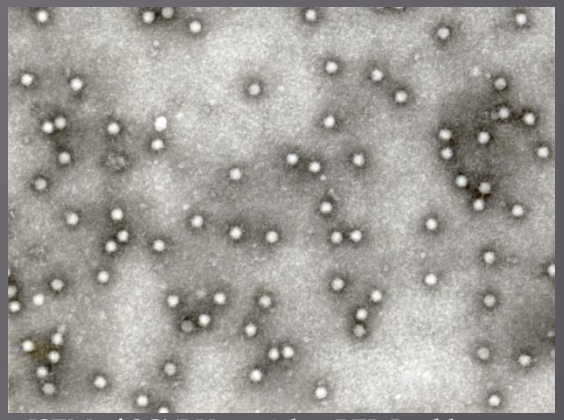


The virus: SCYLV

- Gender *Polerovirus,* family *Luteoviridae*
- Colonises phloem cells
- Vectored by an aphid: *Melanaphis sacchari*
- SCYLV genetic variability:
  - 6 genotypes : BRA, PER, REU, CUB, IND, CHN1
  - 3 groups identifiable by molecular diagnosis, are present in **Guadeloupe** :
    - BRA-PER , REU, CUB



Simplified phylogenetic tree of SCYLV genotypes (Abu Ahmad *et al.*, 2006)



ISEM of SCYLV particles. BEL Lockhart



Phloem cells infected by SCYLV. JH Daugrois



Aphid colony. JH Daugrois

Purpose of the study

- **To check if SCYLV genetic diversity impacts sugarcane disease resistance**



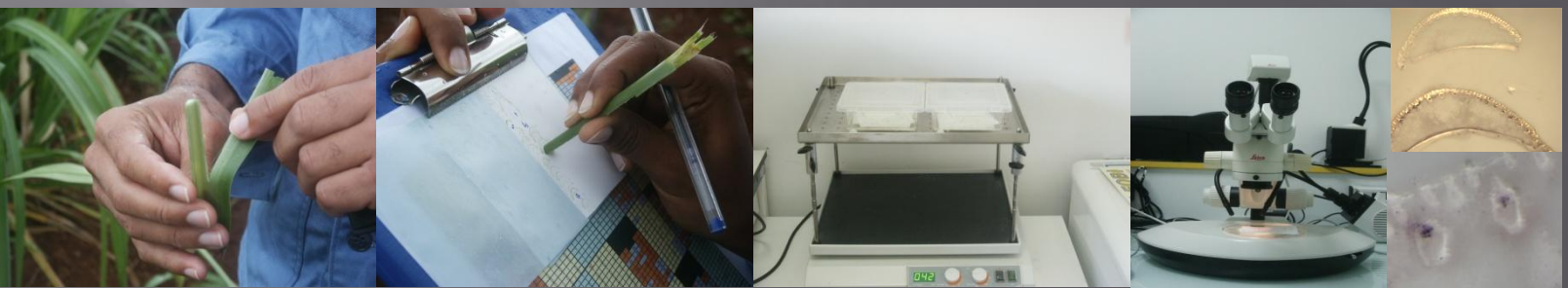
Inside the presentation

- Methods used
- SCYLV genotype incidence
  - Number of infected cultivars
  - Number of infected samples
- Genotype incidence estimations per cultivar
- Relationship between incidence of genotypes and incidence of SCYLV
- Variability in aggressiveness of SCYLV genotypes based on genotype incidence
- Outcome

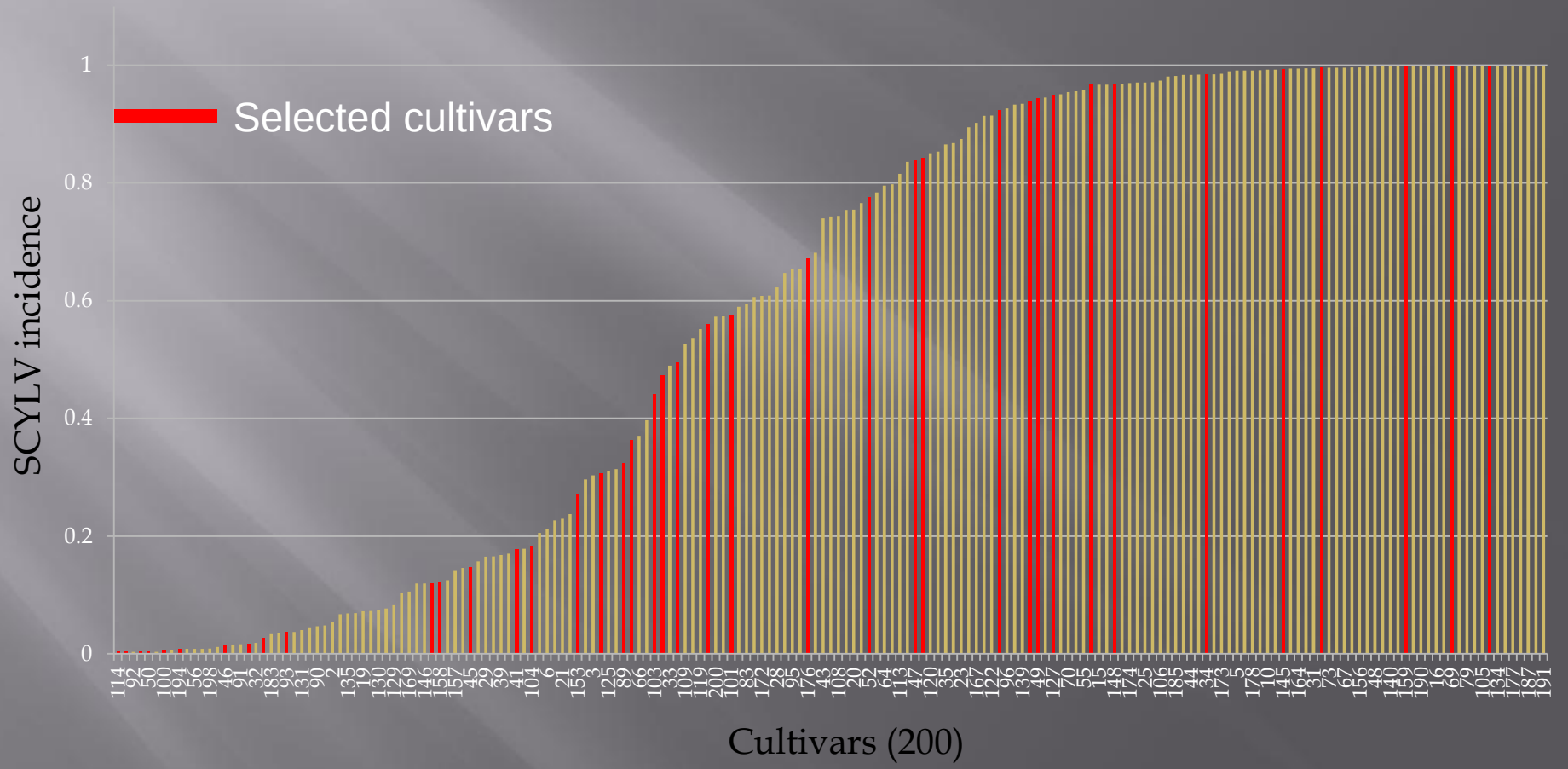
Plant material and methods used

- A 3 block design trial containing 200 cvs from which 40 cvs were selected.
- Cultivars followed during 2 crop cycles
- 10 leaves per plot per year tested for SCYLV by TBIA on First Visible Dewlap (FVD) leaf
- RT-PCR on positive leaves (one bulk per plot per year) with specific primers to identify SCYLV genotypes BRA-PER, CUB, REU.





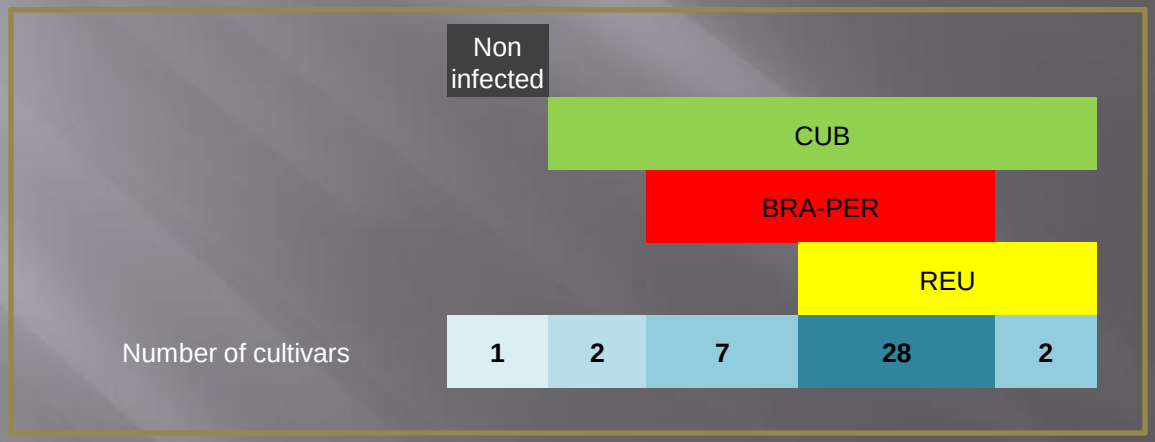
Representativity of selected plant material



SCYLV genotype incidence

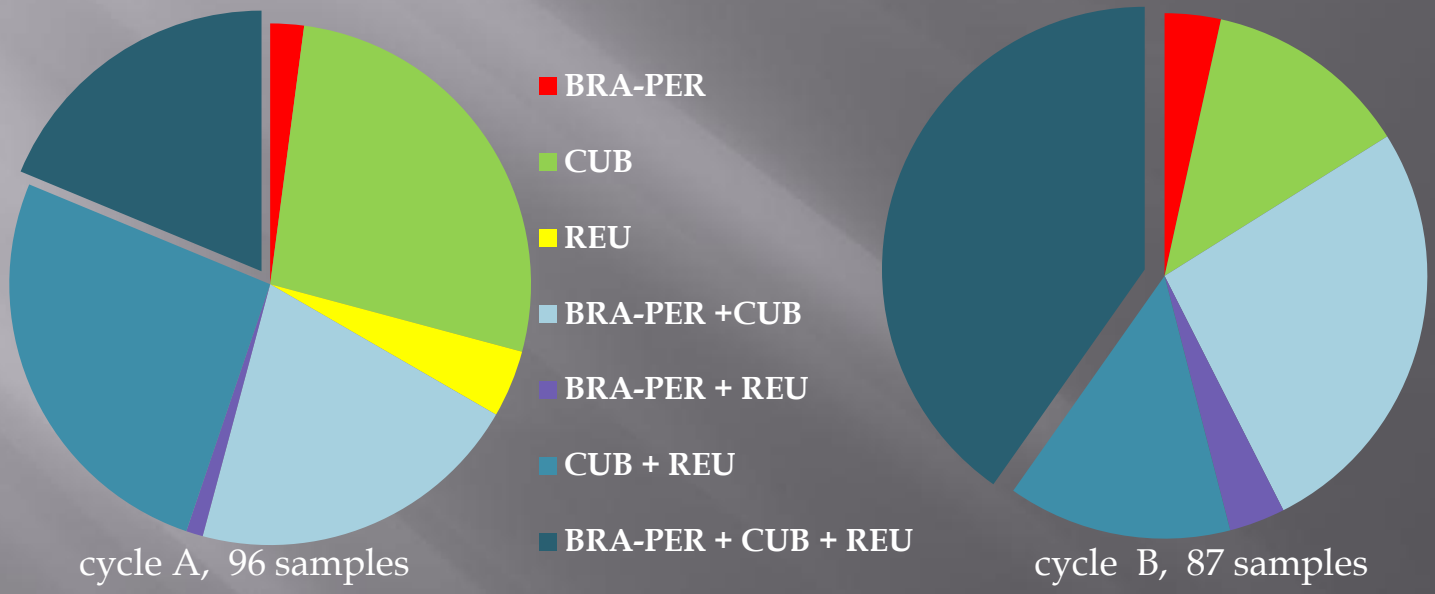
Potential host range of SCYLV genotypes BRA-PER, CUB and REU

Number of cultivars with SCYLV genotypes



SCYLV genotype incidence

SCYLV genotype identification in sampled plots during two crop cycles

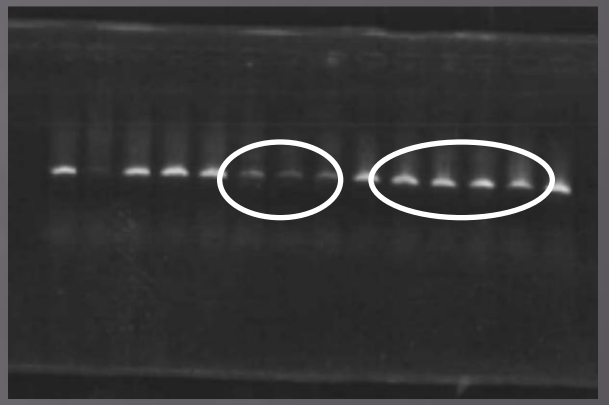


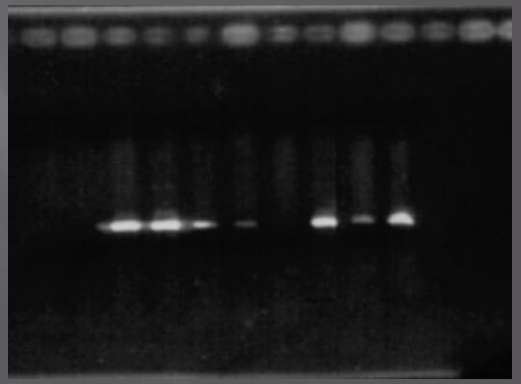
cycle A, 96 samples

cycle B, 87 samples

120 plots (3 plots per cultivar) tested in 2 crop cycles for the presence of the virus and the presence of different SCYLV genotypes in infected leaves. Only SCYLV positive plots are presented here

Estimation of genotype incidences in each plot of the 40 selected cultivars



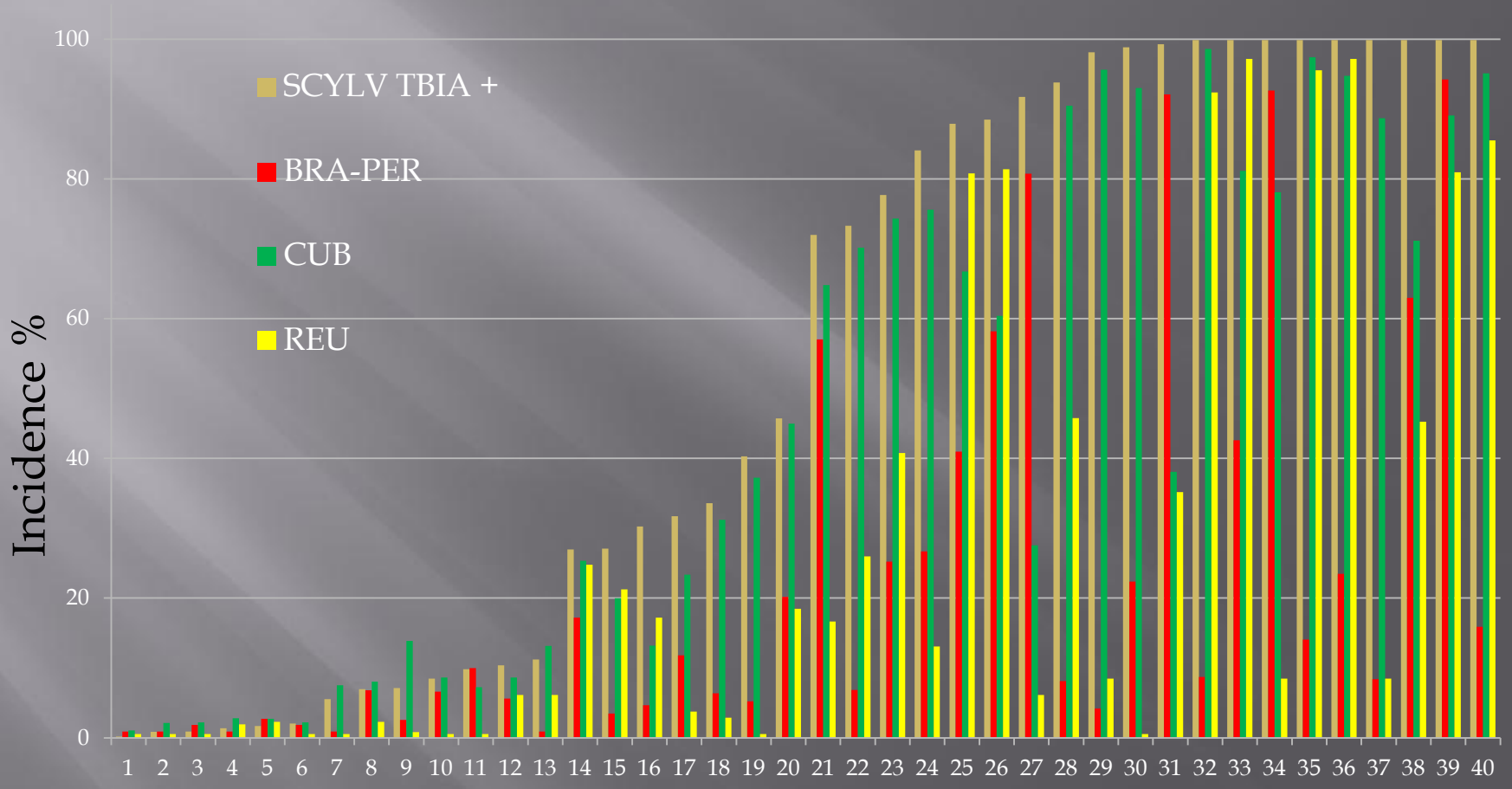


- ✓Diagnosis of SCYLV genotypes on bulked positive leaves of each plot
- ✓Genotype Incidence = SCYLV incidence x A

  A = 1 or 0.5 depending on PCR band density

  Calculated per plot for each genotype
- ✓ Means per cultivar were estimated under SAS mixed procedure with block and cycle as fixed effect, and cultivar as random effect

SCYLV and genotype incidences for the 40 selected cultivars



Impact of viral genotype on measured SCYLV incidence

Impact of viral genotype was analysed by modelling linear regression between incidence of SCYLV (I SCYLV) and virus genotype incidence:

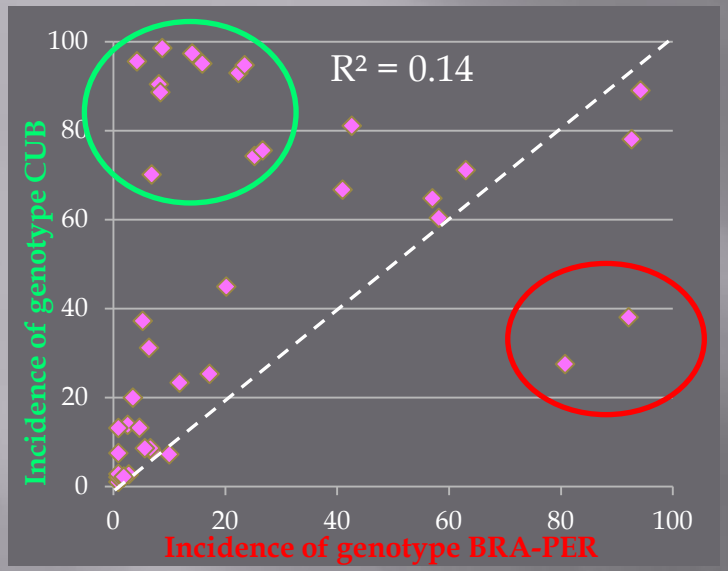
- **I SCYLV= CUB** **r^2= 0,87**
- **I SCYLV = REU** **r^2= 0,44**
- **I SCYLV = BRA-PER** **r^2 =0,38**

- **I SCYLV= CUB + BRA-PER + REU /stepwise keeps CUB +BRA-PER with r^2 =0,95**

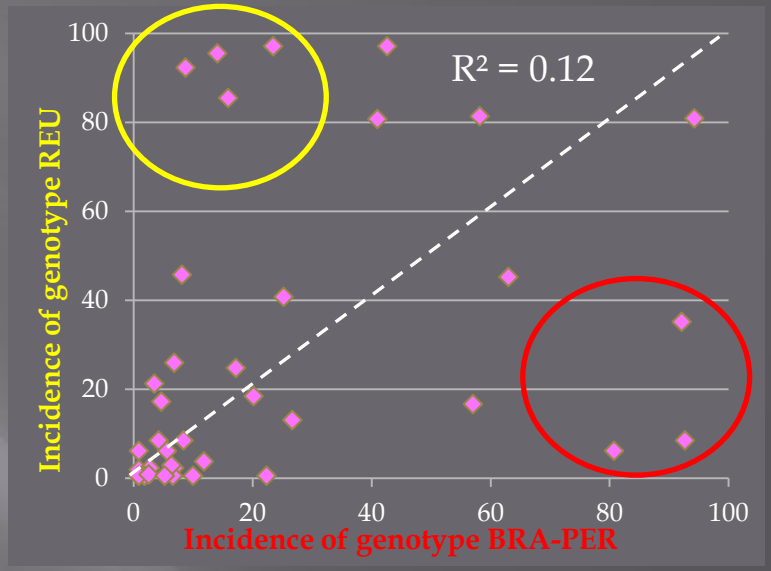
Genotype CUB incidence is the best correlated to SCYLV incidence

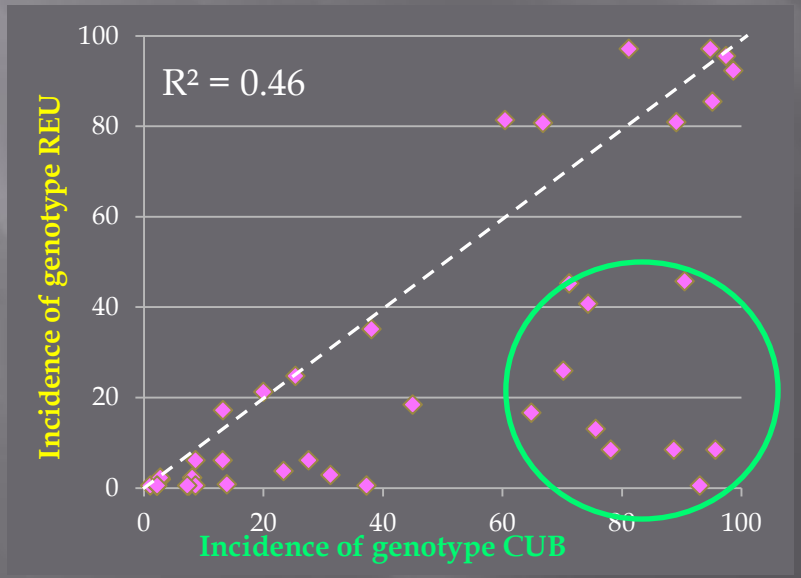
SCYLV genotypes CUB and BRA-PER explain together 95% of the SCYLV incidence variation observed between cultivars

Differences in cultivar response regarding SCYLV genotype incidences



Each pink point represent one cultivar





Outcome

Different aggressiveness traits

Different resistance traits ?

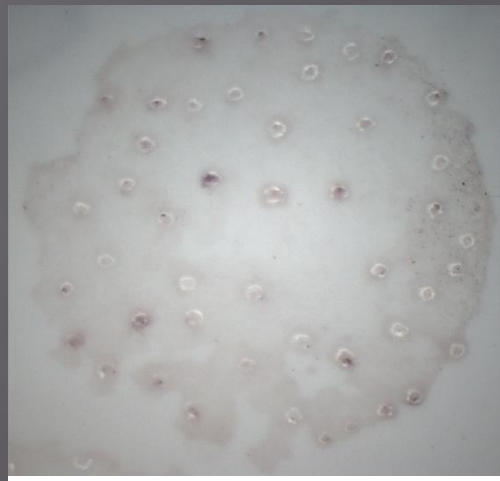
When testing for resistance to SCYLV in one environment, results can not be applied to an other environment if mapping of virus genotypes is not achieved

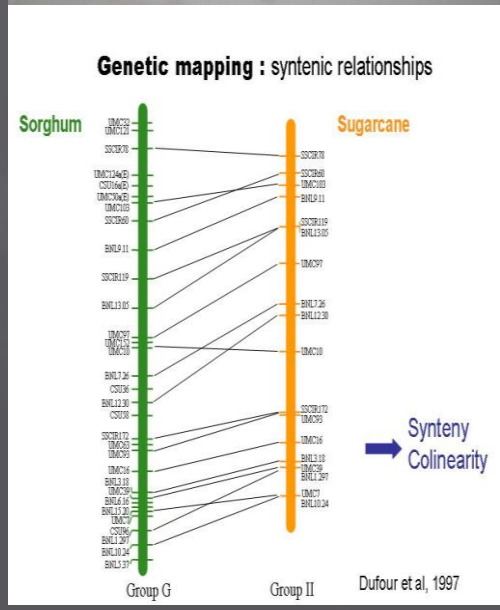
When a cultivar is resistant (low incidence) to SCYLV genotype CUB, it is also resistant to the other genotypes, but the reverse is not true.

Perspectives

- Genetic markers for
  - Resistance to SCYLV infection

- Possibility to target genes by
  - Comparative genomic between sugarcane and related grasses
  - Search for candidate genes





Thanks for listening



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