

# Effect of host plant species and insecticides on the evolution of genetic diversity of a crop pest

Benoit BARRÈS<sup>1</sup>, Lise ROY<sup>1,2</sup>, Cécile CAPDERREY<sup>1</sup>, Frédérique MAHÉO<sup>3</sup>, Jean-Christophe SIMON<sup>3</sup>

<sup>1</sup>Université de Lyon, Anses, INRAE, USC CASPER, Lyon France

<sup>2</sup>CEFE, University of Montpellier, CNRS, EPHE, IRD, Univ Paul Valéry Montpellier 3, Montpellier, France

<sup>3</sup>INRAE, UMR IGEPP, Rennes, France

## CONTEXT

Pesticides applications can be a strong driver of the evolution and genetic differentiation of pest populations. Pesticides use varies between crops and over time according to marketing authorization. A better understanding of the evolution and spread of pesticide resistance alleles in populations is a major challenge for pest management.

## BIOLOGICAL MODEL

- *Myzus persicae* (Sulzer 1776)
- Generalist (>50 crop species)
- Multi-resistant to most insecticides
- Holocyclic and anholocyclic populations
- Sexual phase on peach trees (primary host) and asexual phase on many plants (secondary hosts)



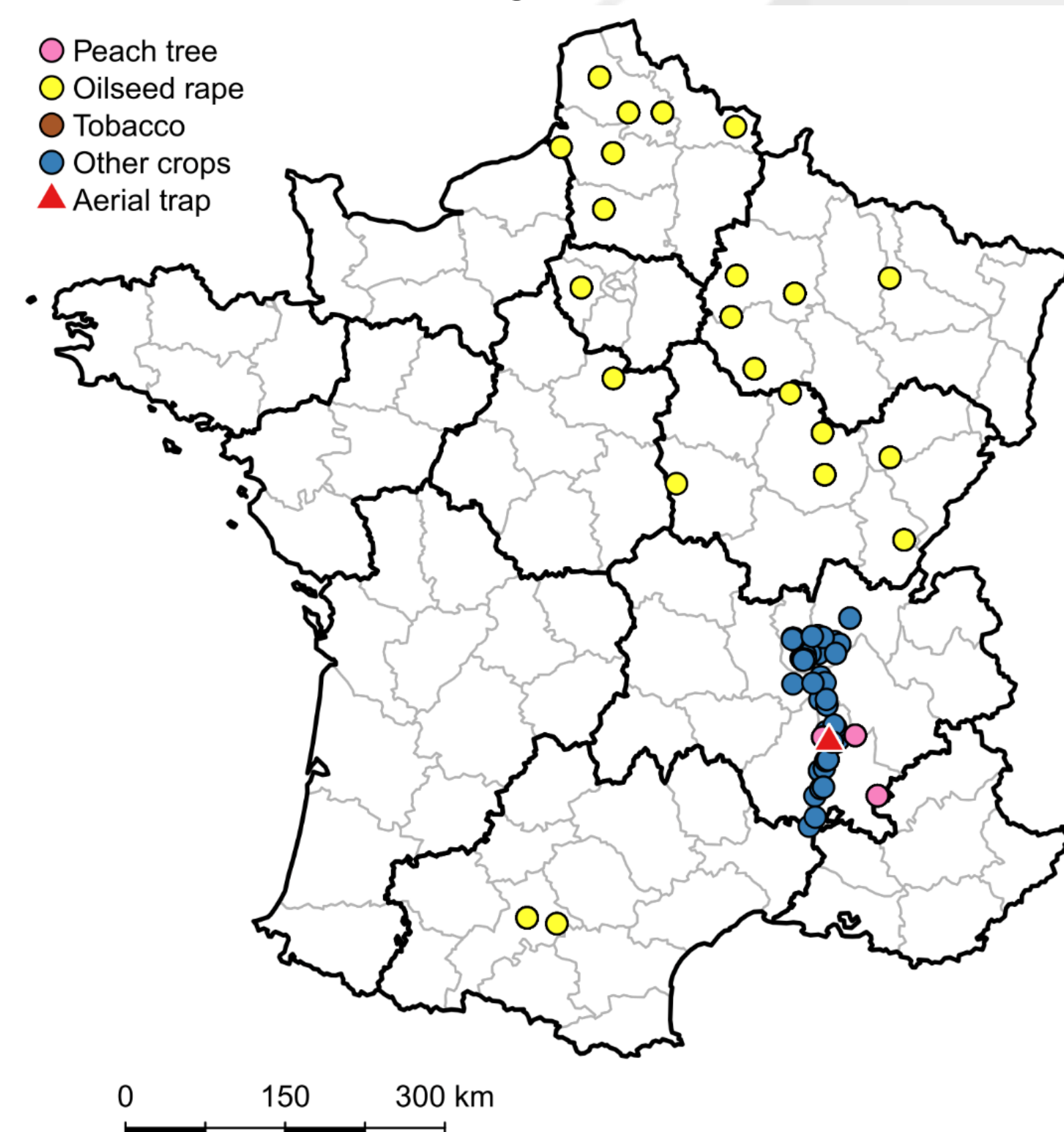
## MATERIAL AND METHODS

- Two sets of samples :
  - From various host plants → identified crop species **peach / oilseed rape / tobacco** (+14 other)
  - From aerial trap → temporal sampling 2001-2007
- 14 microsatellite markers
- 4 target site resistance loci
- 1299 successfully genotyped individuals

## RESULTS

### Individual based genetic analyses

#### Map of the sampling sites

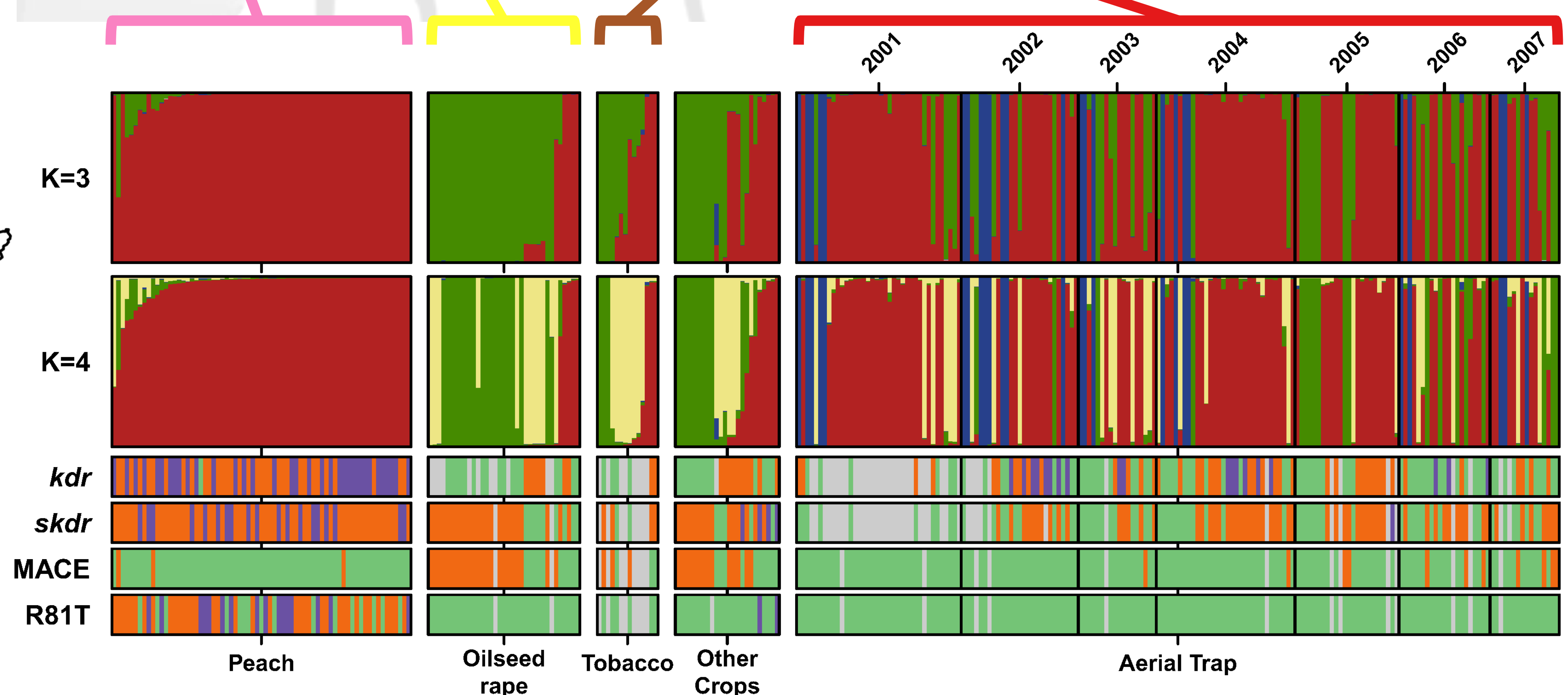


- four well defined neutral genetic clusters
- 1 cluster associated with the primary host
- 2 clusters associated with secondary hosts
- 1 highly divergent cluster (likely *Myzus certus*, a closely related species)
- strong association between resistance genotype and genetic cluster

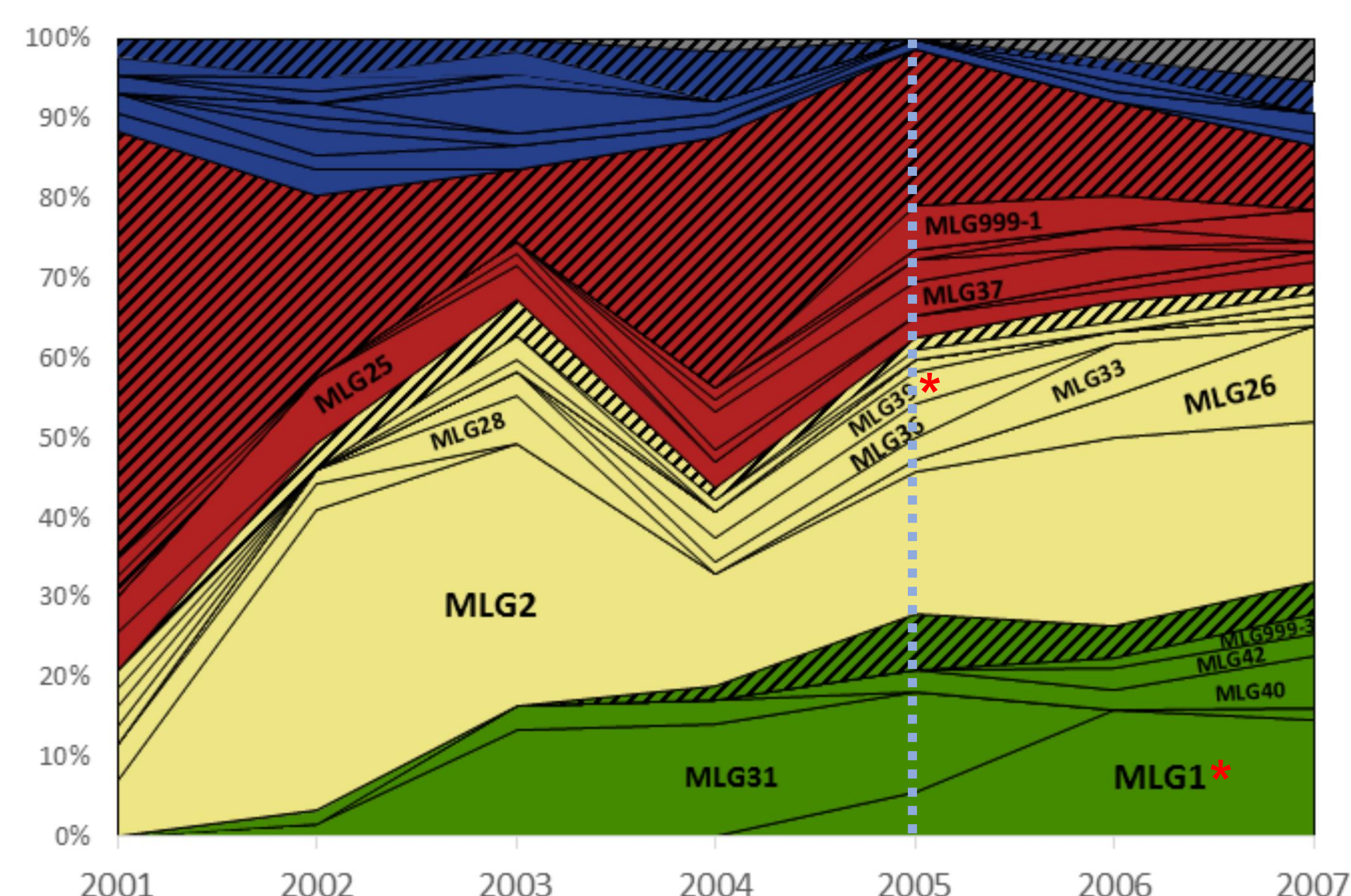


#### Individual genetic structure

The top two lines represent the Q-plot from STRUCTURE analyses for K=3 and 4, respectively. Each colors represent the proportion of the assignment to each cluster for each individuals. The 4 last lines depict the genotypes for the 4 target site resistance (TSR) loci: *kdr* and *skdr* loci are linked to pyrethroids TSR, *MACE* to pirimicarb TSR and *R81T* to neonicotinoids TSR: susceptible homozygote (light green), heterozygote (orange) and resistant homozygote (purple).



### Temporal clonal dynamics



#### Temporal variation of multilocus genotypes (MLG) in the aerial trap

Genetic cluster membership of MLG is indicated by the same colors as in the 4-K STRUCTURE analysis. Solid colors: repeated MLG. Shaded colors: unique MLG. MLG belonging to the resistotype RG2 (carrying both a pyrethroid and pirimicarb resistance alleles) are indicated by a red star. Vertical dashed light blue line: first record of recurrent control failures with carbamate in oilseed rape in France

- some persistent MLG
- rapid turn-over of MLG
- higher genotypic and genic diversity in the red and blue clusters
- emergence of a multi-resistant clone linked to control failure

## CONCLUSIONS

- genetic differentiation strongly associated with host plant/reproductive mode and resistotypes
- a small number of generalist clones carrying resistance alleles and persisting over time
- an evolutionary dynamic driven both by biological capacities and human activities
- better understanding of the evolution of pesticide resistance in agricultural landscape necessary for a better control of pests

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