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

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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

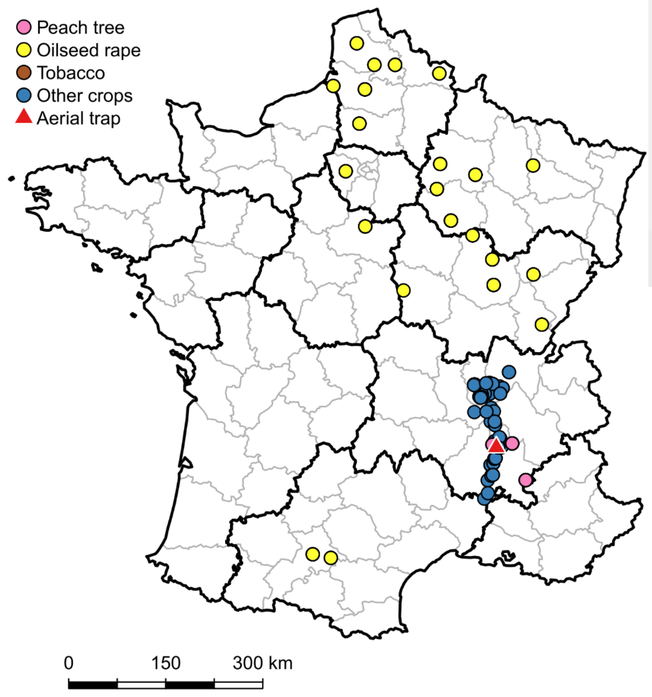
-Two sets of samples :
- From various host plants → identified crop species **peach / oilseed rape / tobacco** (+14 other)
- From aerial trap → temporal sampling 2001-2007

- 14 microsatellite markers
- 4 target site resistance loci
- 1299 successfully genotyped individuals

RESULTS

Individual based genetic analyses

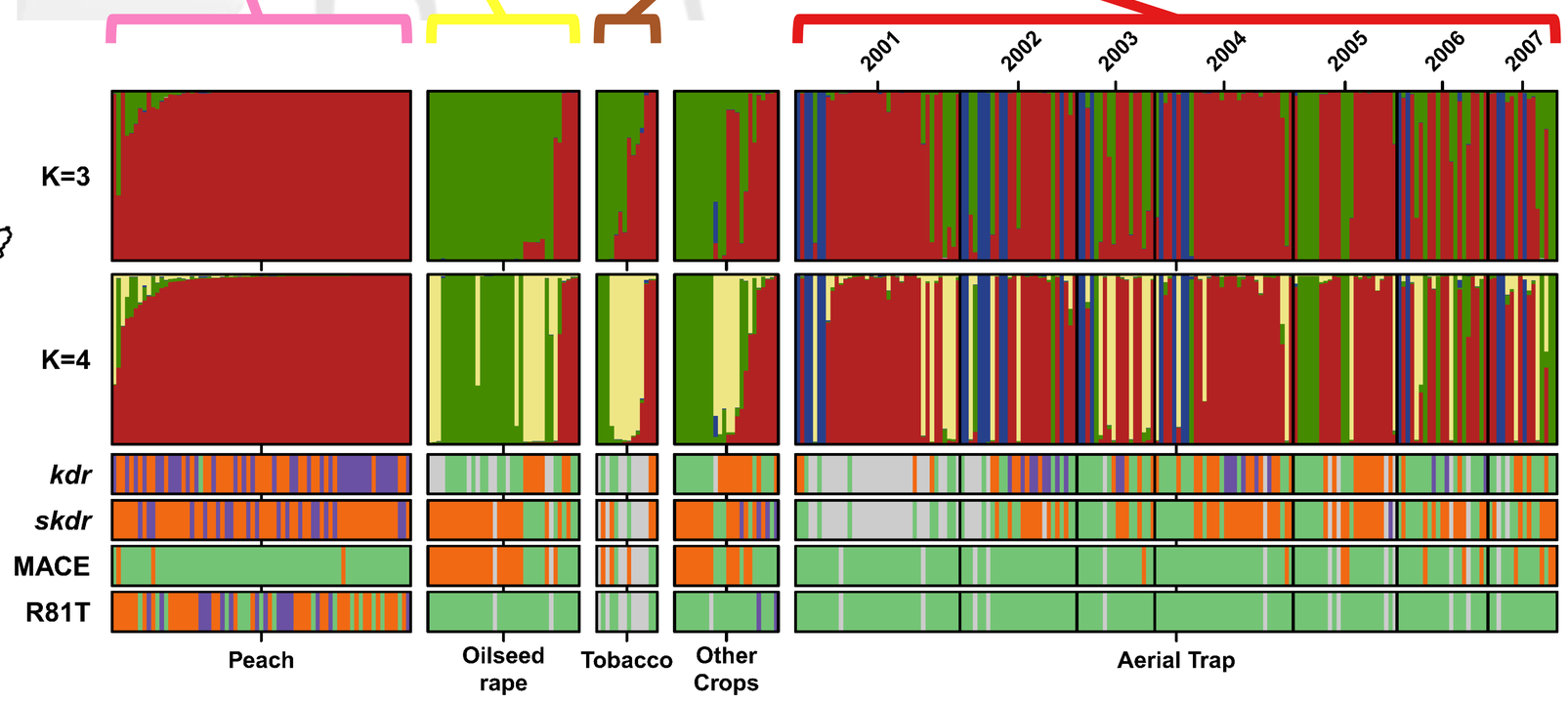
Map of the sampling sites



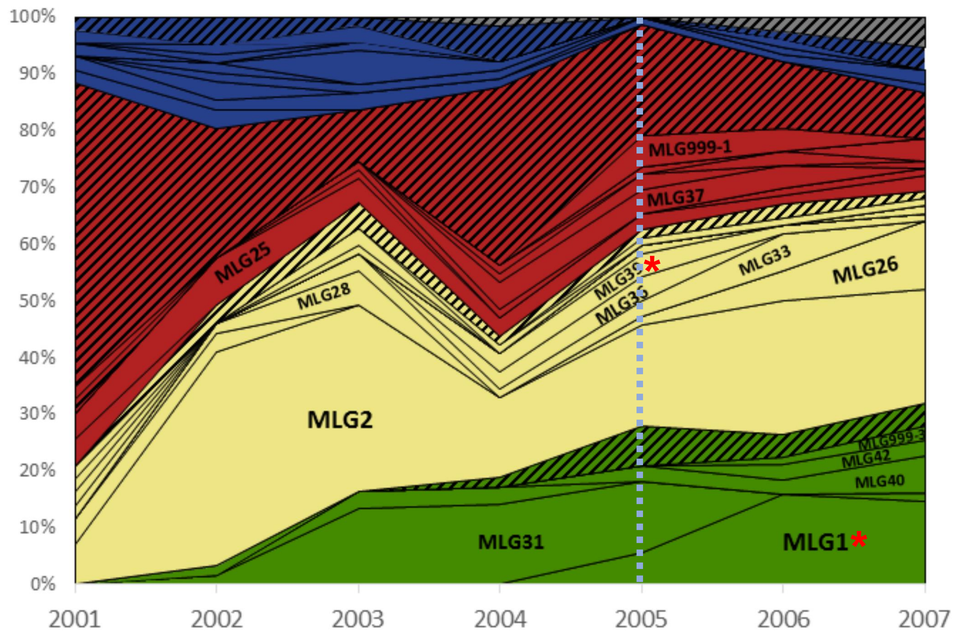
-four well defined neutral genetic clusters
-1 cluster associated with the primary host
-2 clusters associated with secondary hosts
-1 highly divergent cluster (likely *Myzus certus*, a closely related species)
-strong association between resistance genotype and genetic cluster

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



-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

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

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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