COEVOL MULTI-SCALE COEVOLUTION

EVOLUTIONARY GENETICS OF INTERACTIONS GROUP

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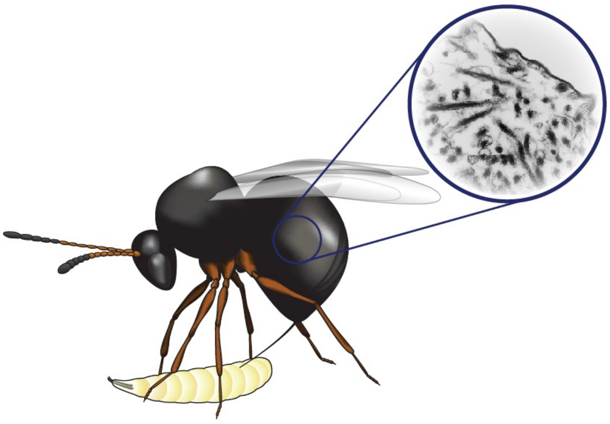
My work focuses on the **evolutionary genetics of insects**. I am currently developing four main themes:

1. Organisms are confronted with numerous viral infections during their lifetime. Although viruses are known for their pathogenic effects, a number of them, under-studied, reveal more subtle effects, and are potentially heritable. We discovered such a virus in a parasitoid wasp, whose main effect is to manipulate the wasp's egg-laying behavior, thereby promoting horizontal transmission. This virus turned out to be the first member of a new family of viruses, the Filamentoviridae, which actually infect many parasitoid insects (Guinet et al. 2024). We are studying the **distribution, diversity and phenotypic** impacts of these viruses.

2. In the course of evolution, sequences of these viruses have been able to integrate into the chromosomes of their hosts (whether or not integration is part of their natural cycle). Some of these insertions have led to major genetic innovations, as illustrated by the "invention" of the placenta in mammals. In hymenopteran parasitoids, which live as parasites on other insects, several clades have "domesticated" viruses, enabling them to address virulence factors to their hosts. These endogenized viruses are now necessary for the parasitoids' development. The first cases documented so far concerned the Ichneumonoidea superfamily. Our recent work has revealed similar, albeit completely independent, phenomena in other superfamilies, notably involving the Filamentoviridae (Di Giovanni et al. 2020, Guinet et al. 2023, 2025). One of the challenges is to define the extent and **evolutionary impact of these domestications** in insects.

3. Although most genetic information is transmitted from parent to offspring, through reproduction, certain regions of the genome have probably been acquired through horizontal transfer. These phenomena are well known in bacteria, but we now know that eukaryotes can also be involved. In this context, we are testing the impact of ecological connections on these transfers in closely interacting insect communities (host-parasitoids). We are also measuring the contribution of viruses domesticated by parasitoid wasps to these transfers.

4. **Bedbugs**, *Cimex lectularius*, represent a plague that is re-emerging. These hematophagous insects have experienced an extremely significant demographic boom in recent years, probably linked to the evolution of **insecticide resistance**. We are currently investigating the genetic determinants underlying the resistance phenotype (Haberkorn et al. 2023, 2024). In addition, this model is being studied in the context of **speciation**. Indeed, these bugs derive from populations that feed on bat blood, of which there are contemporary representatives. We are trying to understand the demographic history of these populations and the mechanisms that enabled the ancestral population(s) adapt to this new human host.



Parasitoid depositing an egg (and its virus) in a *Drosophila* larva. (drawing credit : J. Martinez)

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