

Management of aphids in understanding the ecology to enhance the biological control of parasitoids' efficiency



...te pests that often require several insecticide applications per season. ...s are eager to use **inundative biological control** strategies. These strategies consist in releasing mass-produced natural enemies of a pest in order to achieve a reduction of the pest population. However, for some pests of strawberry crops, like **aphids**, biological control is often inefficient and the use of a chemical control is needed.

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Keywords

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Scientific context

Parasitoids are major natural enemies of aphids, they have very close relationships with their host and their efficiency depends on the compatibility between the parasitoid individual and the aphid host. Some parasitoid species are **generalist**, but inside these species, populations can have a **preference** for some aphid species¹. **Genetic differentiation** may thus arise from the use of different hosts². The existence of such differentiation in a parasitoid species may compromise the effectiveness of biological control³.

Aphid immunity is often related to the **symbiosis** with **protective bacteria**. For several aphid species, these heritable bacterial endosymbionts can strongly increase the **resistance to parasitoid wasps**⁴. The protective role of bacterial symbionts has been largely studied in the pea aphid *Acyrtosiphon pisum*. This symbiont is widely distributed among aphid species but its role in aphids infesting strawberry crops remains unknown. The presence of protective endosymbionts in aphids in strawberry crops could prejudice the ability of released parasitoids to control the pest populations⁵.

Objectives

We will study ecological and evolutionary factors that could disrupt biological control of aphids in strawberry crops.

- Is there a **host specialization** in parasitoids attacking aphids in strawberry crops?

By genetic analyses of field-collected parasitoids, we will determine if there is a genetic substructure related to the aphid host in parasitoid populations. By parasitism assays, we will identify if this substructure is connected with a specialization on an aphid host.

- Are aphids protected against parasitoids by **bacterial endosymbionts**?

A sampling of aphids in strawberry greenhouses followed by PCR detection will permit to determine the prevalence of bacterial symbionts in these populations. Parasitism assays will allow to detect resistances to parasitoids in aphids.

The final objective of this PhD is to identify parasitoid populations able to control efficiently aphids in strawberry greenhouses.

Results

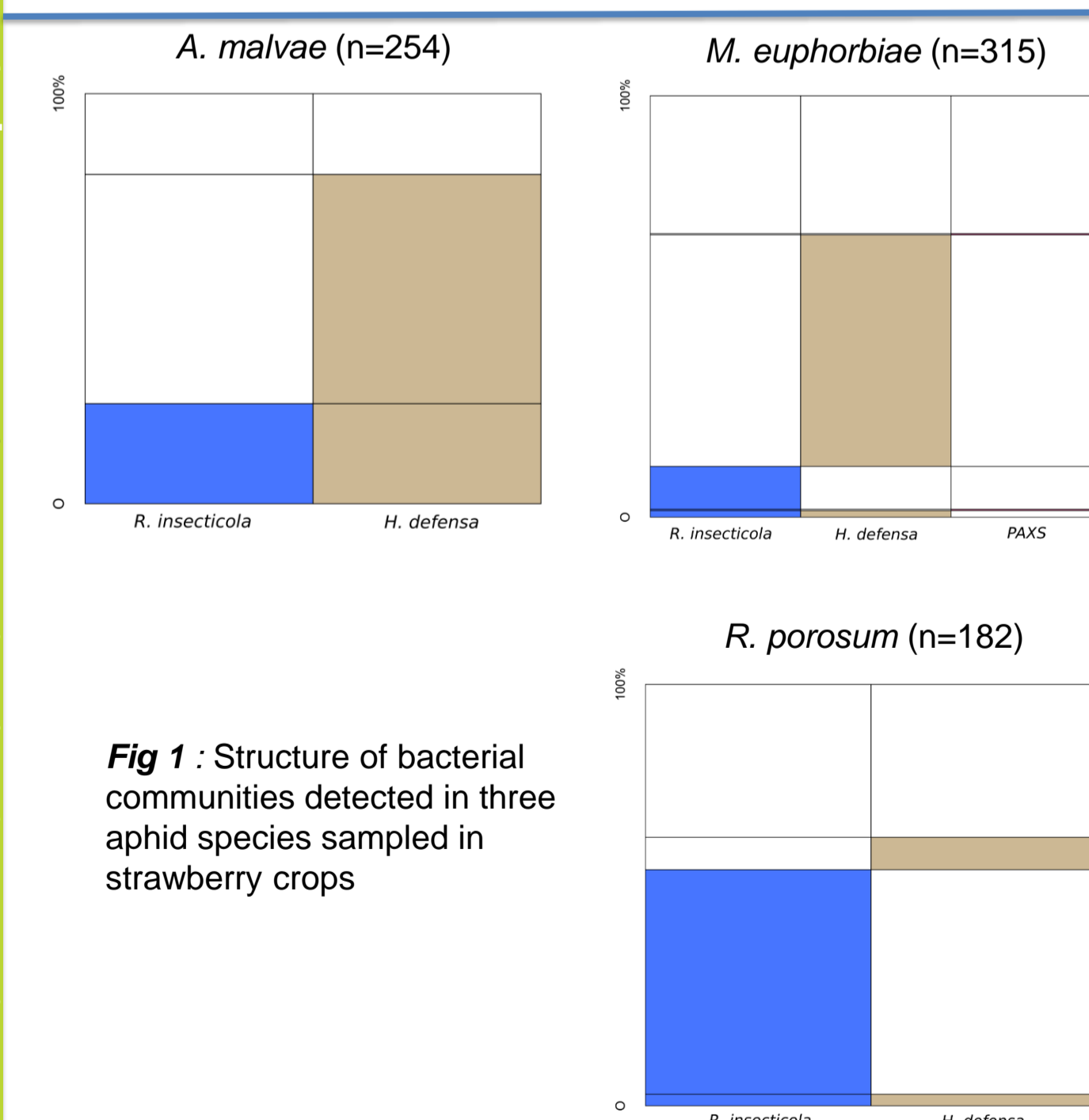


Fig 1 : Structure of bacterial communities detected in three parasitoid sharing between crop and noncrop habitats. *Mol. Ecol.* **23**, 3900–3911 (2014).

In 2017, a sampling of aphids was conducted in strawberry fields and greenhouses in several regions of France (Brittany, South-West, South-East, Center and Auvergne-Rhône-Alpes). This sampling enabled identifying a dozen of aphid species infesting this crop with differences in species composition between regions and between the time of year (spring or summer). *Acyrtosiphon malvae*, *Macrosiphum euphorbiae* and *Rhodobium porosum* are among the most represented species.

By PCR detection, we showed that the prevalence of some endosymbiont species is very high in these aphid species (Fig 1). The bacterial endosymbionts *Hamiltonella defensa* and *Regiella insecticola* were the most represented bacterial species. In some cases, they were found in co-infection. These two endosymbiont species are known to confer protection against parasitoids in some cases, this needs to be confirmed in our system.

Perspectives

A better understanding of parasitoid host specialization and of symbiont-conferred protection in aphids will permit to improve mass rearing of parasitoid wasps. This could help to enhance biological control of aphids in strawberry greenhouses but also in other horticultural productions.

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