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Team

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Direction

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Impact of symbionts on life-history traits and behavioral ecology of a pest and its parasitoids



Social-economic context

The cabbage root fly *Delia radicum* is a major pest of brassicaceous crops (rape, cabbage, turnip...) where its belowground larva feed on roots. Since the interaction between pests and their natural enemies is becoming an increasingly important factor (because of the limitations imposed on chemical control), describing and understanding the role of symbionts on life-history traits and behaviors of this fly and its predators is both a scientific and applied challenge.

Scientific context

Delia radicum's microbiome and that of three of its main parasitoid natural enemies have just been described by our team (PhD thesis of Mikael Bili). This NGS sequencing has in particular revealed the presence of at least four vertically transmitted symbionts in this trophic network, which effects on their hosts are unknown.

Symbionts can deeply influence major life history traits of their hosts, such as nutrition, fecundity, fertility, choice of sexual partner and resistance to natural enemies. The evolutionary interest of vertically transmitted symbionts being to reach the next generation of hosts, they bear selective pressures favoring traits that will improve host fitness.

In the pest, these traits include the exploitation of the plant host but also its detectability and vulnerability regarding natural enemies such as parasitoids. In parasitoids, selected traits are those allowing a more efficient foraging i.e. detection and exploitation of the host. Moreover, whenever parasitoid species compete for the same host, their respective symbionts are part of the ecological niche that must be shared.

We thus postulate that symbionts, taking part in the extended phenotype of their host, will influence trophic networks.

Objectives

The general objective is to measure the impact of symbionts in the trophic network of an agricultural pest.

Experiments will consist in:

- (i) characterizing the presence of symbionts in natural populations (sampling and PCR typing of wild individuals),
- (ii) measuring the vertical transmission rate to the offspring,
- (iii) measuring the impact of the presence or absence of symbionts on the fitness of the pest and of its parasitoids.

Taking three trophic levels into account (plant, pest, parasitoids), "classic" life history traits (development time, size, longevity fecundity, fertility), detectability of the pest by its parasitoids (directly and via odors released by attacked plants) and resistance to parasitoids (which egg is laid inside the host and thus confronted to its immune response) will therefore be assessed.

Sexual behavior will also be studied because symbionts can modify odors used in courtship and can also create a reproductive barrier by promoting post-zygotic crossing incompatibilities.

Perspectives

This study will allow as a first step to assess the extent to which symbionts have an impact on the partners of such a network in an agronomic context.