

# Impact of entomopathogenic fungi on multitrophic insect-plant interactions

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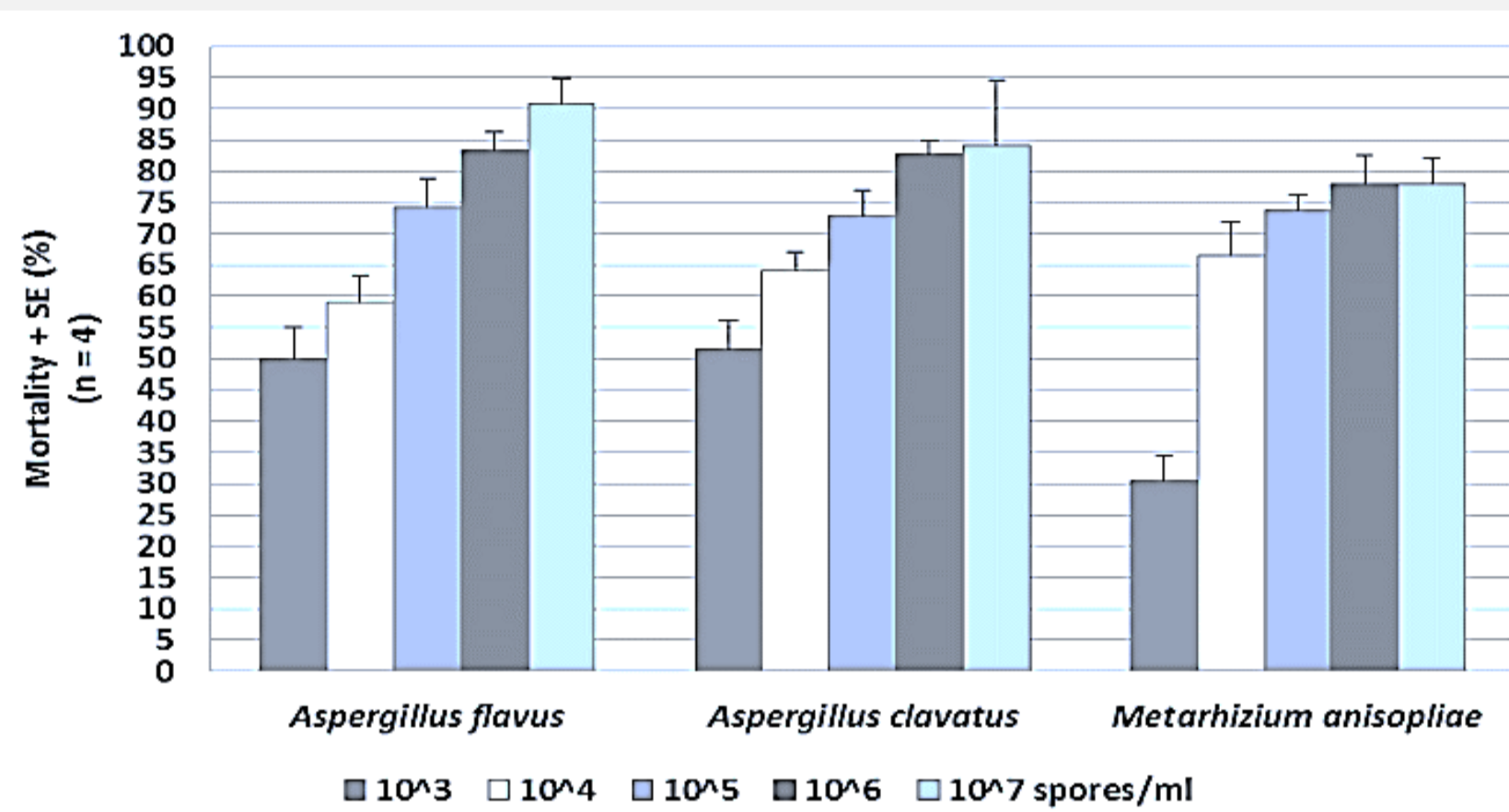
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In microbiological control using entomopathogenic fungi (EPF) against crop pests, the interactions generated by the presence of a new organism in the plant environment merits special attention. We investigate the impact of a treatment with EPF on target and non-targets organisms including plant in a multitrophic approach, but also on the opportunities to develop new strategies to control crop pests.

## 1. Fungal toxicity effect on herbivore insects

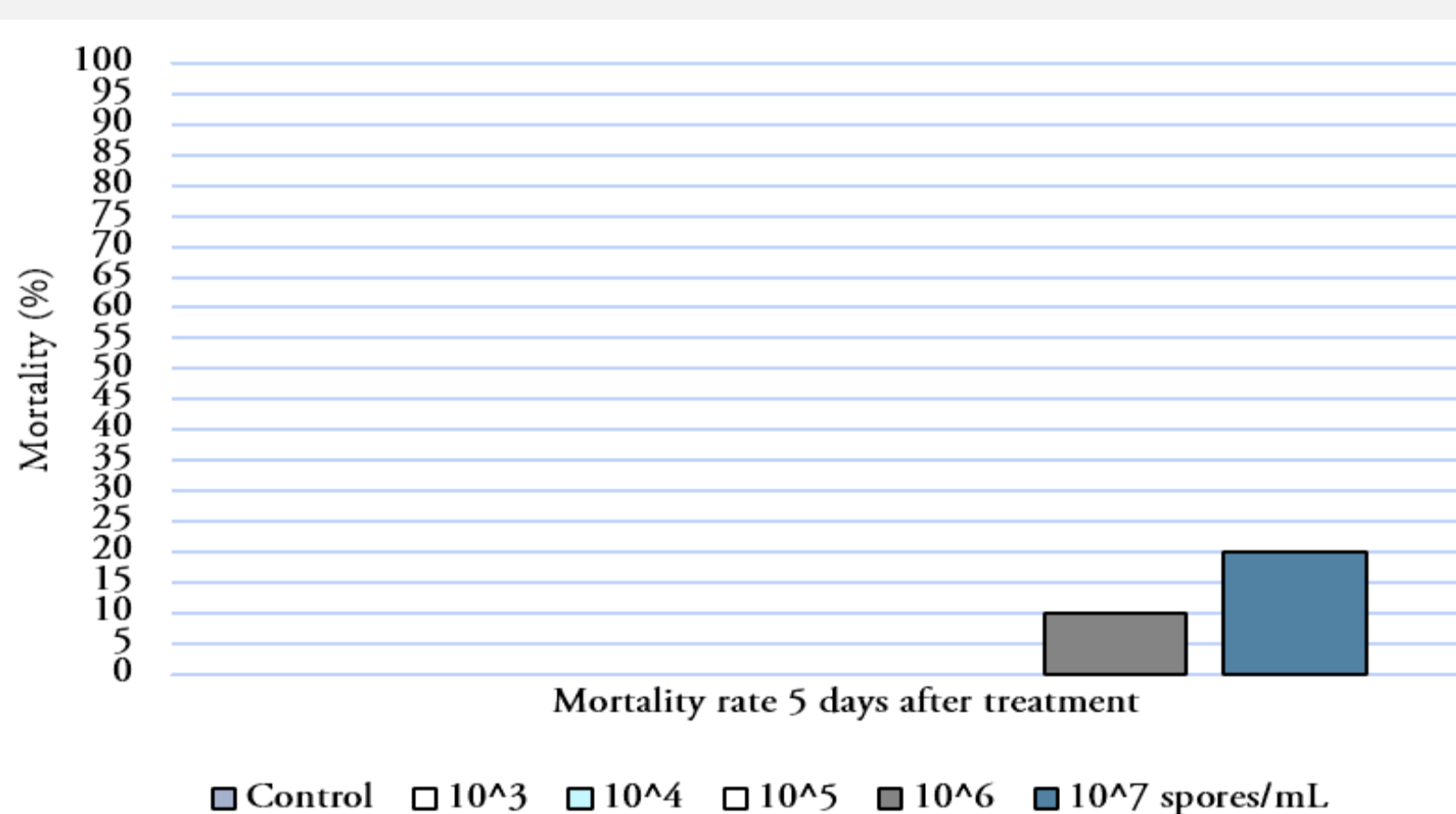
- New (*Aspergillus*) and commercialized (*Metarhizium* and *Beauveria*) strains are used.
- Example: 3 EPF strains toxicity test against *Acyrtosiphon pisum* (Hemiptera : Aphididae)



## 2. Toxicity effect on non target insects: selectivity test

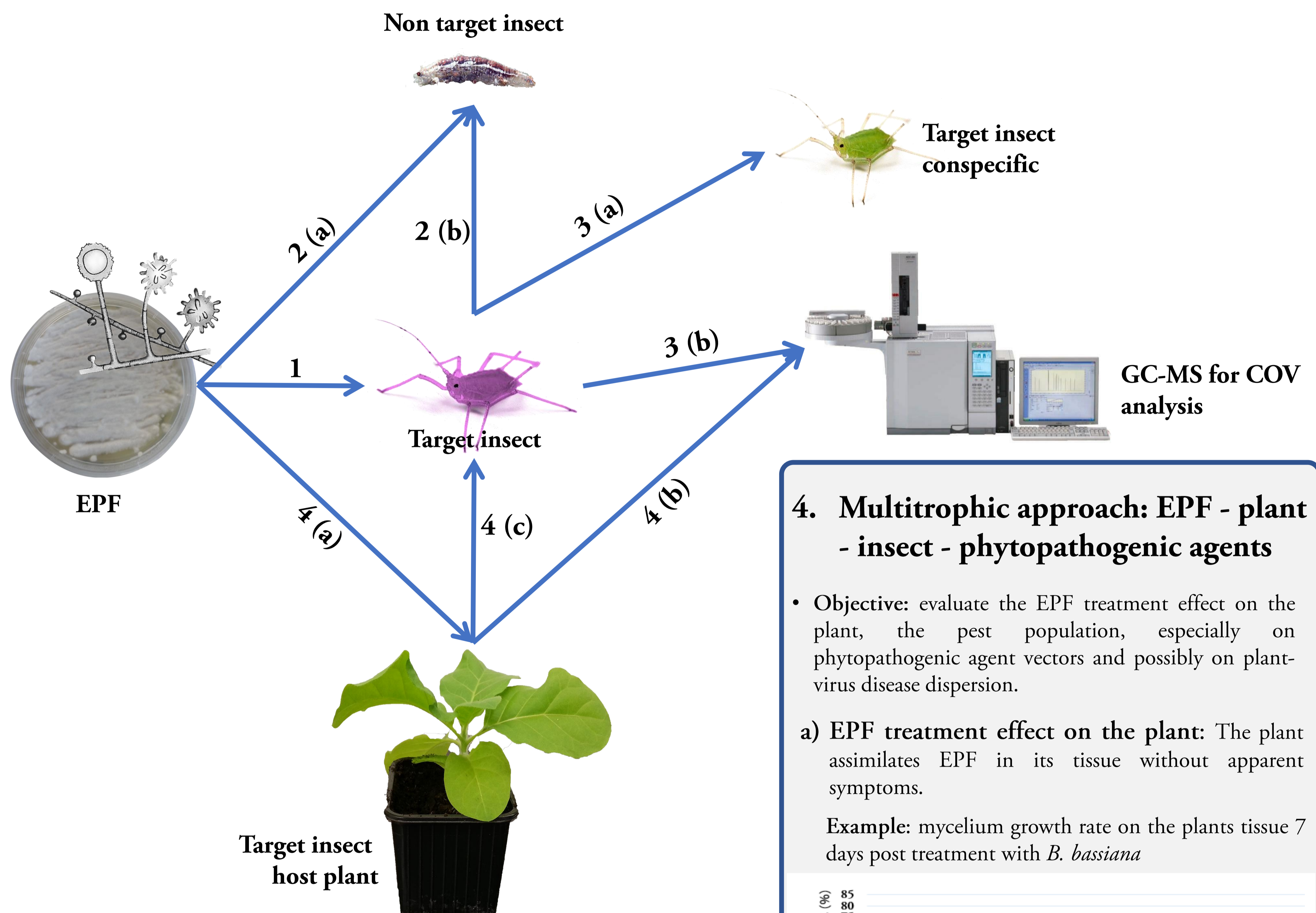
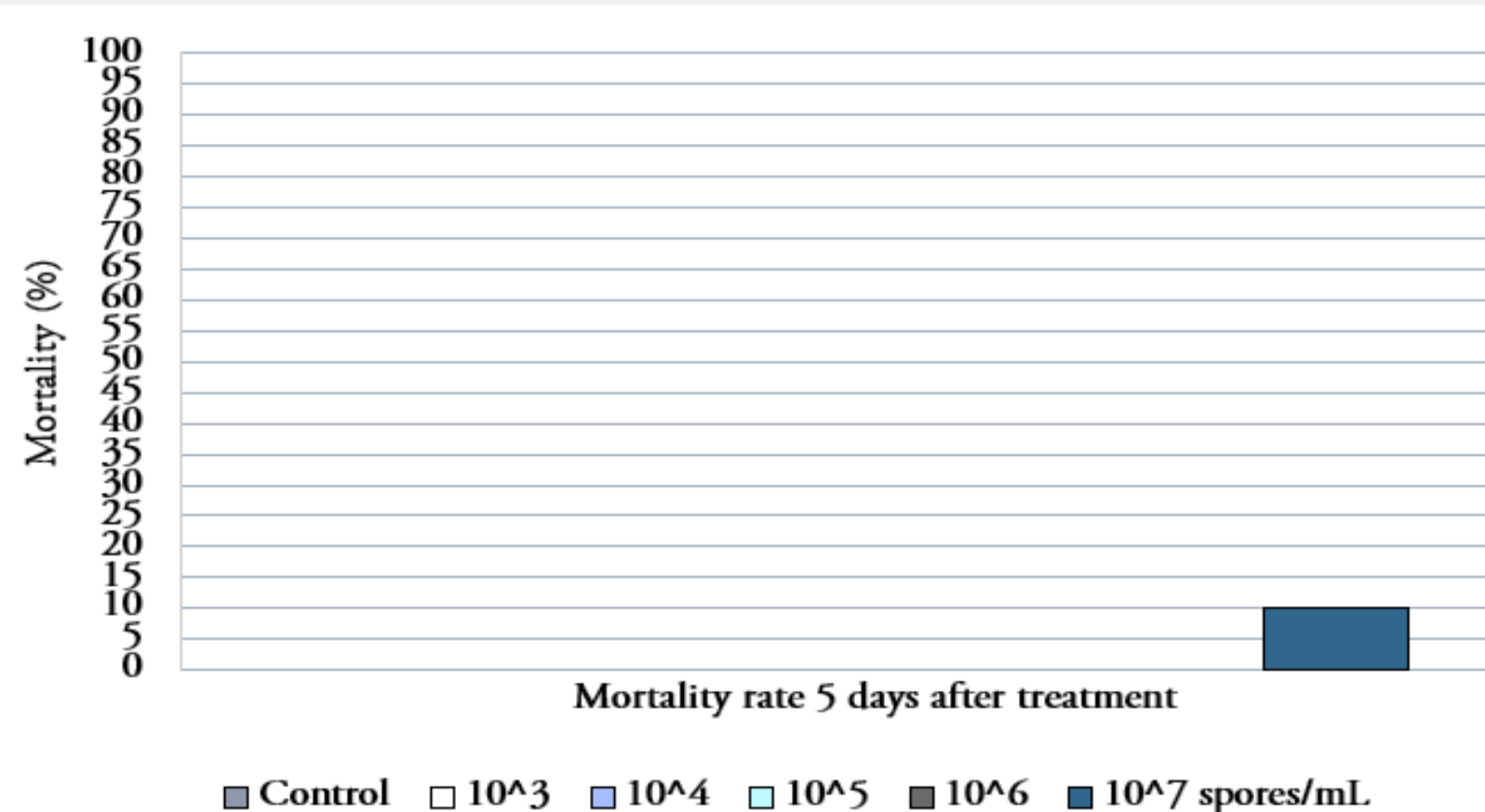
### a) Direct effect (contact)

- Non targets insects treated with EPF and fed with uninfected insects.
- Example: *A. flavus* toxicity test against *Episyrphus balteatus* larvae (Diptera : Syrphidae)



### b) Indirect effect (ingestion)

- Non targets insects fed with EPF treated insects (tritrophic interaction).
- Example: *E. balteatus* larvae fed with *A. pisum* treated with *A. flavus*.

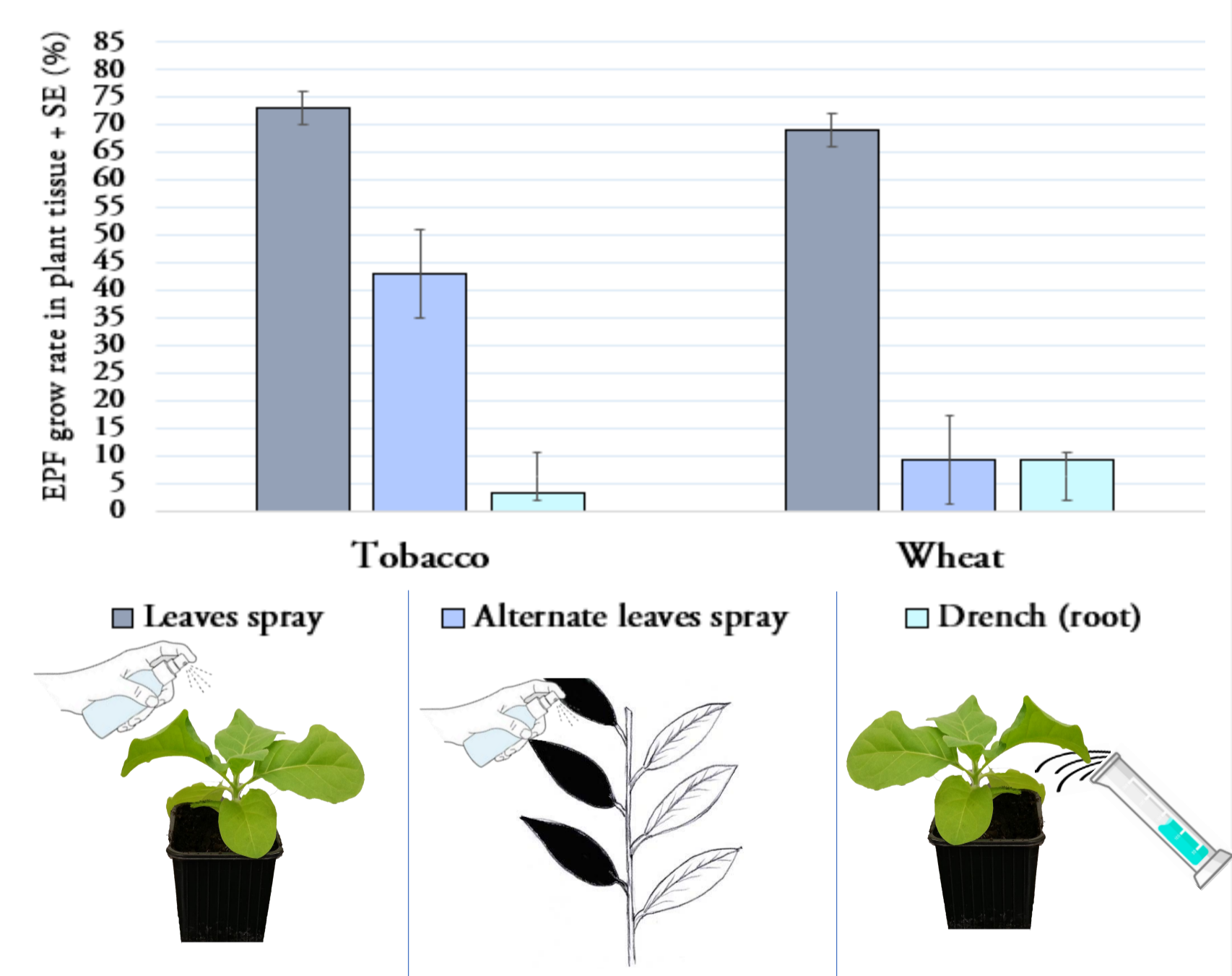


## 4. Multitrophic approach: EPF - plant - insect - phytopathogenic agents

- Objective: evaluate the EPF treatment effect on the plant, the pest population, especially on phytopathogenic agent vectors and possibly on plant-virus disease dispersion.

a) EPF treatment effect on the plant: The plant assimilates EPF in its tissue without apparent symptoms.

Example: mycelium growth rate on the plants tissue 7 days post treatment with *B. bassiana*



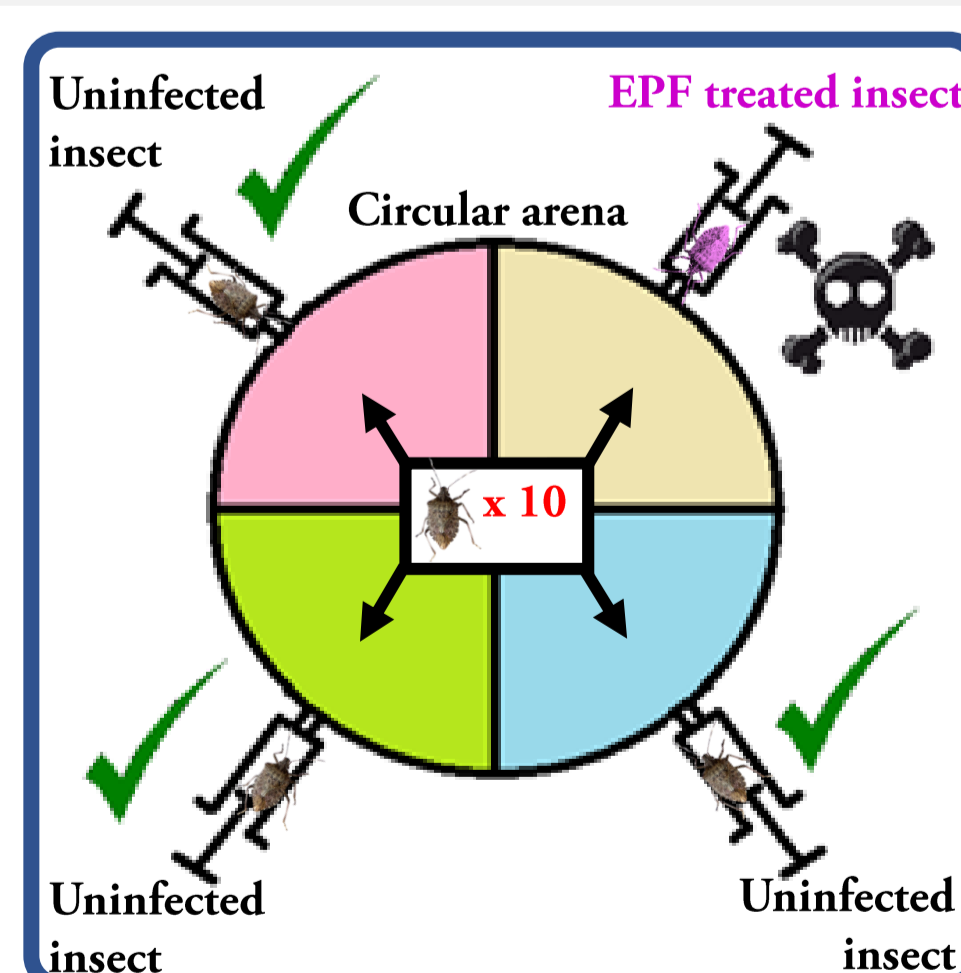
b) Physiological impact analysis of the EPF inoculated plant : VOCs, carbohydrates, immune system, ...

c) Effect of the EPF presence in the plant tissue on the insect: attractiveness (preference), reproduction, survival, feeding behavior (EPG: Electropenetrography) and phytopathogenic agents (virus) transmission.

## 3. Insect behaviour: attractive or repellent?

- Study of horizontal (intraspecific) transmission possibility of EPF infection.
- Objective: improve efficiency, reduce the amount and the frequency of application.

a) Behavioural analysis: Insect gregarious behaviour with *Halyomorpha halys* (Hemiptera: Pentatomidae)



b) Volatile collection and analysis: For a possible development of a specific control strategy against *H. halys*.

We conclude that, an EPF-based treatment effect analysis may reveal new strategies to control crop pests from the connections complexity that can be developed between different components in the plant ecosystem. It can also allow us to determine the impact on the propagation of phytopathogenic agents transmitted by a vector.