IIRB
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Agro-ecological infrastructures for better control of aphid-borne sugar beet viruses

The members of the IAE-Betterave 2 research project*

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BACKGROUND

Two aphid species, ***Aphis fabae*** and ***Myzus persicae***, are mainly responsible for the transmission of **yellowing viruses** on sugar beets

The use of **neonicotinoids** is banned in the EU since 2018

We urgently need to develop **alternative** and **sustainable solutions** to control the virus vectors in crop fields, such as conservation biological control using **natural enemies**

The installation of **agroecological infrastructures (AEI)** such as **flower strips** in or close to the fields has already proven its worth in several crops but needs a better evaluation in sugar beet crops

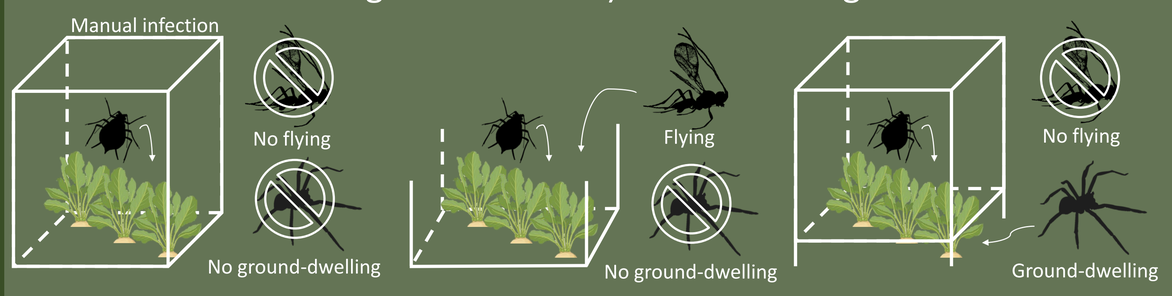
GOAL & QUESTIONS

Understand the links between aphid populations, their natural enemies and flower strips, using a fine-scale mechanistic and large-scale correlative approach

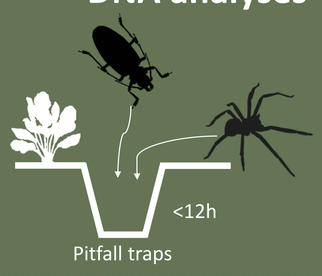
1. Are aphids mostly controlled by **ground-dwelling** or **flying** natural enemies (e.g. carabids and spiders or parasitoids)?
2. Do aphids represent **a significant part of the diet** of the main generalist predatory species found in the fields, and **which species** feed on them?
3. What are the effects of flower strip **AEIs** and **distance** from them on aphid control in different **landscapes** and **mesoclimates**?

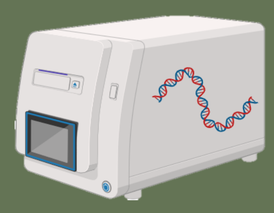
METHODS

1 Setting up **exclusion cages** in sugar beet fields (along the edge of which a flowering AEI was sown) after removing natural enemies



2 Sampling **generalist** ground-dwelling predators (carabids and spiders), close or far from the **flower strip**, and identifying gut content through **DNA analyses**





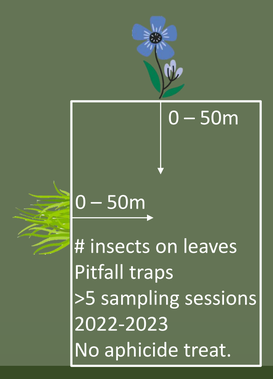
Aphids, springtails, earthworms, slugs, spiders

Detection rate of common prey

Predation potential (value corrected by mean predator voracity and digestion speed)

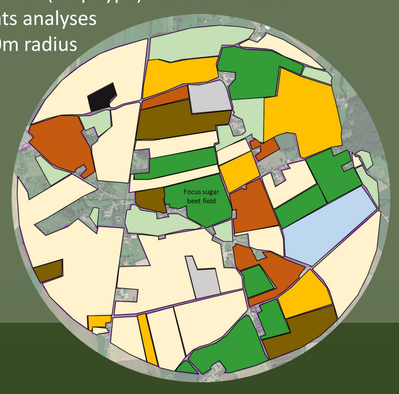
3 **Counting** aphids and natural enemies in 22 sugar beet fields, at different **distances** from AEIs and considering the role of **landscape** and **climatic** conditions

Meteorological data from field stations in the main sugar beet crop region in France



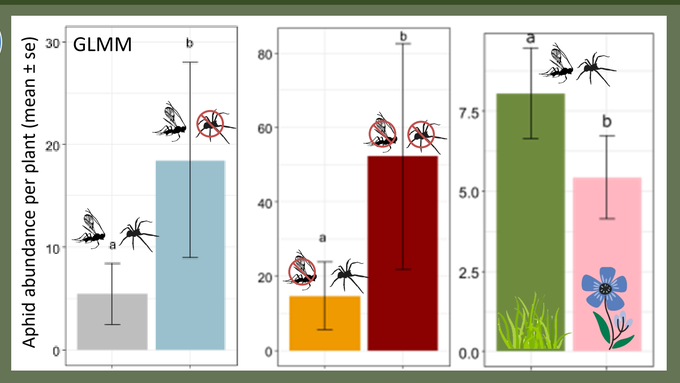
insects on leaves
Pitfall traps
>5 sampling sessions
2022-2023
No aphicide treat.

Land cover (crop type) and semi-natural habitats analyses at 500m radius



RESULTS

1

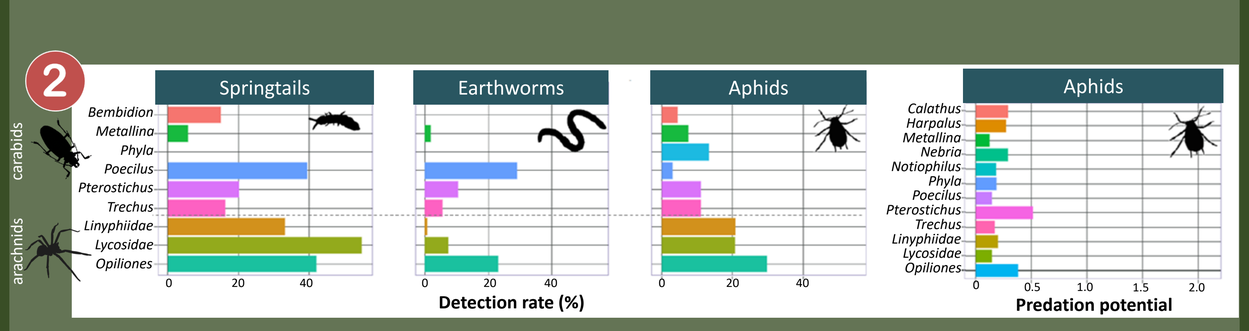


. **Ground-dwelling predators** are the most efficient natural enemies

. Ground-dwelling predators: **3.2x less** aphids than control

. Close to the flower strip edge: **1.5x less** aphids than grass strip

2

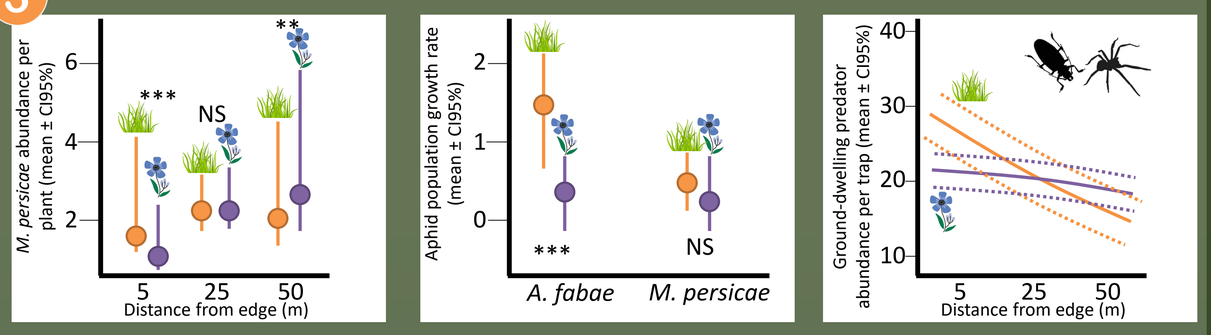


. 10% of carabids and 20% of spiders do consume aphids, and **all generalist species** feed on aphids, but prefer springtails and earthworms

. Dynamic study shows a predatory activity **as soon as first aphid infestations occur**, probably thanks to alternative prey (e.g. springtails)

. Predation rates on aphids are **higher close to the flower strips**, and lower in the middle of the field (50m) and close to the grassy strip

3

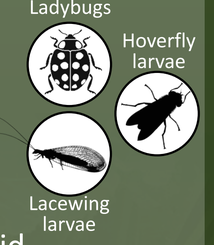


. Flower strips are effective **at proximity** (5m), especially on *A. fabae* and on ground-dwelling predators

. **Leaf-foraging** natural enemies were spotted relatively late in the aphid infestation period, and represented **low total abundances**

. They were however **greatly advantaged by the flower strip**

. Landscape-level characteristics **interact** with climatic conditions on aphid control during the infestation phase



Selected landscape metrics	*M. persicae* (abundance)	*A. fabae* (abundance)	Ground-dwelling predators (abundance)
Flower strip (presence)	+ unless large Fabaceae and grassland cover in the landscape	- especially at high temperatures	+ especially at high temperatures & high precipitations
Sugar beet (surface)		+	
Cereals/Pea (surface)		+	

CONCLUSION

Flower strips have **a positive impact on aphid control**, particularly via **ground-dwelling predators**, but the effect diminishes with distance

Effectiveness **strongly modulated** by climatic and landscape factors

AEI deployment strategies therefore need to be tailored to **the context** of the field and **its surroundings**!

Density, total surface and recurrence of flower strips, spatial organization, floristic composition, complementarity with hedges and grass strips, long-term impact and cost-efficiency must now be assessed

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