Intraguild interactions among arthropods : starting the natural enemy cocktails



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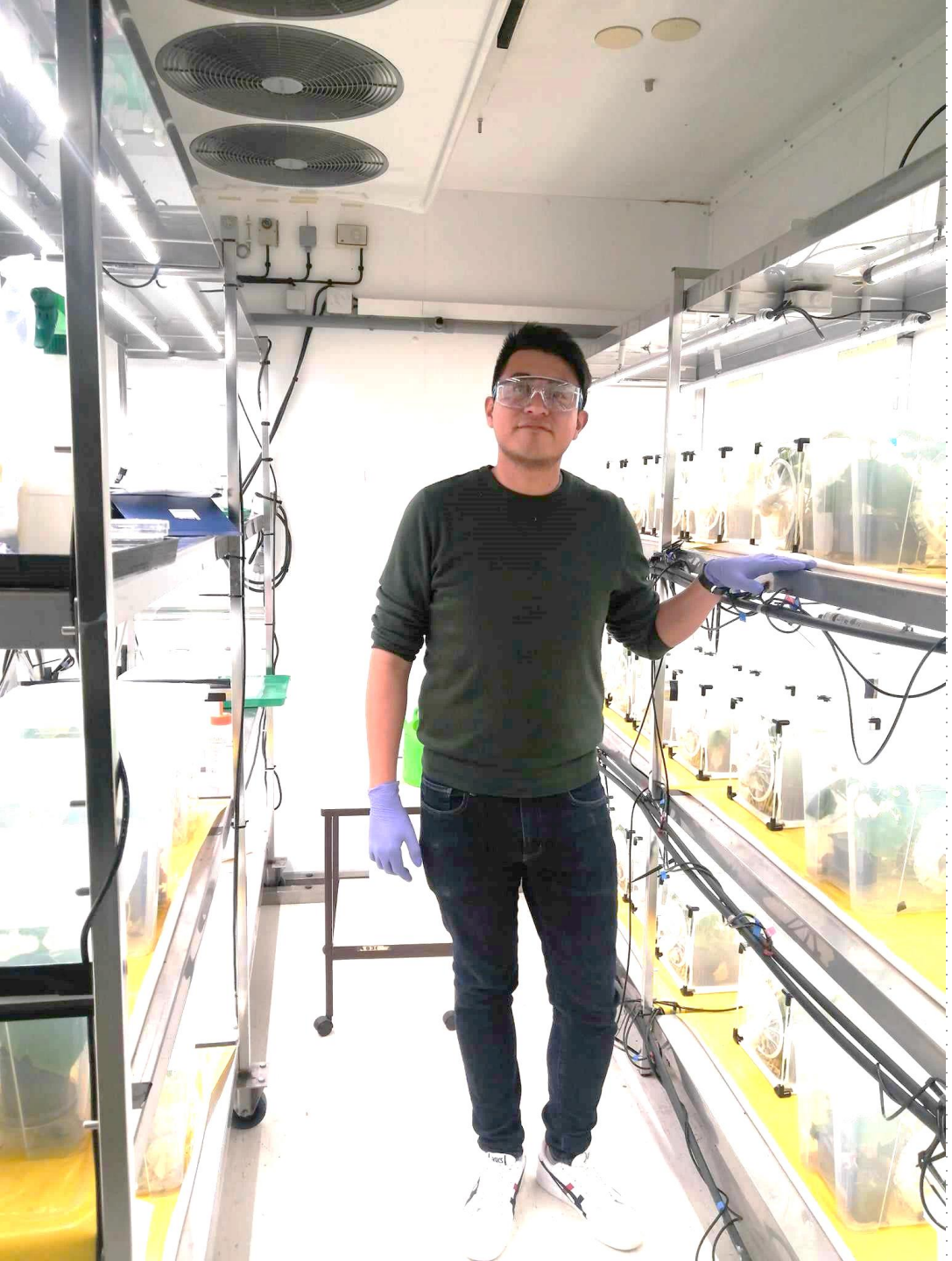
April, **2024**

Designing Natural Enemy Cocktails for a Better Biocontrol



1st year PhD student

Role of natural enemy complementarity and antagonism on herbivore dynamics and biocontrol

- Meta-analysis
- **Natural enemies - herbivores experiments**

Myzus persicae and *Tetranychus urticae* are a worldwide economically important pest

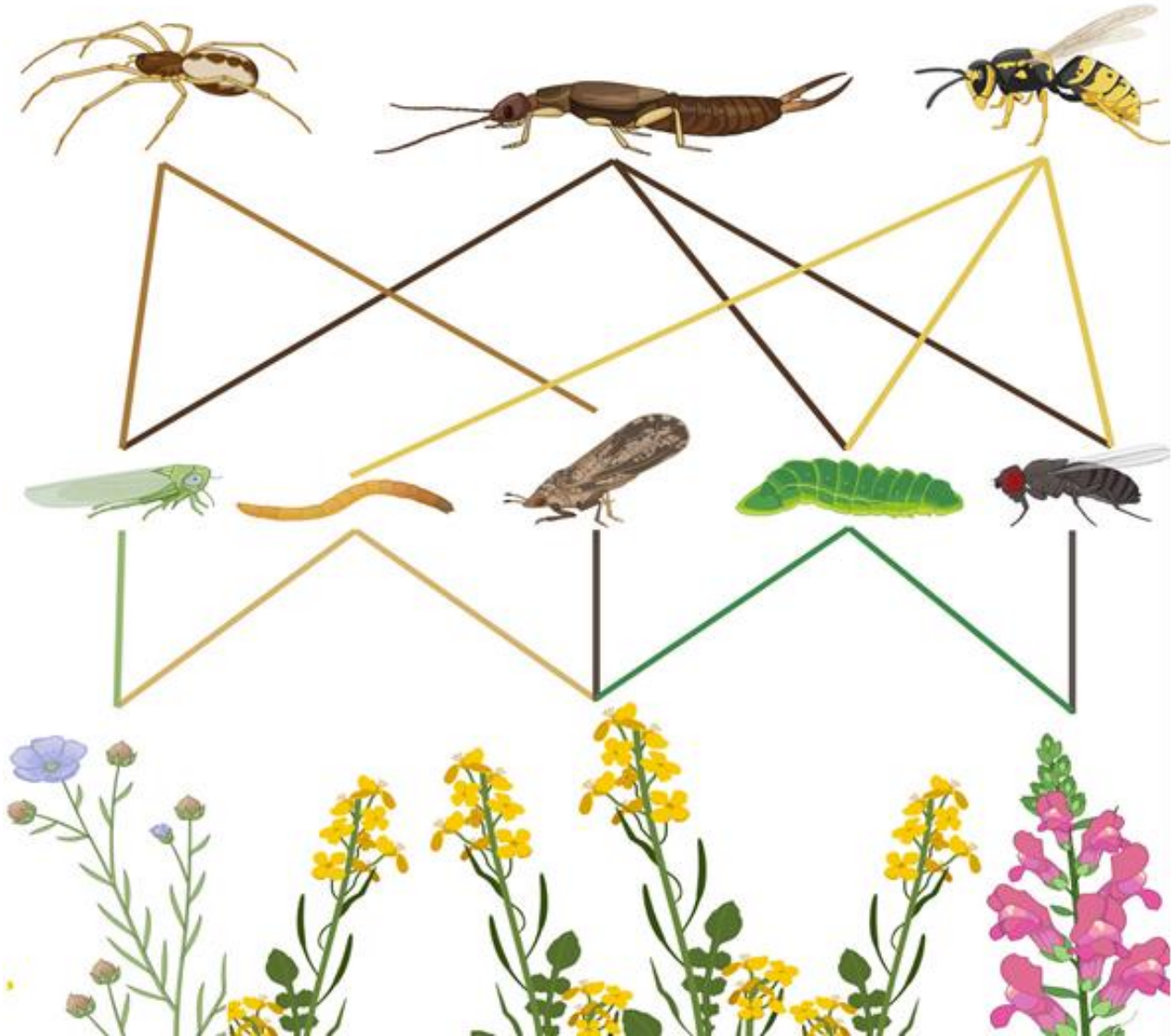
- ❑ Leaf chlorotic damage and photosynthesis reduction
- ❑ Yield loss (20 to 60%)

- ❑ Wilting, inhibition of photosynthesis and viruses vector
- ❑ Yield loss (38 to 42%)

Does natural enemy communities with strong complementarity and weak intraguild predation provide better long-term biocontrol services?

Natural communities

- ✓ Natural food webs involve multiple interaction between a variety of consumers and available resources
- ✓ Trophic levels may alter with omnivory's diverse diets

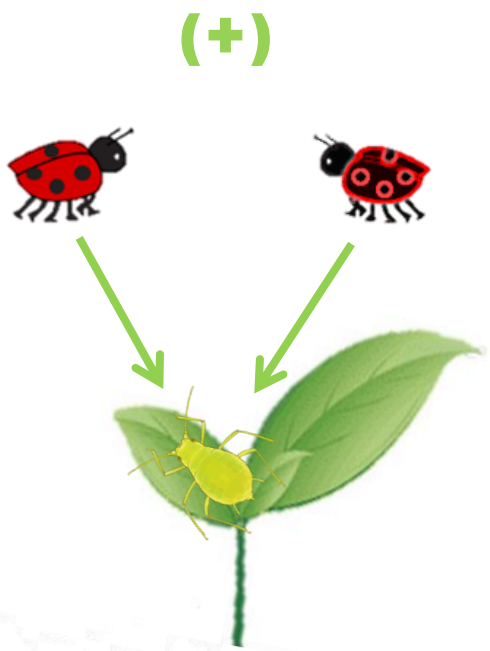


Two forms of omnivory in arthropods

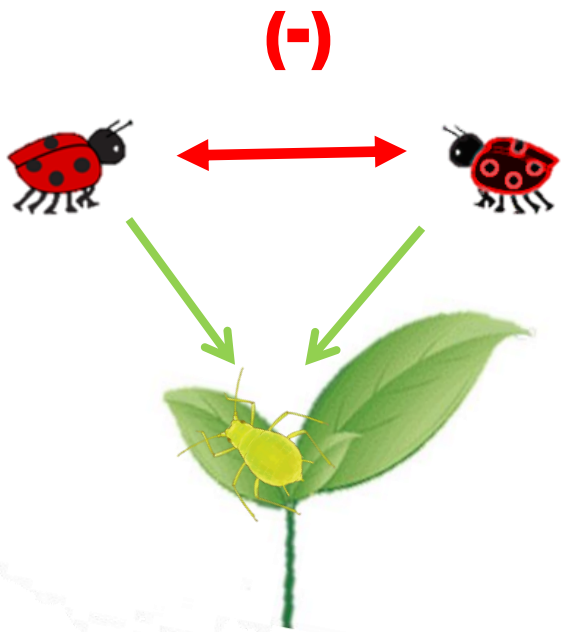
- Dual feeding habits as herbivores or predators
- Predators prey on insects with multiple roles in the food web: detritivores, herbivores and predators as well
- **Intraguild predation (IGP)** a omnivory form

IGP can affect suppression on herbivorous insects through natural predator-prey dynamics

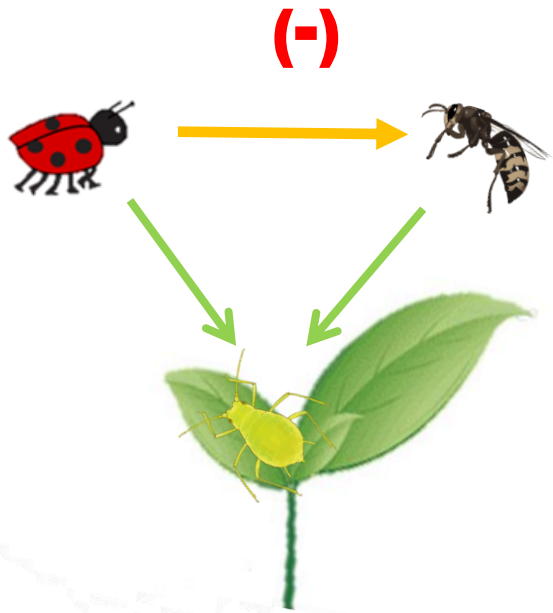
IGP occurs when two consumers that share a resource engage in competition. In biocontrol one natural enemy (**intraguild predator**) attacks another species of natural enemy (**intraguild prey**)



Complementarity



Symmetrical Intraguild predation



Asymmetrical Intraguild predation




Experimental approach to community dynamics by long-term multigenerational dynamics

Parasitoid-Predator-Prey interaction :

Aphidius colemani in presence of *Adalia bipunctata* or *Micromus angulatus* sharing the commun prey *Myzus persicae*



Test evaluations :

1. Population Dynamic interactions
2. Predation Preference Behavioral

Population Dynamic interactions (Parasitoid-Predator-Aphid)

Does *A. colemani* can co-exist in presence of Top predators?

Experiment Set-up

5 treatments in 8 replicates:

1. *A. colemani*
2. *A. bipunctata*
3. *M. angulatus*
4. *A. colemani* + *A. bipunctata*
5. *A. colemani* + *M. angulatus*

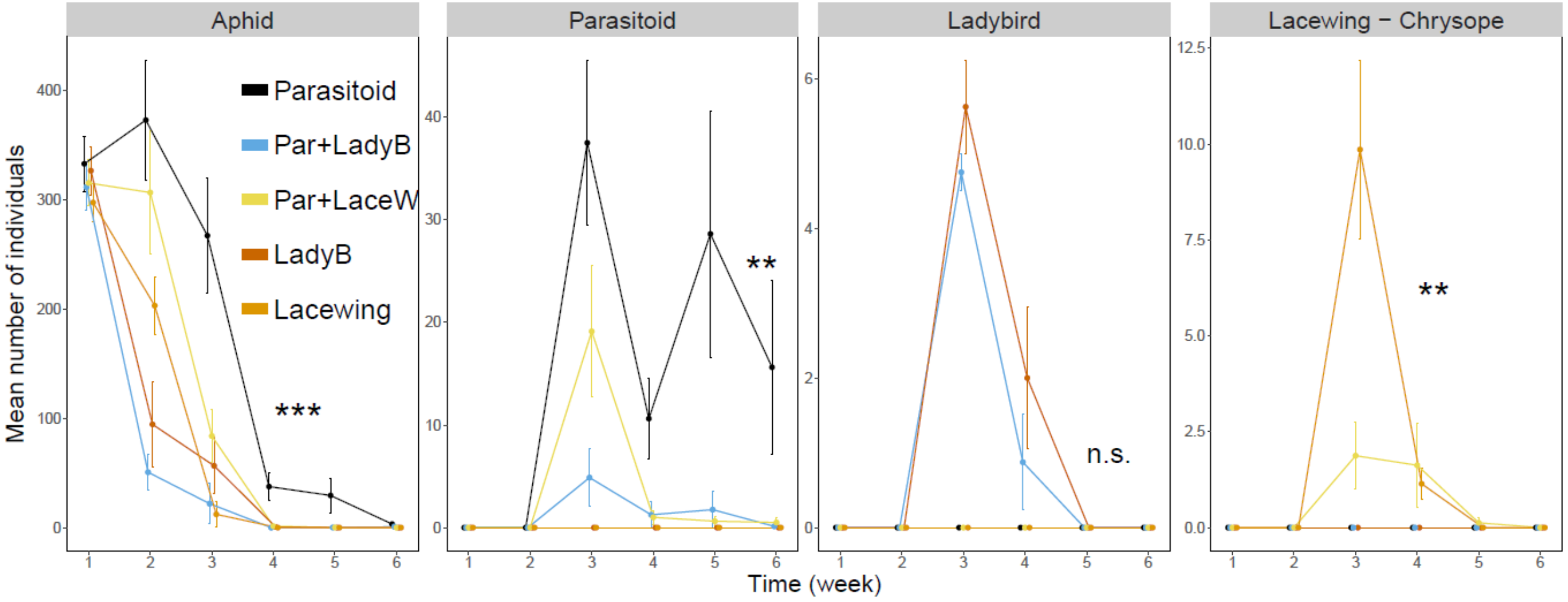
n = 10 (5♀+5♂)

n = 10

n = 5♀

n = 300

The parasitoid had a negative impact on lacewing population growth



Predator No-choice test for Parasitized and Healthy Prey

Does *M. angulatus* have a selective predation behavioral avoiding parasitized aphids?

Experiment Set-up

6 treatments in 10 replicates for each predator:

1. Predator + healthy aphids(**2d**)
2. Predator + Parasitized aphids(**1d**)
3. Predator + healthy aphids(**6d**)
4. Predator + Parasitized aphids(**5d**)
5. Predator + healthy aphids(**9d**)
6. Predator + Parasitized aphids(**8d**)

***2 control for 1d and 5d age of parasitized aphids were established**

n = 20

n = 1 ♀

Survival counts 1h-5h, 7h and 24h

Predator Choice test for Parasitized and Healthy Prey

Experiment Set-up

3 treatments in 10 replicates for each predator:

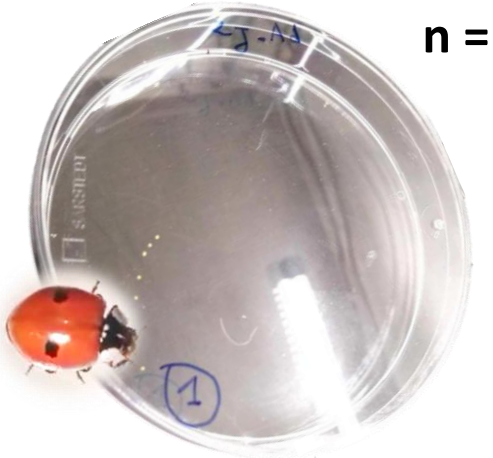
1. Predator + healthy (**2d**) and parasitized aphids(**1d**)
2. Predator + healthy (**6d**) and parasitized aphids(**5d**)
3. Predator + healthy (**9d**) and parasitized aphids(**8d**)

***2 control for 1d and 5 d parasitized aphids were established**

*** Survival aphids of 1d and 5d were followed until adulthood or mummified stage**

n = 20
(10H+10P)

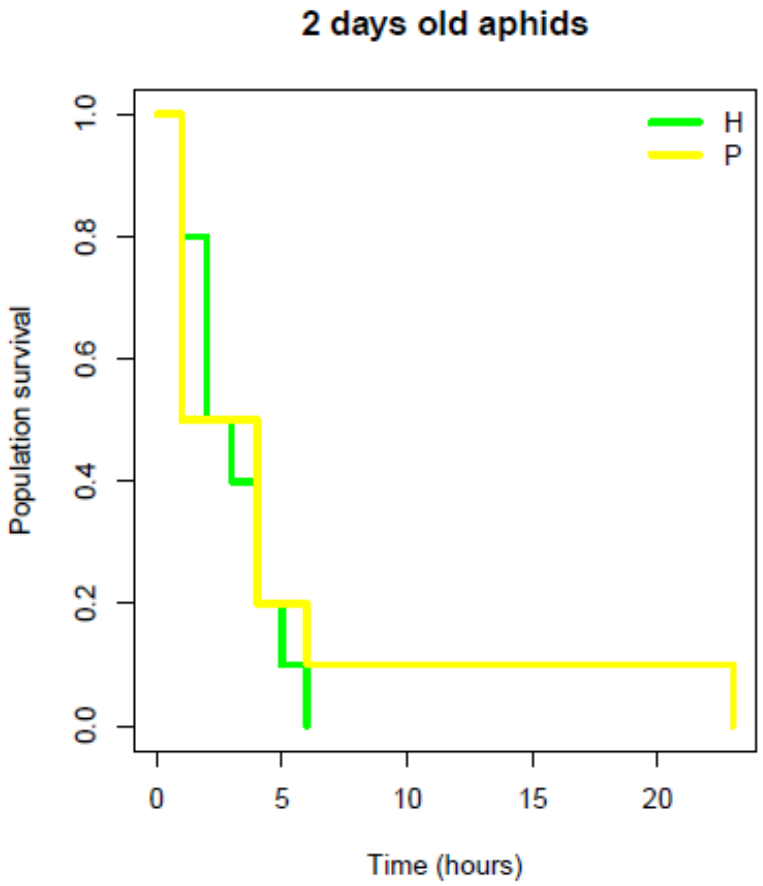
n = 1 ♀

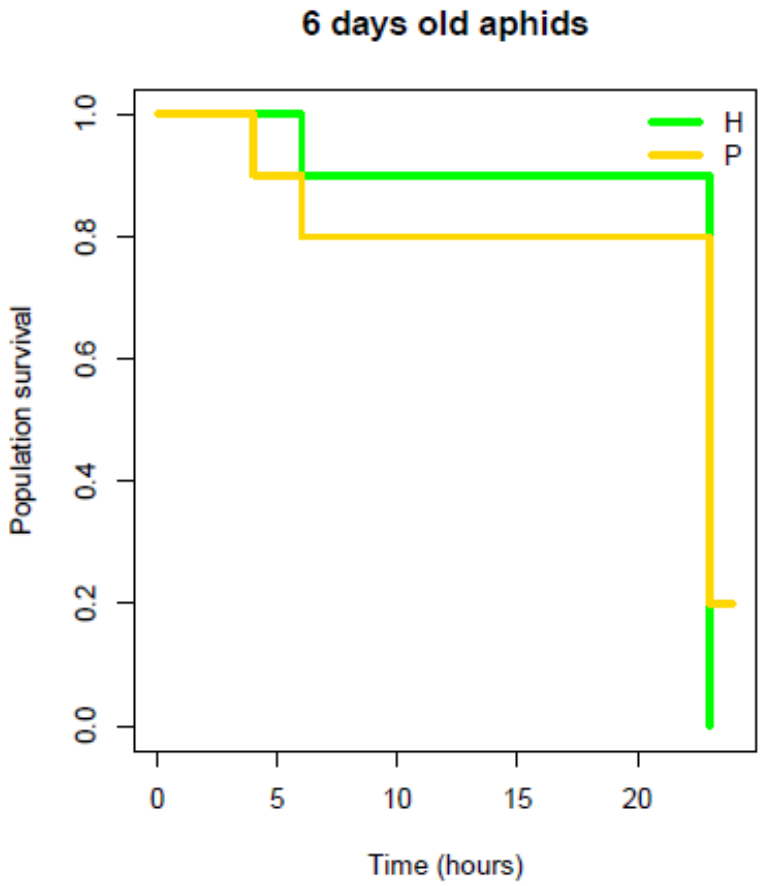


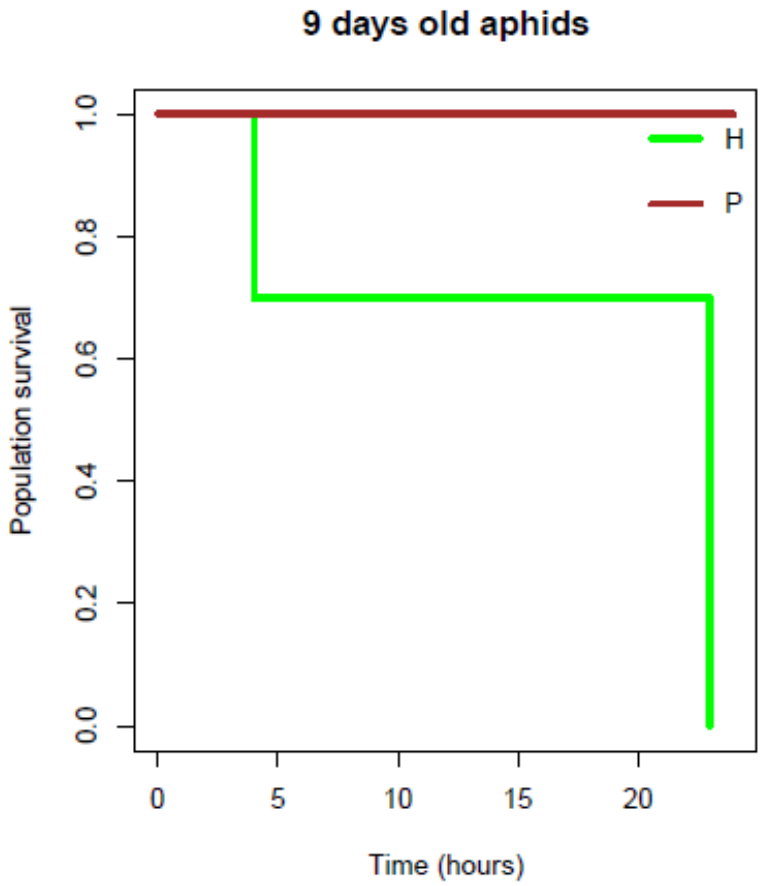
ladybugs removed after release at **1h (1d aphids)** and **3h (5d,8d aphids)**

Lacewings removed after release at **3.5h (1d aphids)** and **6h (5d,8d aphids)**

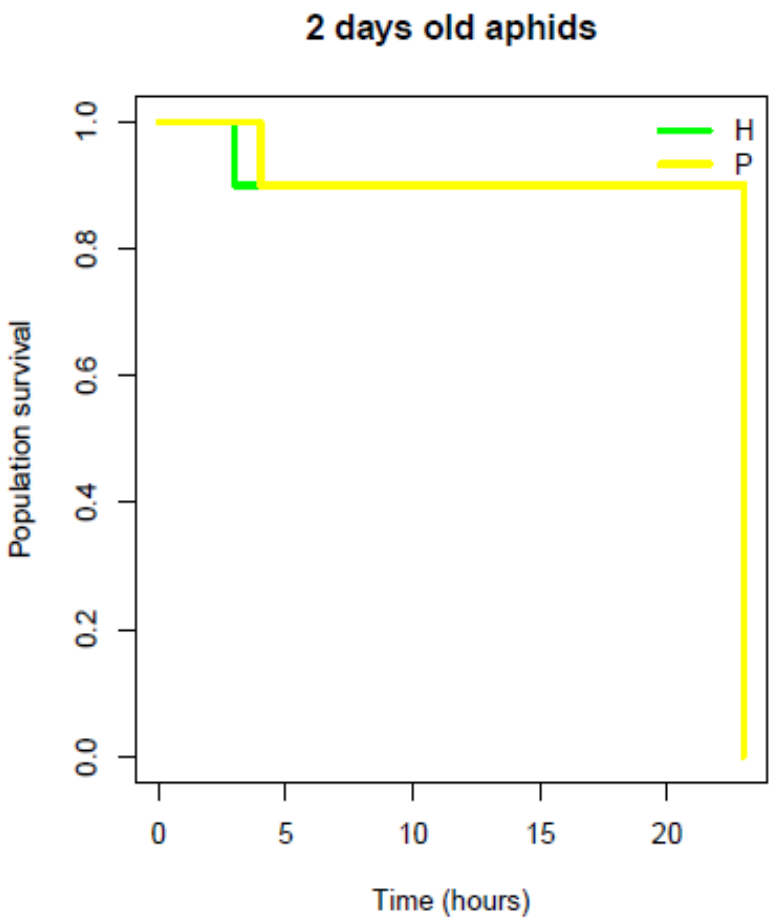
A. bipunctata faster predation on parasitized and healthy aphids

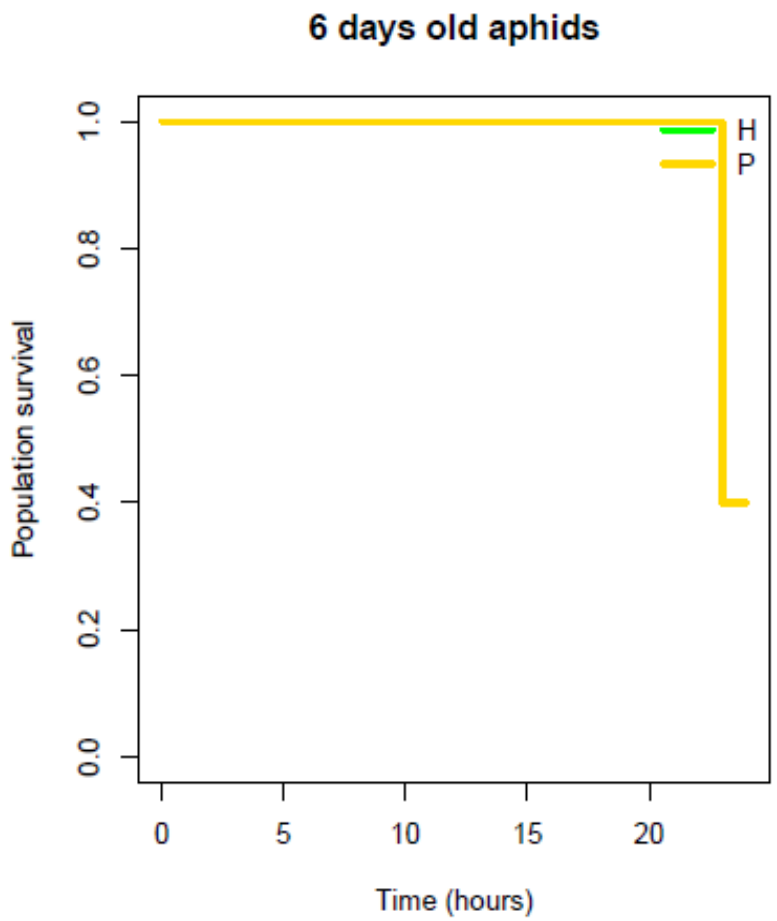


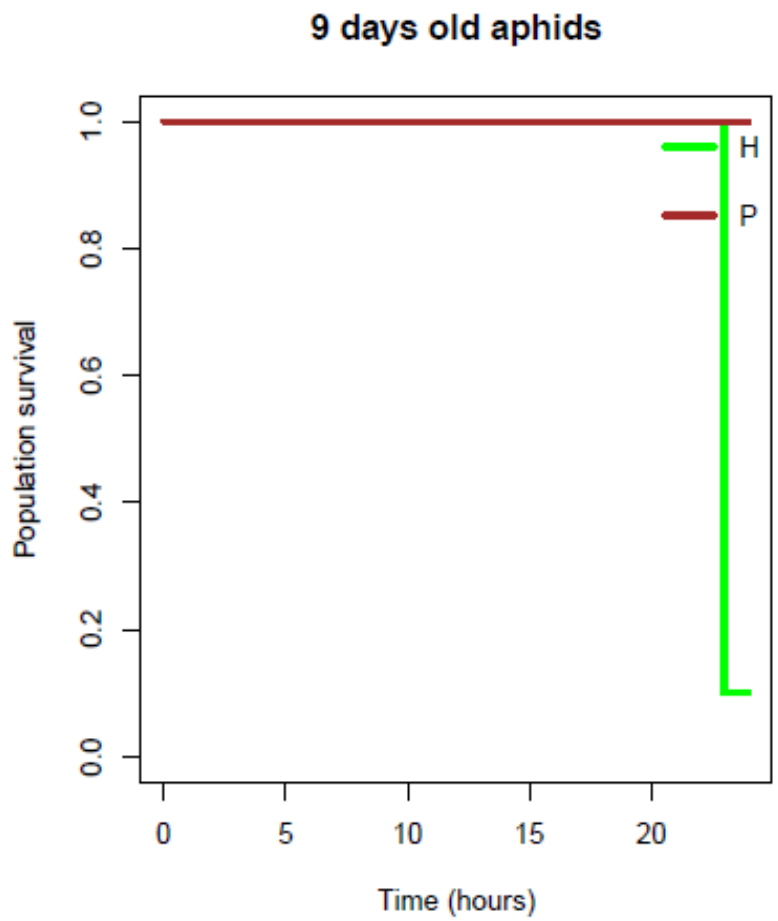




M. Angulatus slow predation on aphids







Conclusions

✓Ladybirds consumed aphids more rapidly than lacewings

✓Lacewings feeding preferences reduce predation efficacy

✓ The reduction of population growth on lacewings by parasitoids possible coexistence (**partitioning**)

Future: **long-term experiments may simulated communities dynamics when resources are similar than in nature**

ENEMY COCKTAIL

Designing natural enemy cocktails
for a better biocontrol

Thank you for your attention!

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