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Trophic interactions and biological control of aphids and spider mites by generalist predators

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Introduction

Several arthropods afflict greenhouse cucumbers throughout the production season. Aphids and spider mites are among the most important. Generalist predators can contribute to regular populations of several pests. The effectiveness of these predators depends on their voracity for prey and food preferences. A combination of several complementary generalist predators would control a wider range of pests. Predators can share prey based on their preferences in the context of multiple preys. However, antagonistic interactions between predators, such as intraguild predation, can reduce the effectiveness of predator combinations.

Objective

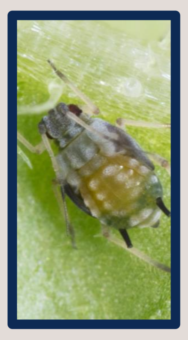
Test the ability of the generalist hemipterans *Nabis americoferus* and *Orius indisiosus* to regulate populations of aphids and two-spotted spider mites in cucumber greenhouse.

Methods

- Microcosm trials: Bugdorm muslin cages (77 x 32.5 x 32.5 cm) with a Lebanese cucumber plant.
- Prey treatments:
  - Aphids (12 adults)
  - Spider mites (12 adults)
  - Both prey
- Predator treatments:
  - Control (w/o predators)
  - *Nabis* (4 females)
  - *Orius* (4 females)
  - Both predators (2 *Nabis* + 2 *Orius*)
- Monitoring:
  - conducted 14 and 28 days after the start of testing.
  - One cucumber leaves were observed per plant.
    - 3 equivalent zones were defined (4.5 cm in diameter).
    - Only prey in these areas was counted.
  - The number of predators on the main stem and petioles were counted in each cage.
- The project was carried out on two sets of 96 tests. Thus, for each set, each of the 16 treatments was repeated 6 times for a total of 12 repetitions for both sets.

Results

After 14 days



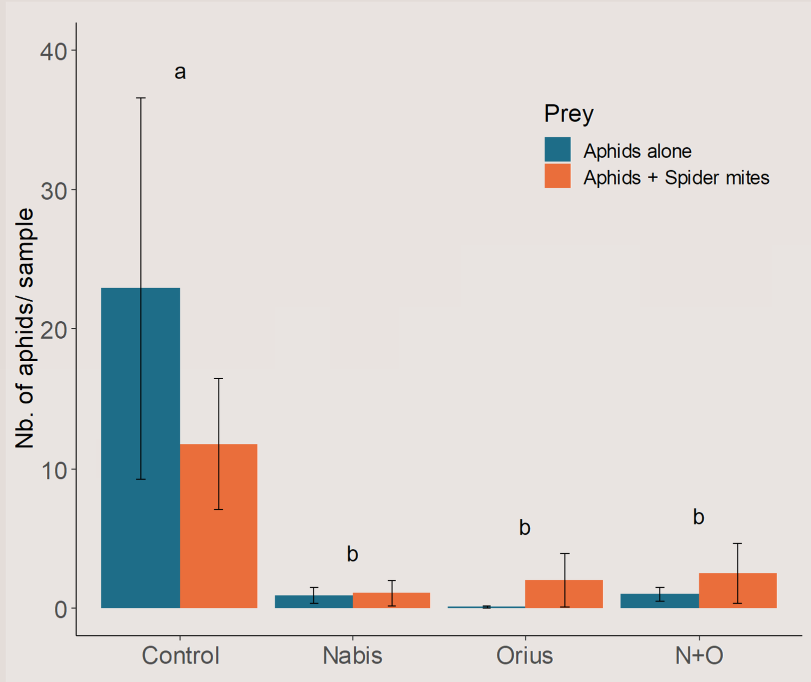


Fig. 1: Number of *Aphis gossypii* per sample after 14 days based on predator and prey treatments. The different letters indicate statistical differences.

After 28 days

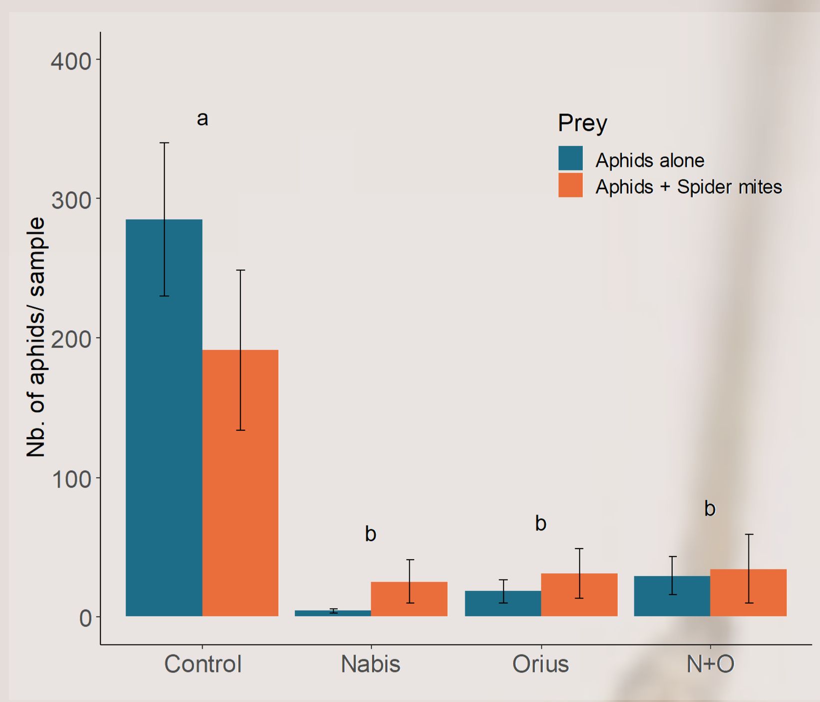


Fig. 2: Number of *Aphis gossypii* per sample after 28 days based on predator and prey treatments. The different letters indicate statistical differences.

All predatory treatments reduced aphid populations 14 days($p < 0.0001$) and 28 days ($p < 0.0001$) after their introduction into cages (Fig. 1 & 2).

Neither predator treatments ($p = 0.31$) nor prey treatments ($p = 0.34$) had an effect on spider mite populations after 14 days (Fig. 3).

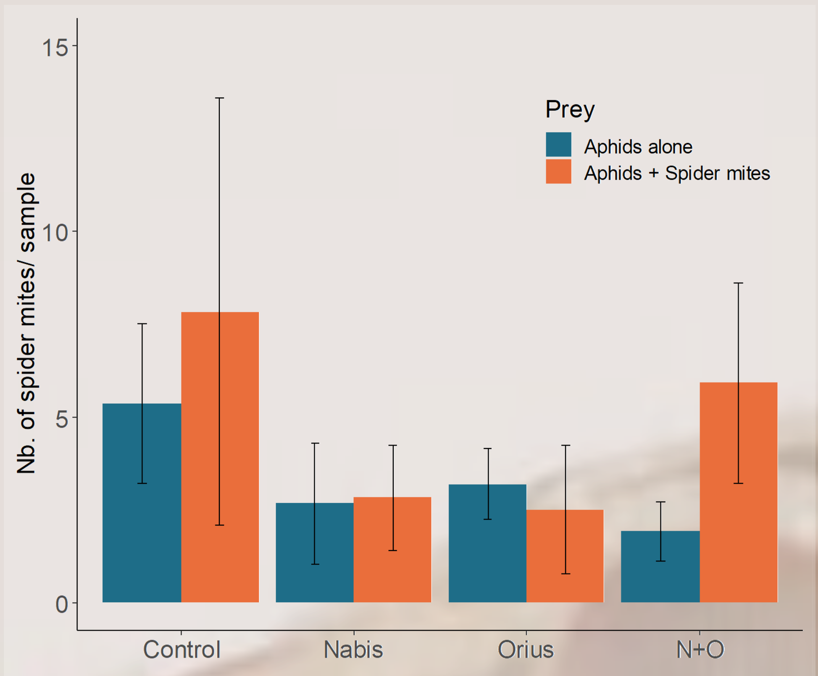


Fig. 3: Number of *Tetranychus urticae* per sample after 14 days based on predator and prey treatments. The different letters indicate statistical differences.

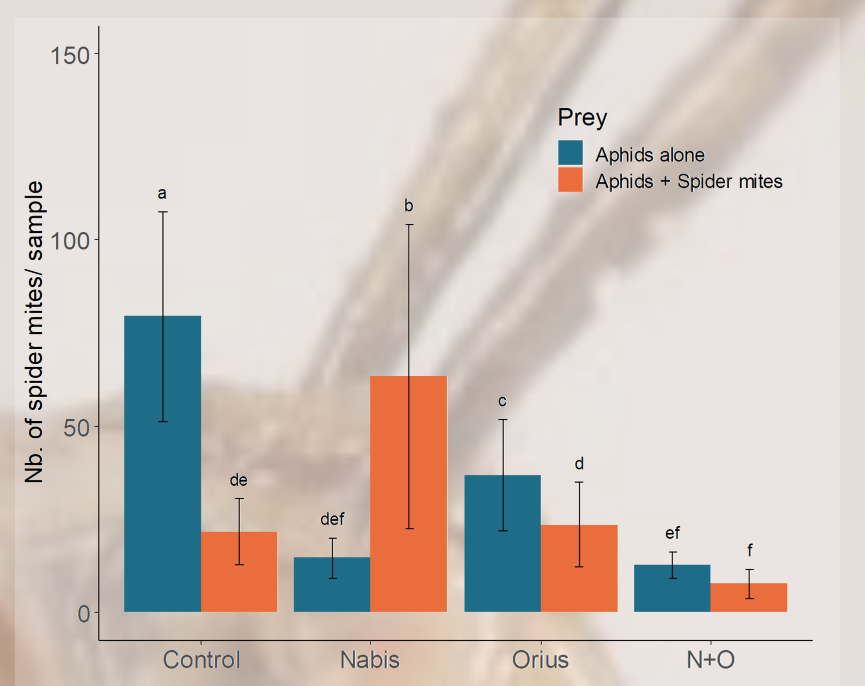
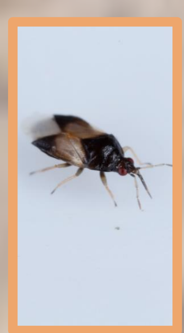


Fig. 4: Number of *Tetranychus urticae* per sample after 28 days based on predator and prey treatments. The different letters indicate statistical differences.

After 28 days, predatory ($p = 0.12$) and prey ($p = 0.65$) treatments had no significant individual effect, but the interaction between these factors indicates that the presence of alternative prey modulates predator behavior towards spider mites ($p = 0.02$).

No interactions between predator and prey treatments were observed after 14 days ($p = 0.22$) and 28 days ($p = 0.32$).

IGP & competition between predators



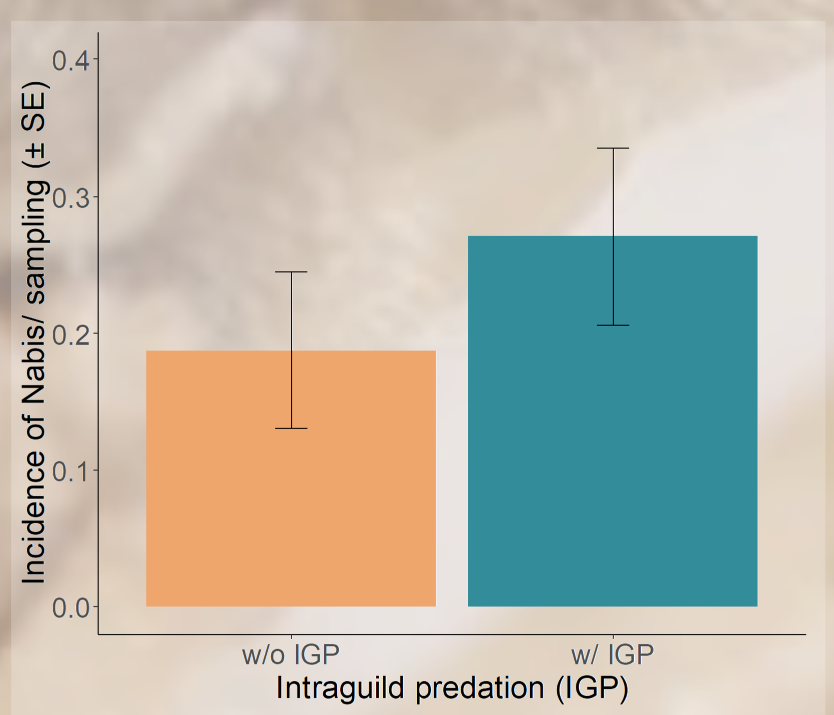


Fig. 5: Number of *Nabis* per sample after 28 days depending on the treatment of the presence or absence of intraguild predators. Different letters indicate statistical differences ($\alpha = 0.05$).

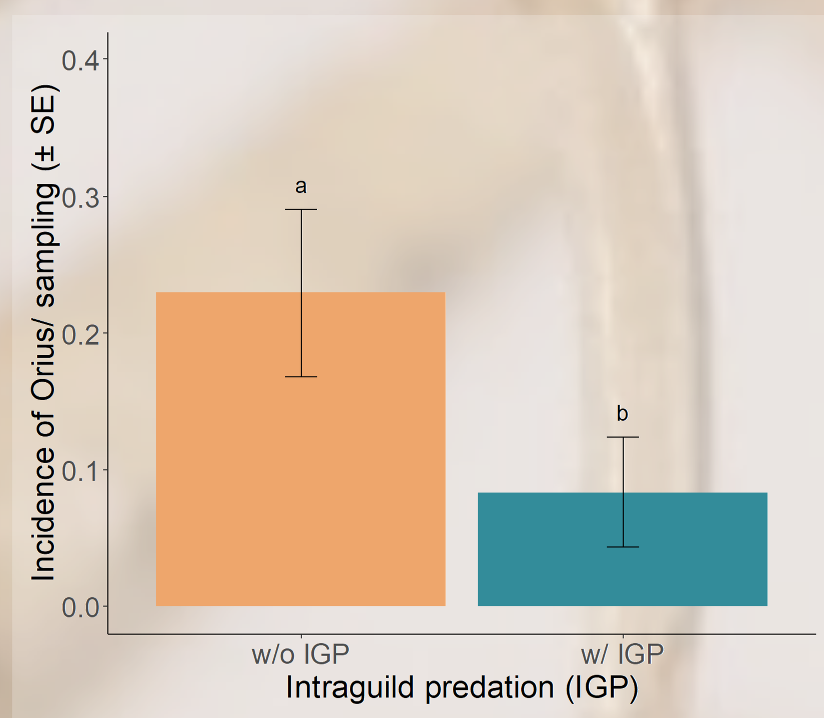
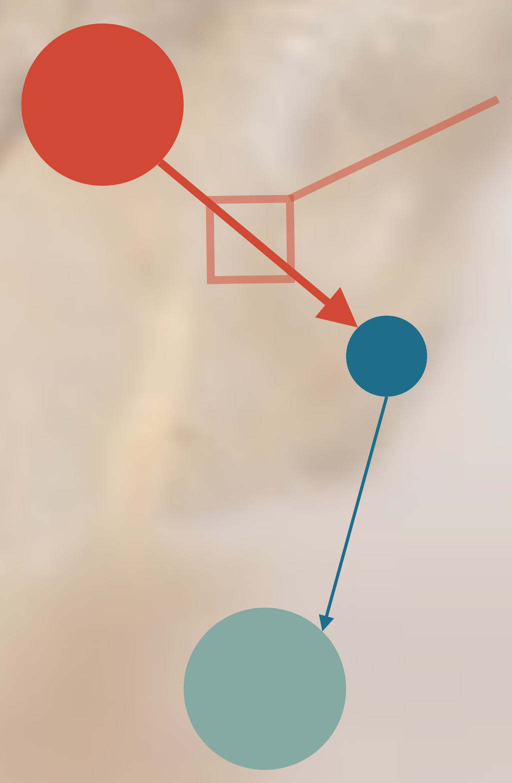


Fig. 6: Number of *Orius* per sample after 28 days depending on the treatment of the presence or absence of intraguild predators. Different letters indicate statistical differences ($\alpha = 0.05$).

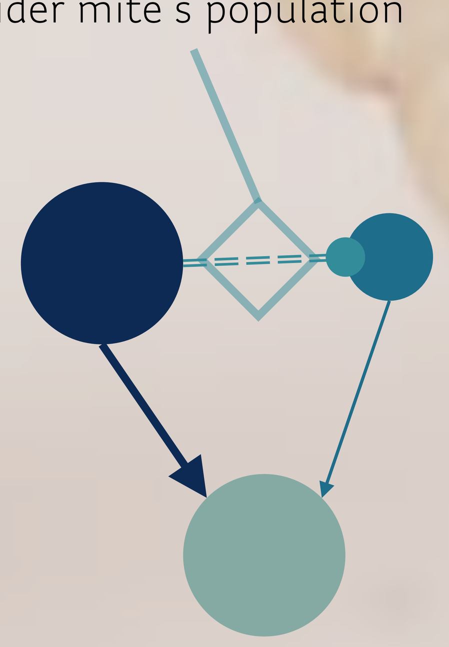
The presence of *Orius* had no significant effect on the *Nabis* population after 28 days ($p = 0.31$) (Fig. 5). Treatment of prey had no effect ($p = 0.65$). No interaction between these two factors was detected ($p = 0.50$).

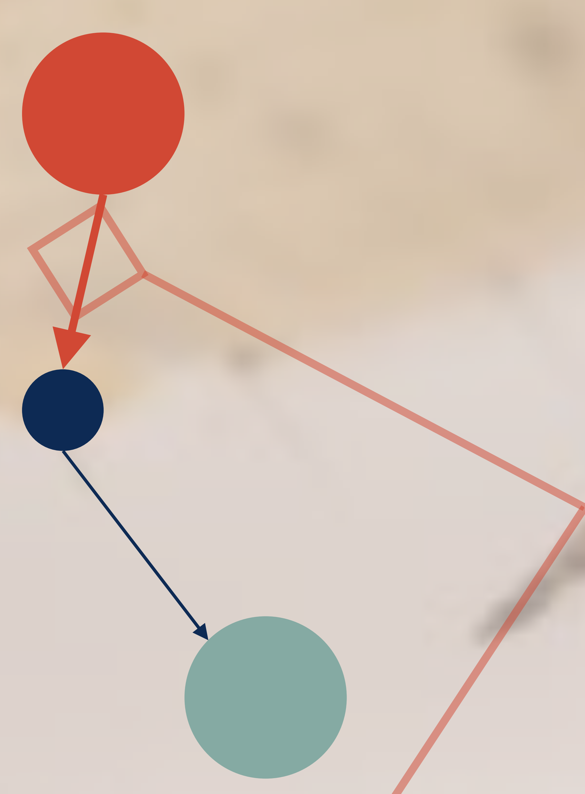
Nabis reduced *Orius* populations after 28 days ($p = 0.04$) (Fig. 6), but *Orius* was not influenced by prey treatment ($p = 0.60$). These two factors had no interactive effect ($p = 0.54$).

Conclusion



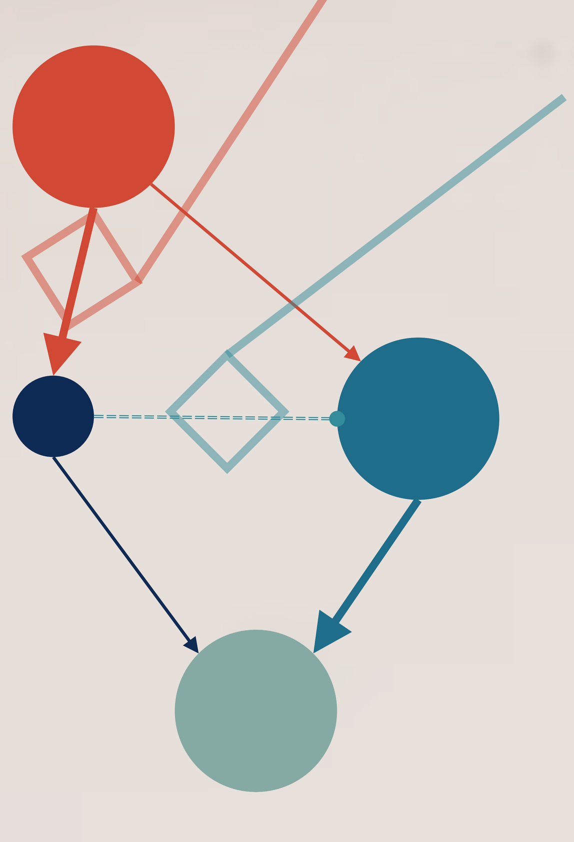
Nabis' predation and aphid's competition had similar effects on spider mite's population



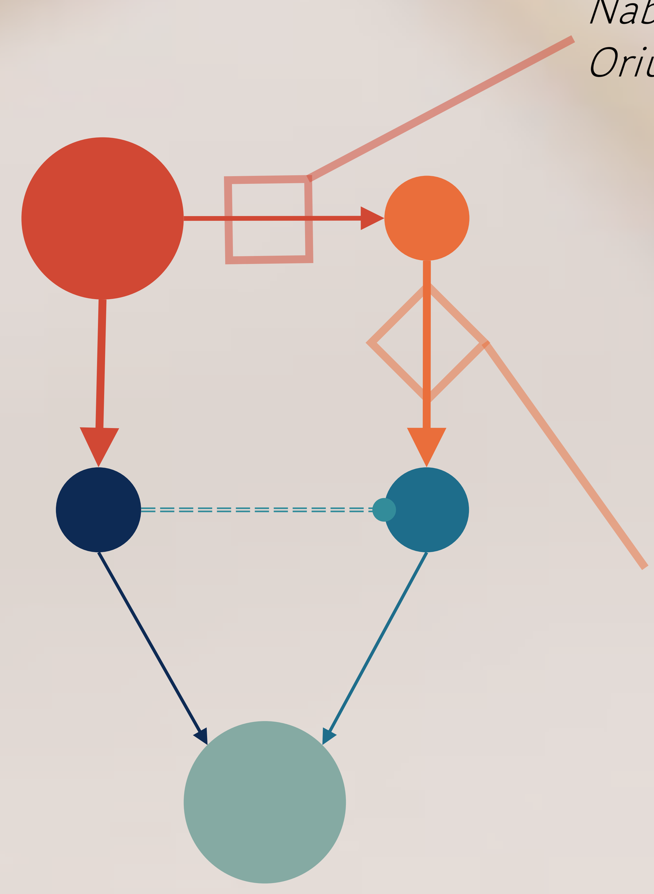


Nabis pressure on aphids is equivalent with or without spider mite.

Predation by *Nabis* on aphids reduces competition against spider mites and allows their population to grow.



Nabis can impact *Orius* density.



Together, *Nabis* and *Orius* reduced both aphid's and spider mite's populations

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