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Potential of damsel bugs for biological control of the tarnished plant bugs in fields and greenhouses

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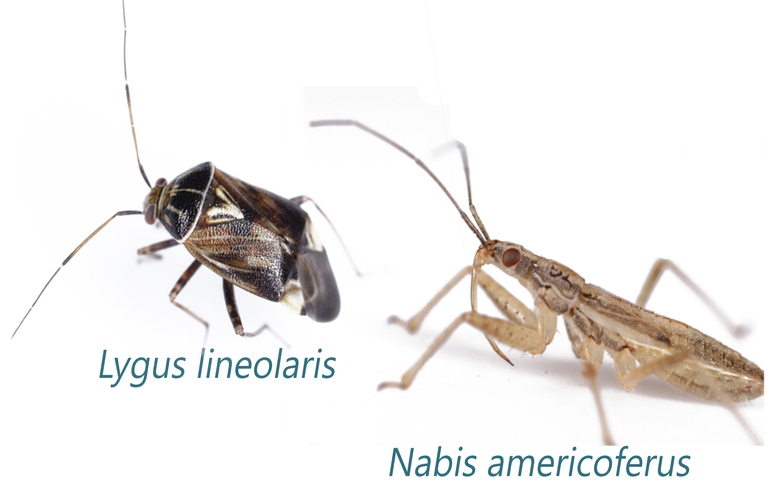

Lygus lineolaris

Nabis americoferus

Introduction

The tarnished plant bug (**TPB**), *Lygus lineolaris* (Palisot de Beauvois) (Hemiptera: Miridae) is a polyphagous pest that causes important economic damages in several crops. This phytophagous insect feeds on more than 350 hosts, of which about 120 are economically relevant (Young 1986). The TPB has several predators that can reduce its density in agroecosystems (e.g. predatory bugs, ladybeetles, spiders) (Arnoldi et al. 1991; Hagler et al. 2018). However, their potential in biological control is unknown.

In a recent study (Dumont and Provost 2019) on the effect of trap crops on TPB in strawberry fields, we observed that the damsel bug *Nabis americoferus* (Carayon) (Hemiptera: Nabidae) naturally colonize plots exploited by the TPB and are suspected to be the main contributor to the TPB's mortality (about 75% from small nymphs to adults).

The damsel bug feeds on every TPB's developmental stages and has a life cycle that matches the TPB (besides having high fertility). This predator is omnivorous and feed on several crop pests including aphids. Hence, these predators have interesting potential as biological control agents of the TPB in both field and greenhouse crops.

Main objective

Determine the potential of the damsel bug as biological control agent of the tarnished plant bug in both field and greenhouse crops.

Laboratory tests: level of predation

Methods

Experimental design

Prior to the test, nabis was fastened for 24h. Then, nabis was allowed to feed on 15 TPB prey for a period of 24h. The insects were kept in a plastic box (10 x 10 x 8 cm) on a strawberry leaf.

Conclusions

- All stages of *Nabis* feed on equivalent or lower stages of TPB.

Results

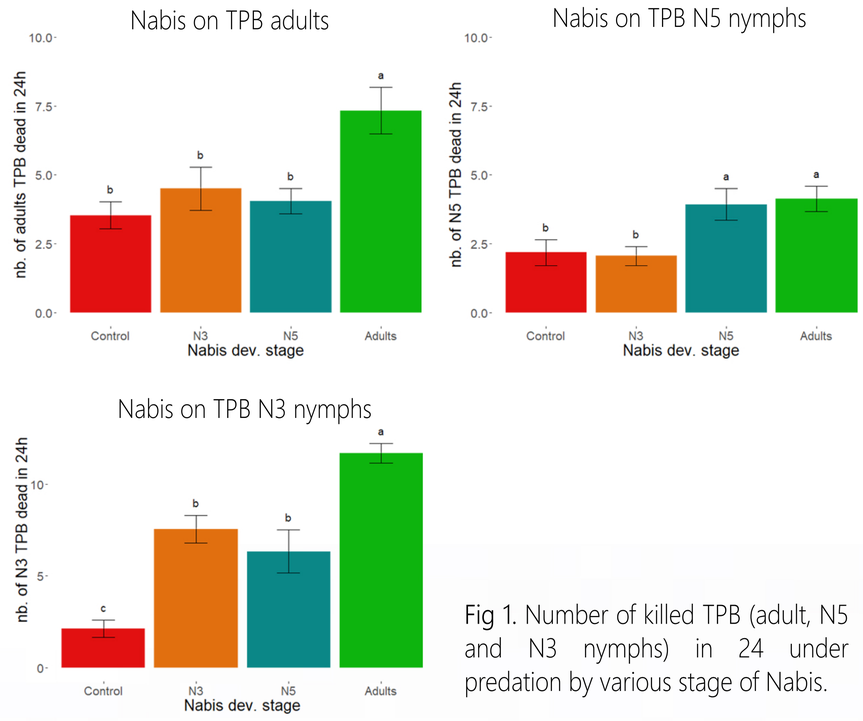

Fig 1. Number of killed TPB (adult, N5 and N3 nymphs) in 24 under predation by various stage of Nabis.

Strawberry field

Methods

Experimental design

Fourty eight plots were implanted in June 2019. Each plots contained 16 strawberry plants on a 2.5 m distance. A distance of 10 m were kept between plots. Each side of the plots (about 1 m) pigweed and ragweed were allow to grow.

Nabis' release

On August 7th 2019, 4, 8 or 12 N5 nymphs and immature nabis adults were release in each plots (12 rep by treatment). A control treatment without nabis was also done.

Population monitoring

The TPB was monitored weekly by beating two strawberry plants and one weed (pigweed or ragweed) by plots.

What we learned

Nabis effect last two weeks.

Higher density of nabis had a significant effect on TPB population that last about two weeks (Fig. 2).

High nabis density had local effect

On day 231 (August 20th), the number of TPB was significantly lower in plot where 12 nabis were released ($p = 0.01$) (Fig. 3).

Ragweed > pigweed > strawberry

Most TPB were observed on ragweed and, in a lesser extend, on pigweed ($p < 0.0001$) (Fig. 3), but no interaction between the host plant and the treatment was observed ($p = 0.11$).

Results

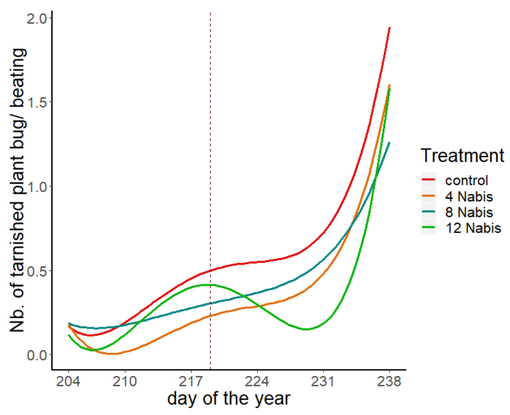

Fig 2. Number of TPB by beating on strawberry plants, pigweed and ragweed (pooled) in function of the number of nabis released. The dashed line indicates the release date.

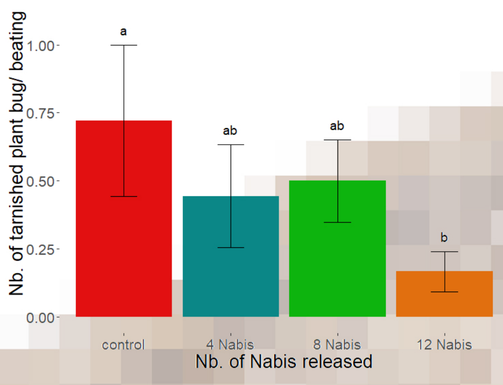

Fig 3. Effect of the number of Nabis released on the TPB population two weeks after the release (on day 231).

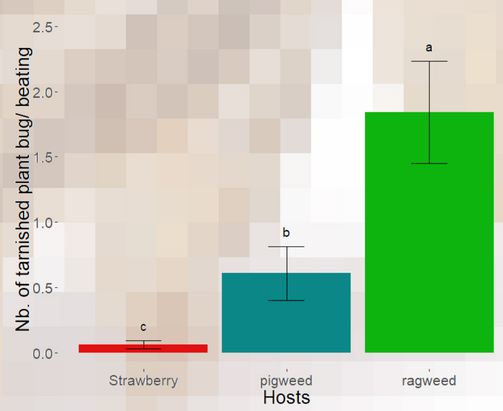

Fig 3. Number of TPB by beating on strawberry plants, pigweed and ragweed on day 231 (two weeks after the release).

Cucumber greenhouse

Methods

Experimental design

Fourty cages containing 5 cucumber plants were installed in a greenhouse. Each were attributed one of these treatments:

1) 25 TPB (L5 and young adults) + 50 aphids (*Aphis gossypii*) (control);

2) 25 TPB + 50 aphids + 3 nabis (2F + 1M);

3) 50 aphids + 3 nabis;

4) 25 TPB + 3 nabis.

Population monitoring

TPB, nabis and aphids population were estimated weekly

What we learned

Nabis had an early effect.

One week after the release, Nabis significantly decrease TPB when aphids were not available ($p = 0.02$) (Fig. 5 & 6).

It's now or never (for the TPB)

The TPB responded to the risk of predation by investing massively in their reproduction, which lead to a significant higher population on week 6 ($p < 0.0001$) (Fig. 5 & 6).

Nabis prefers aphids?

Nabis generates more nymphs on a diet that include aphids ($p < 0.0001$) (Fig. 7).

Results

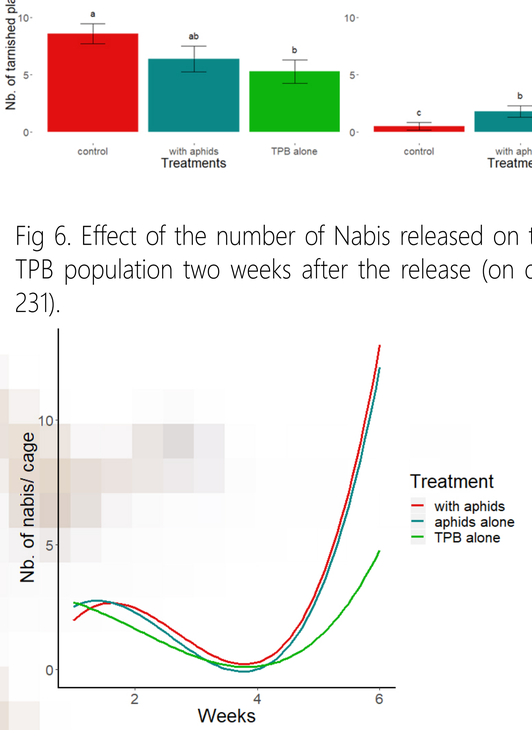

Fig 5. Number of TPB by cage on cucumber plants in function of the treatment.

Fig 6. Effect of the number of Nabis released on the TPB population two weeks after the release (on day 231).

Fig 7. Number of nabis by cage on the 6th week.

References

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Arnoldi, D., Stewart, R. K., & Boivin, G. (1991). Journal of economic entomology, 84(3), 830-836.
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