Dicyphus cerastii Wagner (Hemiptera: Miridae) a biological control agent for more sustainable horticulture

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1. Introduction

Biological control of crop pests is an environmentally friendly alternative to the use of pesticides. The use of natural enemies like mirids (Hemiptera: Miridae) contributes to more sustainable production in horticultural crops. *Dicyphus cerastii* Wagner **(Fig.1)** is found in the Mediterranean basin, and in Portugal, it colonizes low pesticide pressure tomato greenhouses, both in the mainland and in the Azores. *Dicyphus cerastii* preys on several horticultural pests and, therefore, it is an interesting candidate as biological control agent (BCA) on these crops.

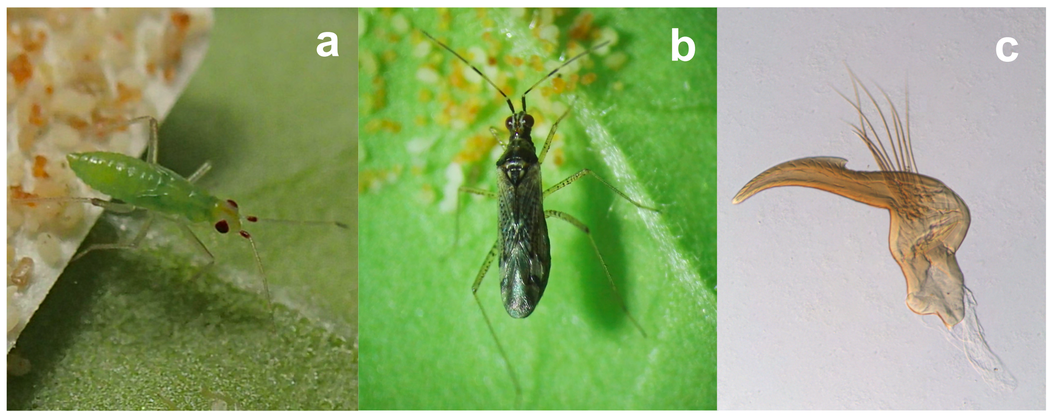

Fig. 1 – *Dicyphus cerastii* 4th instar nymph (a), adult female (b), and left paramere of male genitalia (c).

Table 1 – Mean (+SE) developmental period, longevity and fertility of *Dicyphus cerastii* on tomato, at different temperatures.

Temperature (°C)	Development (d)		Longevity (d)	Fertility (nymphs)
	Embryonic	Post-Embryonic		
15.0	30.6 ± 0.4	40.0 ± 0.5	158.6 ± 11.8	-
20.0	16.5 ± 0.3	25.1 ± 0.5	70.9 ± 8.1	159.6 ± 23.1
25.0	11.2 ± 0.3	20.0 ± 0.4	35.7 ± 3.9	116.5 ± 14.6
27.5	9.8 ± 0.2	16.1 ± 0.3	12.4 ± 1.1	-
30.0	9.6 ± 0.3	16.4 ± 0.3	13.8 ± 1.6	0
32.5	9.7 ± 0.2	nd	-	-
35.0	nd	nd	-	-

(nd) no development; (-) not performed

2. Development and reproduction

Mirid species have distinct thermal thresholds for their development and reproduction. This had not been studied previously for *Dicyphus cerastii.* In order to further understand the advantages or limitations of this species as a BCA, embryonic and post-embryonic development was recorded at different temperatures on tomato, tobacco and *Physalis* sp. (host plants on which it is also found). Reproduction was studied on tomato (**Table 1**). Preliminary results indicate that *Dicyphus cerastii* performs better at cooler temperatures, and that at warmer temperatures it may be outperformed by competitors like *Nesidiocoris tenuis* (Reuter).

3. Functional response and predation rates

Predation was evaluated on four different prey: *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) 4th instar nymphs, *Ephestia kuehniella* Zeller (Lepidoptera: Pyralidae) eggs, *Myzus persicae* (Sulzer) (Hemiptera: Aphididae) 1st instar nymphs and *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) eggs. The predator exhibited type II functional response for all prey tested and showed high predation rates when compared to other dicyphine mirids (**Fig. 2**).

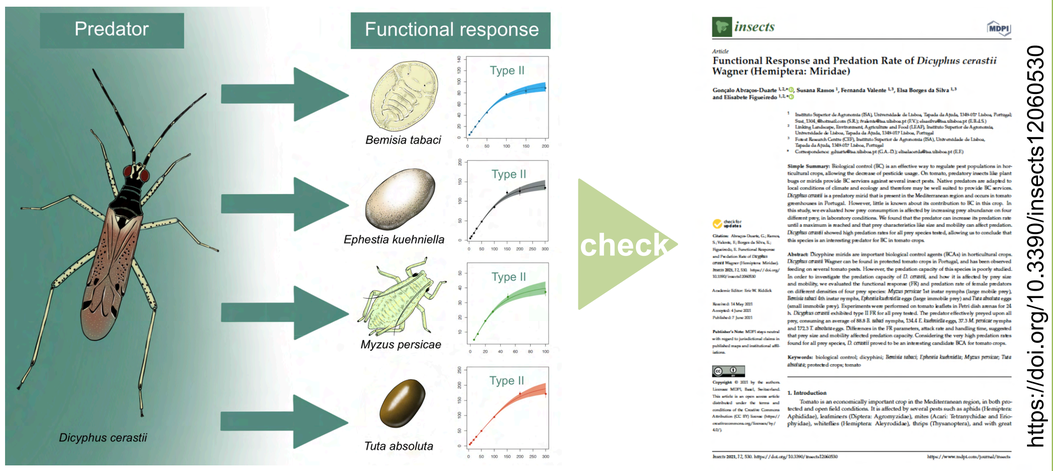

Fig. 2 – Functional response and predation rate of *Dicyphus cerastii* on *Bemisia tabaci* 4th instar nymphs, *Ephestia kuehniella* eggs, *Myzus persicae* 1st instar nymphs and *Tuta absoluta* eggs.

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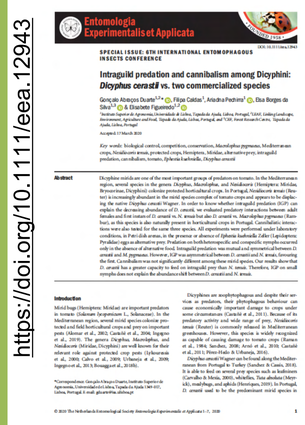

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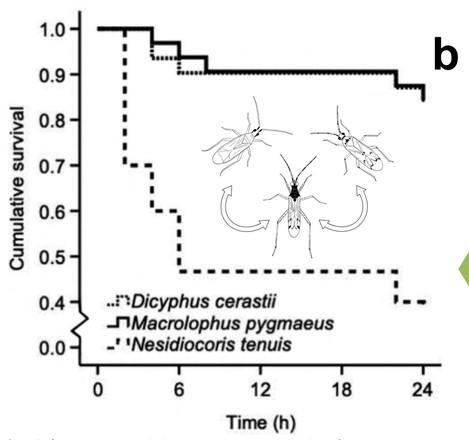

Fig. 3 – *Dicyphus cerastii* feeding on *Nesidiocoris tenuis* nymph (a), 1st instar mirid nymph survival under predation by *Dicyphus cerastii* (b).

4. Intraguild predation

Dicyphine mirids are generalist predators that may display cannibalistic and intraguild predation interactions. These interactions were evaluated between adult females and 1st instar nymphs of *D. cerastii* and two commercialized species: *Macrolophus pygmaeus* (Rambur) and *N. tenuis*. *Dicyphus cerastii* females consumed more *N. tenuis* 1st instars than the other two species **(Fig. 3)**.

5. Conclusions

Dicyphus cerastii is an interesting candidate BCA as it is a generalist and feeds on high numbers of prey. Despite this, its thermal thresholds and long developmental period may curb interest in its mass rearing as it may be outcompeted by other currently commercialized species like *N. tenuis*. Therefore, it is likely that this species may contribute to biological control essentially through conservation strategies (creating and managing favorable habitats near crops). Further research is needed to enable efficient conservation biological control strategies with this species on horticultural crops, aiming at more sustainable production

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