

HAS TIGER-FLY A ROLE IN BIOLOGICAL CONTROL OF PROTECTED CROPS?

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INTRODUCTION

The tiger-fly, *Coenosia attenuata* Stein, is present worldwide. In protected crops, in the adult stage, tiger-fly is the unique known predator of adults of leafminers, whiteflies, fungus gnats, cicadelids, drosophilids (Kühne, 1998; Moreschi & Colombo, 1999) and it preys also winged aphids (Prieto *et al.*, 2005) and adult thrips (Pinho *et al.*, 2009). It has been reported as having little impact on natural enemies (Téllez & Tapia, 2009; Garcia, 2011; Martins *et al.*, 2012), and so it may be a promising biological control agent to take into account in conservation strategies. For improving its populations, open rearing units can be placed inside greenhouses. The optimization of the rearing methodology and the evaluation of the impact and efficacy of *C. attenuata* as a predator are important tasks to allow the growers to use this predator towards sustainability.

REARING

Assays

The “three-steps” rearing methodology described in literature was adapted/ modified:

- ✓ Larvae were reared on a highly humidified rearing substrate, infested with abundant fungus gnats larvae, made with soil rich in organic matter, mixed with oat flakes inoculated with the fungus *Pleurotus ostreatus*, and with coconut fiber. Adults were fed with fungus gnats and drosophilid adults.
- ✓ Assay 1 - Tiger-fly adults (one, five or ten couples per cage) from laboratory rearing units and collected in the field were introduced in 35x35x58 cm cages of transparent tissue (“étamine”) with the rearing substrate and a metal structure (like a perch).
- ✓ Assay 2 - Three types of substrate were tested: soil rich in organic material (S); a mixture (M) of soil and coconut fiber (1:1); two portions of shredded coconut fiber, each in one side of the central portion of the soil (CS).
- ✓ After 20 days, each substrate was placed in a new cage without *C. attenuata* adults and without being humidified. Emergence of the tiger fly adults was checked upon one week after the last emergence.

Main Results

- ✓ Rearing cages with 10 parent couples gave good results, and cannibalism was avoided when adult preys were abundant;
- ✓ No significant differences were detected regarding the number of emerged descendants of the first generation per couple, sex ratio, duration of the mating-oviposition-development period (MODP) and the period that the 1st generation emergences lasted (EP), both among the three number of couples per cage and between the two origins;
- ✓ There was a moderate correlation between the number of fungus gnat larvae in the substrate and the number of emerged tiger-fly adults ($y = 9.617 \cdot 10^{-9}x^3 - 3.884 \cdot 10^{-5}x^2 + 0.057x + 1.786$; $N=57$; $F=33.684$; $r^2=0.656$; $p<0.001$);
- ✓ The MODP, but not EP, and the minimum, maximum and average temperatures in the rearing room were significantly, negative and highly correlated;
- ✓ CS presented significant lower values of fungus gnat larvae ($F=82.25$; d.f. =3, 33; $p<<0.001$) and M presented significantly higher values on the number of total descendant emergences ($F=13.95$; d.f. =2, 22; $p<<0.001$). No differences were found either regarding the MODP or the EP.

EARTHWORM MUCUS

Assays

- Assay 1: In 9 cm ø Petri dishes: water saturated cotton disk and, above it, a humidified filter paper with five adult earthworms *Lumbricus terrestris* L. (Opisthopora: Lumbricidae) for at least one hour, and removed afterwards; by this procedure mucus was produced abundantly on the filter paper;
- Assay 2: in 9 cm ø Petri dishes: substrate infested with fungus gnats larvae, and above it, a humidified filter paper
- *C. attenuata* female (10-12 days after emergence, copulated) were put inside the dish;
- In each repetition, a test (with mucus or substrate with fungus gnat larvae) and a control (cotton disk and filter paper saturated with water without mucus) were in sequence; 80 repetitions were performed;
- The number of laid eggs and the number of times the tiger-fly female extended her ovipositor in a 10 minutes period, at room temperature (20-25°C), were recorded;
- The assays were performed in the first three of the last four hours of the 14h photoperiod, since oviposition of *C. tigrina* is more abundant in this period (Morris & Pivnick, 1991).

Main Results

- ✓ In laboratory conditions, mucus produced by earthworms and substrate infested with fungus gnat larvae induced the tiger-fly females :

- to extend more times their ovipositors
- to lay more eggs in some situations

- ✓ Mucus can act as a kairomone? (Figueiredo *et al.*, 2012)

However, in preliminary tests only sliced earthworms were preyed; alive intact specimens were not preyed

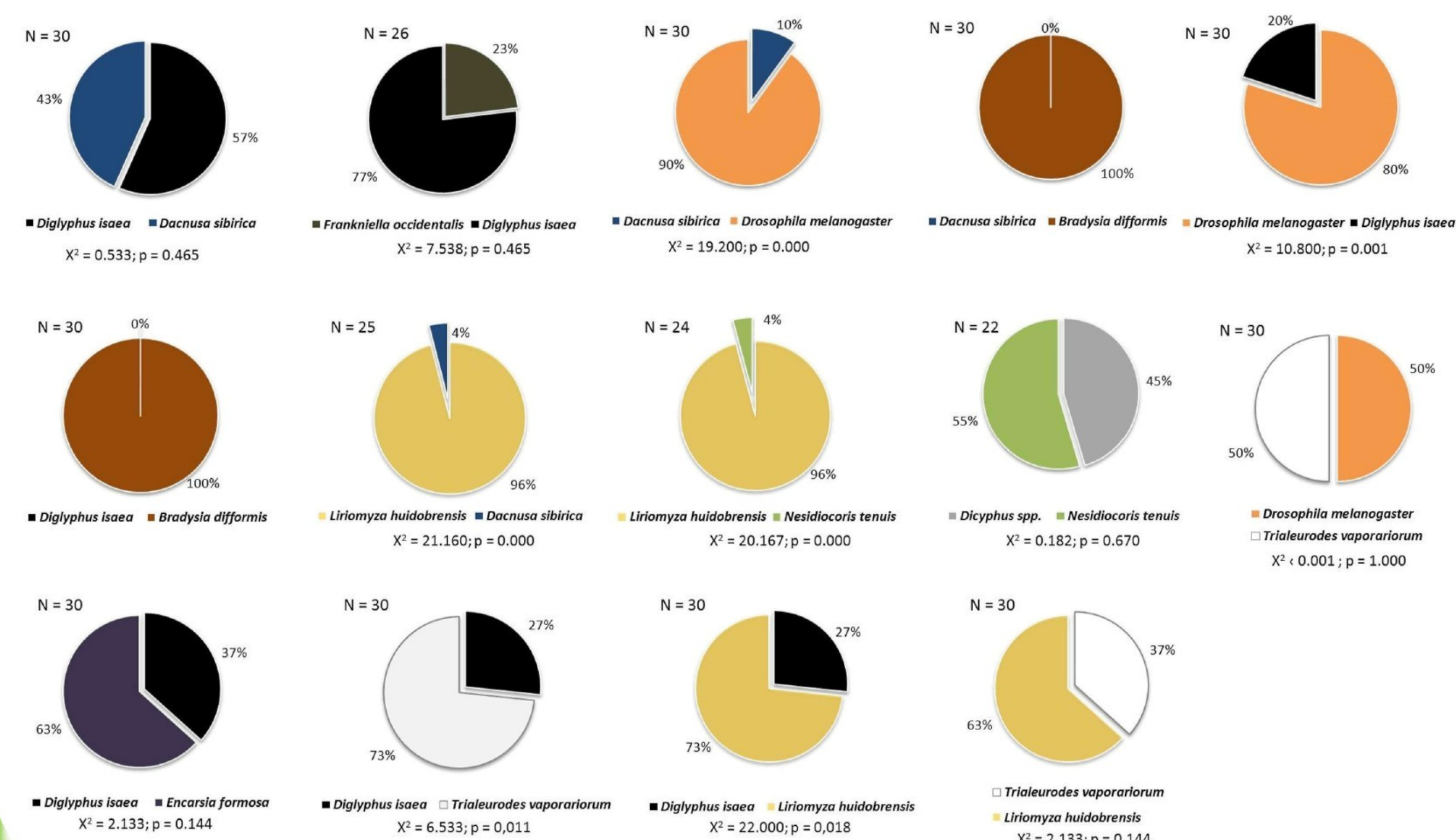


PREYS PREFERENCE

Assays

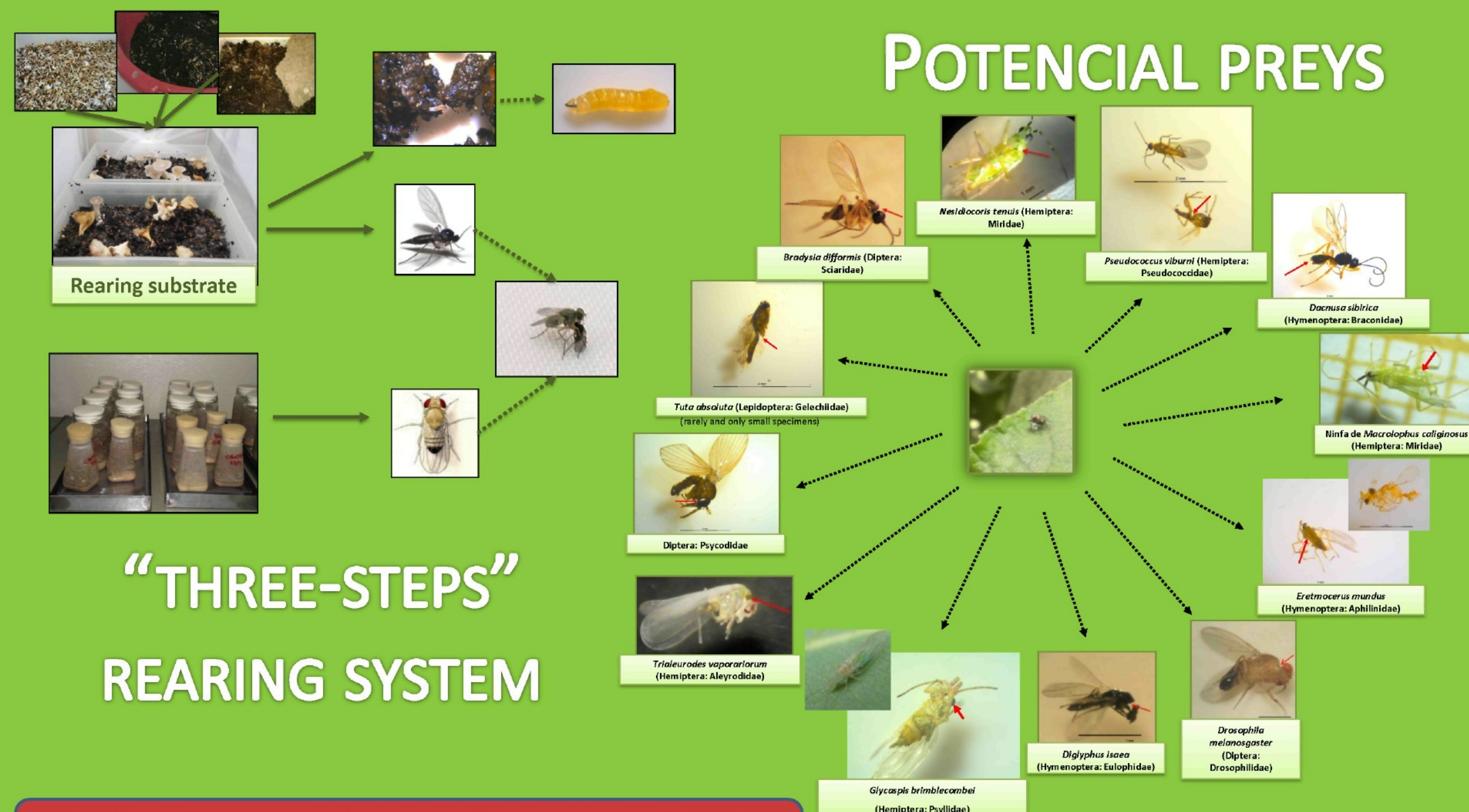
Preys were tested for preference in a two choice arena: one tiger-fly female and one specimen of each of two species at the same time, in 30x30x40 cm³ cages

Main Results



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“THREE-STEPS” REARING SYSTEM

POTENCIAL PREYS

Main Results

- ✓ The predation capacity and behaviour of *C. attenuata* was studied in laboratory in relation to several pests, parasitoids and predators, and all *taxa* tested were preyed;
- ✓ Tiger-fly has been collected in three agro ecosystems in Portugal:
 - Protected crops – predating mainly Sternorrhyncha and Diptera
 - Citrus orchards - in beating techniques
 - Eucalyptus plantations – predating Sternorrhyncha: Psyllidae;
- ✓ Predation on wingless but fast moving insects (e.g. mirid nymphs) was observed in laboratory;