Effect of different food resources on longevity, ovarian dynamics and body nutrient levels of fruit fly parasitoids

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♦ Introduction

To optimize biological control programs, parasitoid nutritional ecology is increasingly taken into account (Lee & Heimpel, 2003). Although nutritional requirements of parasitoids such as *Diadegma insulare* (Cresson), *Pseudacteon tricuspis* Borgmeier, *Macrocentrus grandii* (Goidanich) and *Cotesia glomerata* (L.) have been well-quantified, the nutritional ecology of natural enemies of key pests such as fruit flies (Diptera: Tephritidae) remains to be investigated. In their natural habitat, fruit flies enjoy ample access to damaged fruits, which constitute sugar sources and could greatly benefit wasp fitness. In some baseline assays, Sivinsky *et al*, (2006) demonstrated that the braconid *Diachasmimorpha longicaudata* utilizes fruit juices to increase its longevity. However, it's necessary to complement this seminal work with a further elucidation of the effect of fruit-based resources on distinct fitness components of some of the most important fruit fly parasitoids.

Hence, in this study we measured a set of fitness parameters (i.e., longevity, ovarian dynamics and body nutrient levels) of *D. longicaudata* and the figitid *Aganaspis pelleranoi* (Brèthes), fed on different diets. *A. pelleranoi* is a native parasitoid that attacks fruit flies in the Neotropics and *D. longicaudata*, is an exotic endoparasitoid used in augmentative biological control of fruit flies worldwide (Ovruski, 2000).

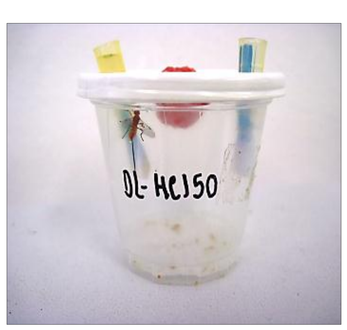
♦ Methods & Materials

• Study insects: Laboratory-reared individuals of *A. pelleranoi* and D. *longicaudata*.

• Treatments: Individuals of both species were subject to:
a) Honey + Water b) Pollen + Water c) Guava juice + Water d) Honey + Pollen + Guava juice + Water and e) Water control

•Longevity essay: Newly emerged, unmated individuals of each species were placed singly in a 90 ml plastic cup, provided with above diets and kept at 25º C, 75% RH, 12L:12D. Per treatment, species and sex, a total of 20 wasp were included and checked daily for mortality.

• Body nutrient levels: Newly emerged wasps were placed singly in 90 ml plastic cups and subject to different treatments. Live wasps were collected and frozen at −20°C on days 0 (newly emerged), 2, 4, 6, 8 and 10. At the different ages, ten individuals of each species and sex were collected from each of the treatments. Females were dissected the number of mature eggs was counted. Also, through biochemical assays modified by Olson *et al*., (2000), Lee *et al*., (2004) and Wyckhuys *et al*., (2008), we determined glycogen, fructose and total sugar levels of both species.



♦ Results

Longevity:
Females and males of both species lived longer when honey and combined treatment of honey, pollen, guava juice and water were provided. Both species lived longer with honey than in treatments with solely guava juice or pollen (Fig. 1). Furthermore, longevity of individuals with access to guava juice did not differ from individuals with access to water.

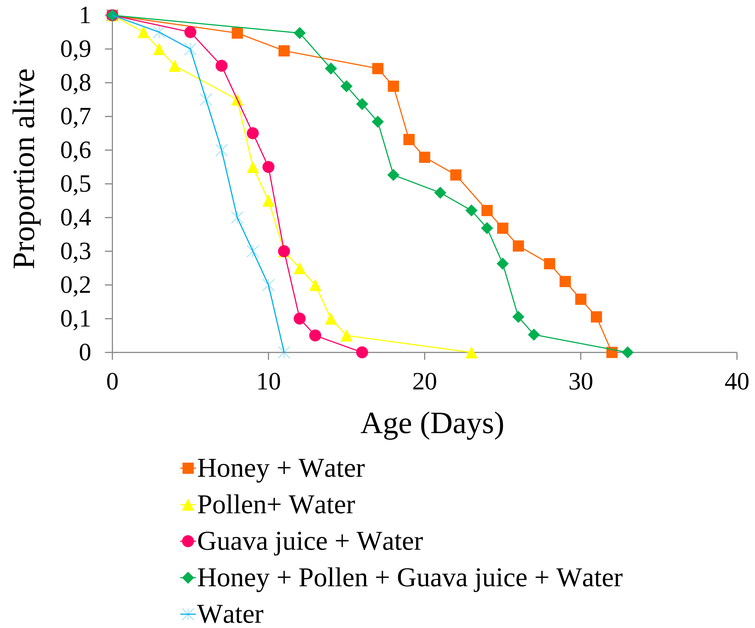


Fig. 1. Survivorship curves for females *A. pelleranoi* and provided of five diets (X^2=14.652; gl=1; P<0.000)

Ovarian dynamic:
Multiple regression analyses showed that age affects egg load of *D. longicaudata*, while age and treatment significantly affects the egg loads in *A. pelleranoi*. Egg loads of *A. pelleranoi* did not differ between females provided with guava juice and newly emerged ones. In *D. longicaudata*, no differences were found in egg load of wasps feeding with honey and guava juice or pollen.

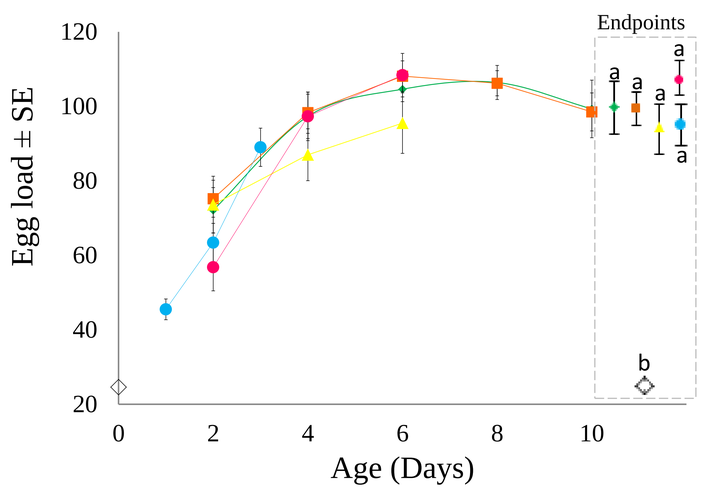


Fig. 2. Egg load of newly emerged female *D. longicaudata* and those in five diets over their entire lifespan. Females given honey, pollen, guava juice, combined treatment and water had a significant regression between age and egg load (P=0.002, r^2=0.17, slope=2.72, intercept=80.91; P=0.047, r^2=0.13, slope=5.47, intercept=63.46; P=0.000, r^2=0.55, slope=13.18, intercept=35.13; P=0.003, r^2=0.17, slope=3.17, intercept=76.89, P=0.000, r^2=0.62, slope=21.75, intercept=22.46). Emergent and endpoint egg loads significantly differed (F=24.05, d.f. =5, P = 0.000).

♦ Results

Nutrient levels:
Newly emerged wasps of both species had low glycogen levels, which did not differ from wasps subject to water, pollen or guava juice (Fig. 3). Glycogen levels of females that had fed on honey were significantly higher than those of newly emerged ones. No significant regressions between age and glycogen levels were found. In multiple regressions, diet significantly affected glycogen levels in both species when comparing honey vs. guava juice and honey vs. pollen diets.

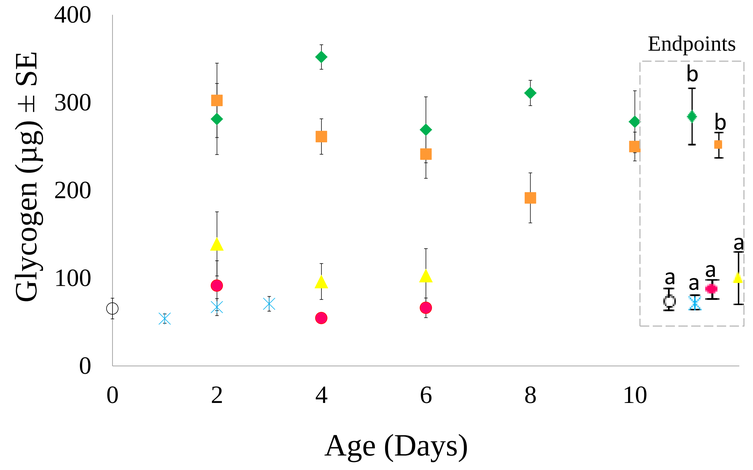


Fig. 3. Glycogen levels (± SE) in females *D. longicaudata* that were newly emerged and under five treatments over a period of 10 days. Emergent and endpoint glycogen levels significantly differed in an overall ANOVA (F = 11.10, P<0.000)

Fructose levels in newly emerged wasps were low in both species, and did not differ from those of wasps with access to water or guava juice (Fig. 4). Females with access to honey had higher fructose levels than newly emerged wasps or those with access to water. In multiple regressions, diet significantly affected glycogen levels in both species when comparing honey vs. guava juice and honey vs. pollen diets.

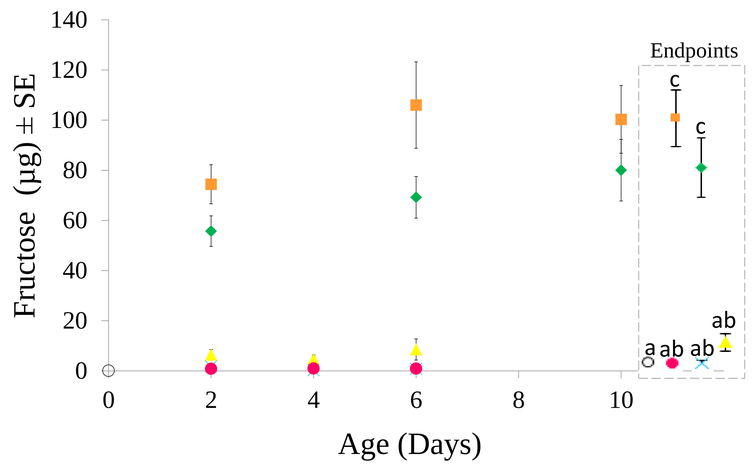


Fig. 4. Fructose levels (± SE) in females *A. pelleranoi* that were newly emerged and under five treatments over a period of 10 days. Emergent and endpoint fructose levels significantly differed in an overall ANOVA (F = 35.50, P<0.000)

♦ Conclusion

This work shows that access to honey significantly increases longevity, egg load and glycogen, fructose and total sugar levels in 2 species of fruit fly parasitoids. Hence, natural (extra-)floral nectar sources or artificial sugar sprays may have potential to augment efficacy of *A. pelleranoi* and *D. longicaudata* for fruit fly biological control.