



Consequences of developmental temperature on the parasitoid *Aphidius colemani* Viereck (Hymenoptera: Aphidiinae) efficiency on the aphid *Aphis gossypii* Glover (Homoptera: Aphididae)

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Abstract: The use of parasitoids for biological control of aphids is being increasingly practiced in a large number of crops (Hance et al., 2017). However, in the Mediterranean region, the high temperatures occurring during the vegetative season are a limiting factor affecting parasitism rate or even parasitoid survival (Jerbi-Elayed et al., 2015). Parasitoids are usually mass-produced under controlled conditions and released in large quantities. By modifying the phenotypic characteristics of parasitoids, such as size but also some behavioral capacities, rearing temperatures can influence their efficiency but also be a way to improve their thermal tolerance (Wu et al., 2011). The aim of this work was to analyze the consequences of three development temperatures (10, 20 and 28 °C) on the maximum critical thermal limits that adults of the aphid parasitoid *Aphidius colemani* can tolerate when reared on *Aphis gossypii*. In addition, we analyzed the effect of development temperatures on a series of parameters such as size, dry mass, lipid content, number of eggs at emergence and longevity of parasitoids. We also analyzed their host-search behavior in an air-conditioned room at 28 °C and 50% relative humidity on a light table (273 lux). The females were transferred one by one into this chamber in contact with 25 third instar larvae of *A. gossypii* on a piece of cucumber leaf. For each female, we recorded, the duration of walking behavior, the number of antennal contacts, the number of ovipositor contacts and the residence time.

It appears that the development temperature significantly influences the maximum critical thermal limit of adult parasitoids, with the most tolerant individuals to high temperatures being produced at 20 °C. When reared at this temperature, although individuals are mid-size, they are also the ones with the highest lipid content and the highest longevity. These specimens also achieved the highest number of ovipositor contacts and the highest percentages of parasitism. Thus, it appears that even if *A. colemani* individuals raised at 10 °C are of larger size, they remain less efficient because of trade-offs in energy allocation, more oriented towards the maintenance and the development than to reproduction. In contrast, individuals raised at 28 °C are small as predicted by the size-rule temperature (Colinet et al., 2007) and are also less efficient for most of the tested parameters.

Key words: temperature size-rule, developmental plasticity, thermal limit, *Aphidius colemani*, *Aphis gossypii*

References

Colinet, H., Boivin, G. and Hance, T. 2007. Manipulation of parasitoid size using the temperature-size rule: fitness consequences. *Oecologia* 152(3): 425-433.

- Hance, T., Kohandani-Trafresh, F. and Munaut F. 2017. Biological control. In: Aphids as Crop Pests, 2nd ed. (eds. van Emden, H. F. and Harrington, R.): 448-493. CABI, Wallingford.
- Jerbi-Elayed, M., Lebdi-Grissa, K., Foray, V., Muratori, F. and Hance, T. 2015. Using multiple traits to estimate the effects of heat shock on the fitness of *Aphidius colemani*. Entomol. Exp. Appl. 155(1): 18-27.
- Wu, G. M., Barrette, M., Boivin, G., Brodeur, J., Giraldeau, L. A. and Hance, T. 2011. Temperature influences the handling efficiency of an aphid parasitoid through body size-mediated effects. Environ. Entomol. 40(3): 737-742.