

# Winter and spring ecology of *Anaphes nitens*, a solitary egg-parasitoid of the *Eucalyptus* snout-beetle *Gonipterus scutellatus*

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**Abstract** We investigated the effects of temperature, photoperiod, food and host availability, and body size on the overwintering abilities of the egg parasitoid *Anaphes nitens* Girault (Hymenoptera, Mymaridae) under natural conditions. Seven groups of eighty females received one of four treatments ( $n = 20$ ): (i) honey and hosts, (ii) water and hosts, (iii) honey, or (iv) water. Seven groups of forty males received only honey or water ( $n = 20$ ). To test if short day-length is the main cue for larval dormancy, the experiment was replicated inside a climate chamber at 20°C and under a winter photoperiod. *A. nitens* overwinters because of quiescence or oligopause inside the hosts and increased adult longevity. Mean pre-emergence mortality was up to 26% indoors and 15.2% outdoors, males being more affected. Development time had a

significant and positive effect on body size. Honey-fed females without hosts had the highest longevity (53 days). Mother's diet and size affected development time, body size, longevity, and fecundity of the progeny. The results confirm the good adaptation of the parasitoid to the environmental conditions of NW Spain and its ability to synchronize its life cycle with the phenology of the host.

**Keywords** Body size · Development time · Longevity · Maternal effects · Quiescence

## Introduction

The habitat use and the survival of the insects used as biological control agents during winter may have important consequences for natural pest control. In temperate regions, it is crucial for hymenopterous parasitoids to synchronise their life cycle with host availability, for optimal exploitation of resources and maximising offspring number during the next spring (Tauber and Tauber 1976). Photoperiod is an important indicator of the coming winter season and insects of temperate zones often use day-length to predict unfavourable conditions. Temperature is another, but less reliable, factor which plays a modifying role in the photoperiodic response.

Diapause is an adaptive trait which allows the insects to arrest growth and/or feeding and/or reproduction, and to survive in a state of low metabolic activity when

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