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Behavioural observations of the bodyguard mite *Ensliniella parasitica**

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Abstract

In a mutualistic relation between a potter wasp, *Allodynerus delphinalis* (Giraud) (Hymenoptera: Vespidae), and its specific parasitic mite, *Ensliniella parasitica* Vitzthum (Winterschmidtiidae), behaviour of the mite guarding the wasp and attacking their common natural enemy, *Melittobia acasta* (Walker) (Hymenoptera: Eulophidae), was examined. While mite attacks to *M. acasta* occurred by accidental physical contact, the counterattack by the parasitoid occurred 24 h after both were released onto their mutual host. The two organisms fought until one of them died in our experimental arena, which the parasitoid could not escape from to avoid combat. It was not possible to determine what the behaviour of the parasitoid would be had it been able to escape. Mite phoretic behaviour was also examined to understand the mechanism by which both the host wasp and the mite could reap reciprocal benefits from the presence of acarinaria on the wasp. The results suggested that the newly emerged host wasp might have an attractant to collect the necessary number of mites in an acarinarium, which would later function as guards of its offspring, given that around 46% of mite deutonymphs were able to migrate into one of the acarinaria within only 10 min after they were put together in an experimental arena. To more fully understand the strategy of each organism involved in this mutualism, further observation on their behaviour is needed.

Key words: *Allodynerus delphinalis*, *Ensliniella parasitica*, host searching behavior, mutualism, parasitism.

Introduction

Life histories of mites and insects represent a broad spectrum of symbiotic interactions, from parasitism to mutualism and phoresy. Although the ecological status of many ectoparasitic and phoretic mites is relatively well known (e.g., parasitengone larvae are parasites and many free-living mesostigmatids and astigmatids are phoretic) (Krantz & Walter, 2009), other interactions are obscure and their ecological nature rarely proven. Some examples of other interspecific relations involve tarsonemid mites carrying ascospores of *Ophiostoma* fungi (Ascomycetes), which tend to outcompete mutualistic fungi carried by bark beetles in whose galleries they live (Lombardero *et al*., 2003), and *Poecilochirus necrophori* Vitzthum (Parasitidae), which has a mutualistic relationship with *Necrophorus* burying beetles by preying on natural enemies of juvenile beetles (Wilson, 1983). In both cases, phoresy of mites on the symbiotic insects seems to play a key role in their relationships.

Acarinaria are extraordinary structures of insects that appear to be used solely for phoretically carrying mites into their nests (e.g., Eickwort, 1994). Although insects may have different types of depressions on their exoskeleton where mites can attach, only structures that specifically facilitate mite transport are called "acarinaria" (OConnor & Klompen, 1999). These structures are present in at least three different lineages of bees and vespid wasps (OConnor & Klompen, 1999), suggesting that they have evolved independently several times within the aculeate Hymenoptera. Although lacking in evidence, mutualism between acarinarium-bearing bees and wasps and the mite users has long been suggested. Eickwort (1994) suggested that *Dinogamasus* (Laelapidae) mites carried in the acarinaria of carpenter bees might remove potentially harmful microbes from the body of the carriers, by feeding

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