Biological observations on Kapala Cameron 1884 (Hymenoptera Eucharitidae) in parasitic association with Dinoponera lucida Emery 1901 (Hymenoptera Formicidae) in Brazil

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Biological observations on a species of Kapala Cameron 1884 genus in parasitic association with the ponerine ant Dinoponera lucida Emery 1901 are presented. The study was carried out in an area of the Atlantic rain forest of south-eastern Brazil. Distinctive behavioural aspects of the interaction between the parasitoid and its host are discussed.

key words: Ponerinae, biology, behaviour, parasitoid, wasp, ant.

INTRODUCTION

Eucharitids (Hymenoptera Eucharitidae) are rarely-observed parasitoids of ants that have very distinctive forms of behaviour and ant associations (CLAUSEN 1940, 1941; HERATY 1995). The genus Kapala Cameron 1884 consists of 17 species (HERATY 2005, PEREZ-LAUCHAD et al. 2006), and is widespread throughout the Neotropical region, with one species reaching the southern United States and another coming from central Africa and Madagascar (HERATY 1985, 2003; HERATY & WOOLEY 1993). Although Kapala is the most common Neotropical genus of Eucharitidae, our knowledge of its biology is still scanty. The scope...
of the present study is to describe biological aspects of a specimen of *Kapala* that has been parasitically associated with the ponerine *Dinoponera lucida* Emery 1901 (Hymenoptera Formicidae). The field observations were carried out at the Biological Station of Santa Lúcia (city of Santa Teresa, State of Espírito Santo, south-eastern Brazil). *Dinoponera lucida* is a large ponerine ant, the workers of which reach a length of 3-4 cm. They dig nests in the ground that have large vertical entrances (Fig. 1), and form small, queenless colonies (Paiva & Brandão 1995, Peixoto et al. 2008). Paiva & Brandão (1995) found nests 30-35 cm deep and with 23-29 workers. This species is found in several areas covered with well-preserved Atlantic tropical rain forest in the eastern part of Brazil (Paiva & Brandão 1995, Peixoto et al. 2008).

Although from a morphological point of view the *Kapala* specimen studied seems to be significantly distinct from other described species, we will not be able to consider it a new species until careful taxonomic studies have been carried out. Heraty (1985, 1989, unpublished data in Pérez-Lachaud et al. 2006) and Heraty & Wooley (1993) have stressed the difficulty in identifying species of *Kapala* and the necessity for revisionary studies on the entire genus. The *Kapala* specimen collected was deposited in the entomological collection of the Instituto Oswaldo Cruz (Rio de Janeiro, RJ, Brazil). The specimens of *D. lucida* were identified using the revisionary study by Kempf (1971) and by comparing them with material deposited in the entomological collection of the Museu Nacional Universidade Federal do Rio de Janeiro.

**RESULTS AND DISCUSSION**

In July 2008 a *D. lucida* worker was observed in its nest, near the entrance: it was carrying a cocoon in its mandibles. After a few minutes, the ant dropped the cocoon on the ground and inspected one of its extremities for several seconds. The ant then picked up the cocoon again and came out of the nest (Fig. 2). A few seconds later, while the ant was still holding the cocoon, a *Kapala* wasp emerged from the cocoon through an opening in the extremity that the ant had previously been inspecting (Figs 3-4). The ant continued walking, while the eucharitid climbed onto the ant’s body and remained there motionless (Fig. 5). The ant did not show any aggressive reactions to the parasitoid wasp. It was at that moment that we collected the eucharitid and the cocoon. The cocoon was dissected in the laboratory, and a partially-eaten ant pupa was found inside it. We estimated that 70-90% of the pupa had been consumed. The following day, a completely empty ant cocoon that had a similar apical opening (see Figs 3-5) was found near the same nest, at a distance of about 1-1.20 m from the entrance. Remarkably enough, this opening was too small for an adult *D. lucida* to pass through. It is probable that this cocoon had also been parasitized by a *Kapala* wasp, and that a worker ant had deposited it on this site.

The reports on *Dinoponera* Roger 1861 as a host of *Kapala* corroborate the known associations of this eucharitid genus with poneromorphic ants. The following genera have previously been recorded as hosts of *Kapala*: *Odontoma-*
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In the literature, the emergence of eucharitids is commonly described as taking place inside the host's nest (Clausen 1940, 1941; Heraty 1985, 1995; Lachaud et al. 1998; Howard et al. 2001). Newly-emerged adults escape unharmed from the nest or are even transported by worker ants, possibly because immature instars take on the odours (cuticular hydrocarbon profiles) of the ants and are thus treated like members of the colony (Vander Meer et al. 1989, Howard et al. 2001). However, field observations on the emergence of eucharitids are rare. The interaction observed between *D. lucida* and a member of *Kapala* is different from the pattern usually reported on the family. In addition to the fact that the hypothesis of the presented observations is casual, we must consider the possibility that the parasitoid has manipulated the behaviour of the worker ant for its own benefit. It is remarkable that the exit of the *Kapala* was synchronized with the moment that the ant was transporting the parasitized cocoon outside. Such synchronization is presumably advantageous to the parasi-

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**Fig. 1.** — Entrance to the *Dinoponera lucida* nest parasitized by the *Kapala.*
Figs 2-5. — A *Dinoponera lucida* worker carrying out of the nest a cocoon parasitized by *Kapala*: a worker ant with the parasited cocoon at the entrance to the nest (Fig. 2); a worker ant carrying the parasited cocoon that has an opening at one extremity and the partially-emerged *Kapala* (Figs 3-4); a worker ant with the newly-emerged *Kapala* on its right mid-leg (Fig. 5).
toid because, if the parasitoid emerges from inside the nest and does not mimic the ant’s odour, ants could recognize this and attack it. On the other hand, if the ants remove the parasitized cocoons before the wasp emerges, these cocoons could be consumed by foraging animals. It is tempting to assume that evolutionary pressures have modelled this host-parasitoid association in such a way that the eucharitid stimulates the worker ants to transport the parasitized cocoon outside the nest at the very moment of its emergence. Vibrations produced by the effort of cutting an opening in the cocoon, and perhaps even chemical signals emitted by the Kapala could possibly be responsible for stimulating the ants to discard the parasitized cocoon.

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