

First record of the parasitoid wasp *Lymeon* sp. (Ichneumonidae: Pimplinae) associated with spider eggs-sac of *Araneus vincibilis* (Araneae: Araneidae) in Northeastern Brazil

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Abstract

Lymeon Förster, 1869 is a very large genus of the Cryptinae (Ichneumonidae) with predominantly Neotropical distribution where females attack small cocoons of various groups of insects and spider eggs-sac. In the present study, we report the first record the interaction between the parasitoid wasp *Lymeon* sp. (Ichneumonidae), with eggs-sac of spider *Araneus vincibilis* (Araneidae) in Northeastern Brazil. We observed that although the female of *A. vincibilis* cares for the eggs that were attacked by *Lymeon* sp, the wasp larva consumed about

80% of spider eggs, indicating that both maternal care and the physical barrier offered by the eggs-sac may not provide absolute defense against predators.

Introduction

Ichneumonidae is one of the most species-rich families of Hymenoptera, with approximately 23,000 valid described species worldwide (Yu et al. 2012, Quicke 2015). All members are endo or ectoparasitoids of other arthropods including larvae and pupae of Coleoptera, Hymenoptera and Lepidoptera (Camargo et al. 2015; Pereira et al. 2015; Morales-Silva 2019). Some ichneumonid wasps like the *Polysphincta* genus-group (*sensu* Gauld and Dubois, 2006), are well known to act exclusively as koinobiont ectoparasitoid on various groups of spiders (e.g. Sobczak et al. 2017). On the other hand, some groups are predators of spider eggs where can consume up to 100% of the eggs (Villanueva-Bonilla et al. 2016).

Cryptinae is one of the largest subfamilies within Ichneumonidae with 397 recognized genera and some 4,500 described species (Yu et al. 2012; Quicke 2015). They include taxa with a large range of biologies, some attack naked hosts (e.g. the wasp *Gambrus incubator* Linnaeus, 1758 is a parasitoid of pupae of moths of the family Zygaenidae); some are idiobiont ectoparasitoids of weakly to strongly concealed hosts; some Cryptinae has evolved as a pseudohyperparasitoid like the genera *Gelis* and *Lysibia*; a few attack pseudoscorpion egg masses (Phygadeuontini, Obisiphaga); and some are strictly predators within spider egg cocoons (e.g. *Hydrata sordida* Tschek 1870 reared from egg cocoons of the Lycosidae spider *Pardosa pullata* Clerck, 1757) (Schwarz and Shaw 1999). In the Neotropical region there are few studies involving Cryptinae wasps acting as spider egg predators.

Lymeon Förster, 1869 is a very large genus of the tribe Cryptini within the subfamily Cryptinae with predominantly Neotropical distribution (Yu et al. 2012; Kasparyan 2017). Currently, Cryptinae is represented by about 86 species of which four are found only in the Nearctic region (Townes and Townes 1962). Species of this genus generally inhabit dense vegetation of forests where females attack small cocoons of various groups of insects and spider eggs-sac (Townes, 1970). The vast majority of studies with this genus describe new species where nothing is mentioned about the biology of the individuals (e.g. Kasparyan 2004, Kasparyan and Ruíz-Cancino 2008, Kasparyan 2017).

Recently, in the forest reserve of the Hotel Remanso de Serra, Ceará State, Northeast of Brazil, we collected eggs-sacs of the spider *Araneus vincibilis* Keyserling, 1893 (Araneae: Araneidae) which contained cocoons of the wasp *Lymeon* sp. In this study we present the first record of predation of *A. vincibilis* spider eggs by the wasp *Lymeon* sp. We also present biological information about the spider host.

Material and Methods

This study was conducted in a Montane semi-deciduous tropical forest (Figure 1A) located in the municipality of Pacoti, Ceará State, Brazil (4°13'30"S 38°55'22"W, altitude of 736 m). This area presents mean annual temperature of 21.5 °C and average precipitation of 1,524 mm.

We collected eggs-sacs of *Araneus vincibilis* on April 21, 2018 on a trail in the forest reserve of the Hotel Remanso de Serra during all the day. In field, the eggs-sacs were photographed and kept in plastic recipients (8 x 10 x 10 cm) sealed with tulle fabric to obtain the adult wasps, along with the adult spider. In the Laboratory of Ecology and Evolution of UNILAB, adult spiders were preserved in alcohol for later identification. Under stereomicroscope, eggs-sacs were carefully opened to verify the predation and accounting the eggs. The pupa of the Ichneumonidae were removed and kept in separate pots, sealed with tulle, until the adult wasps emerged from the cocoons. The voucher specimens of wasps were sent to the Coleção de Hymenoptera Parasitoides da Universidade Federal de São Carlos, São Carlos, São Paulo State (DCBU; curator A.M. Pentead-Dias) and spiders were sent to the collection of the Instituto Butantan, São Paulo, São Paulo State (IBSP, curator A.D. Brescovit).

Results

Araneus vincibilis (Figure 1D) wraps the eggs with silk inside a sheet used as a shelter. The sheet is then sealed with another layer of silk (Figure 1B, C). The orbicular web is constructed from the shelter leaf with the eggs (Figure 1B). We collected five eggs-sacs, of which one had *Lymeon* sp. larva feeding on the eggs (Table 1). In this open eggs-sac, we found five cocoons, where three of them had already emerged in the field, and two cocoons contained wasps still in pupae to emerge (Figure 1C). In laboratory, after five days, the adult wasps emerged. To leave the eggs-sac, the adult wasp cuts a hole in the outer web layer that

seals the leaf. The eggs-sacs can contain from 230 - 331 eggs when not attacked. However, with the presence of the predatory wasps, 80% of offspring can be lost (Table 1). Only 15 spiderlings remained in the eggs-sac attacked by the wasp larvae.

Discussion

Spider eggs-sacs are subject to a wide variety of attacks of predators and parasitoids wasp of different families of Hymenoptera. In the present study, we report for the first time a *Lymeon* sp. wasp preying on spider eggs of *A. vincibilis*. To our knowledge, there is a unique record of *Lymeon* attacking spider eggs by the author Townes (1970); however, the manuscript has no details about the type of host spider. The larvae of *Lymeon* sp. observed in this study consumed about 80% of spider eggs. This is not unusual, as recorded for Cobb and Cobb (2004) about the attack of the wasps *Gelis* sp. (Ichneumonidae) and *Baeus* sp. (Platygastridae) on the spider eggs of *Pardosa moesta* Banks, 1892 (Lycosidae) and *P. sternalis* Thorell, 1877 (Lycosidae). In that study, some spiderlings might emerge because the number of larvae was low (Fitton et al. 1988, Schwarz and Shaw 1999). On the other hand, other records show that the egg consumption could be complete, for example, *Camera lunavenatrix* Santos & Onody, 2016 (Ichneumonidae: Cryptinae) consumed 100% of the eggs of the spider *Selenops cocheleti* Simon, 1880 (Selenopidae) (Villanueva-Bonilla et al. 2016). The genera *Tromatobia* (Ichneumonidae: Pimplinae) and *Aprostocetus* (Chalcidoidea: Eulophidae) also consume 100% of the eggs when they attack the eggs-sac of the spider *Araneus omnicolor* Keyserling, 1893 (Araneidae) (Sobczak et al. 2012, 2015). However, the observed percentage of eggs consumed in the present study should be taken with caution, since the amount of eggs inside registered eggs-sacs not predated showed high variation, indicating that other mortality factors occurred in the eggs-sac preyed by *Lymeon*.

Morse (1988) mentions that spiders can experience strong pressure by predatory wasps that cause spiders to exhibit behaviors that diminish the attack on eggs. Females of *Misumena vatia* Clerck, 1757 (Thomisidae), for example, take care of the egg masses over much or all of the period between egg-laying and emergence of the young from the eggs-sac (Morse 1985). In our study, we observed the female of *A. vincibilis* taking care of the eggs that were attacked by *Lymeon* sp. indicating that both maternal care and the physical barrier offered by the eggs-sac may not provide absolute defense against predators. Similar results were observed in the spider *M. vatia* eggs-sacs attacked by *Trychosis cyperia* Townes, 1962 (Ichneumonidae:

Cryptinae) which can consume from 60-100% of the eggs even with the care of the spider female (Morse and Fritz 1987).

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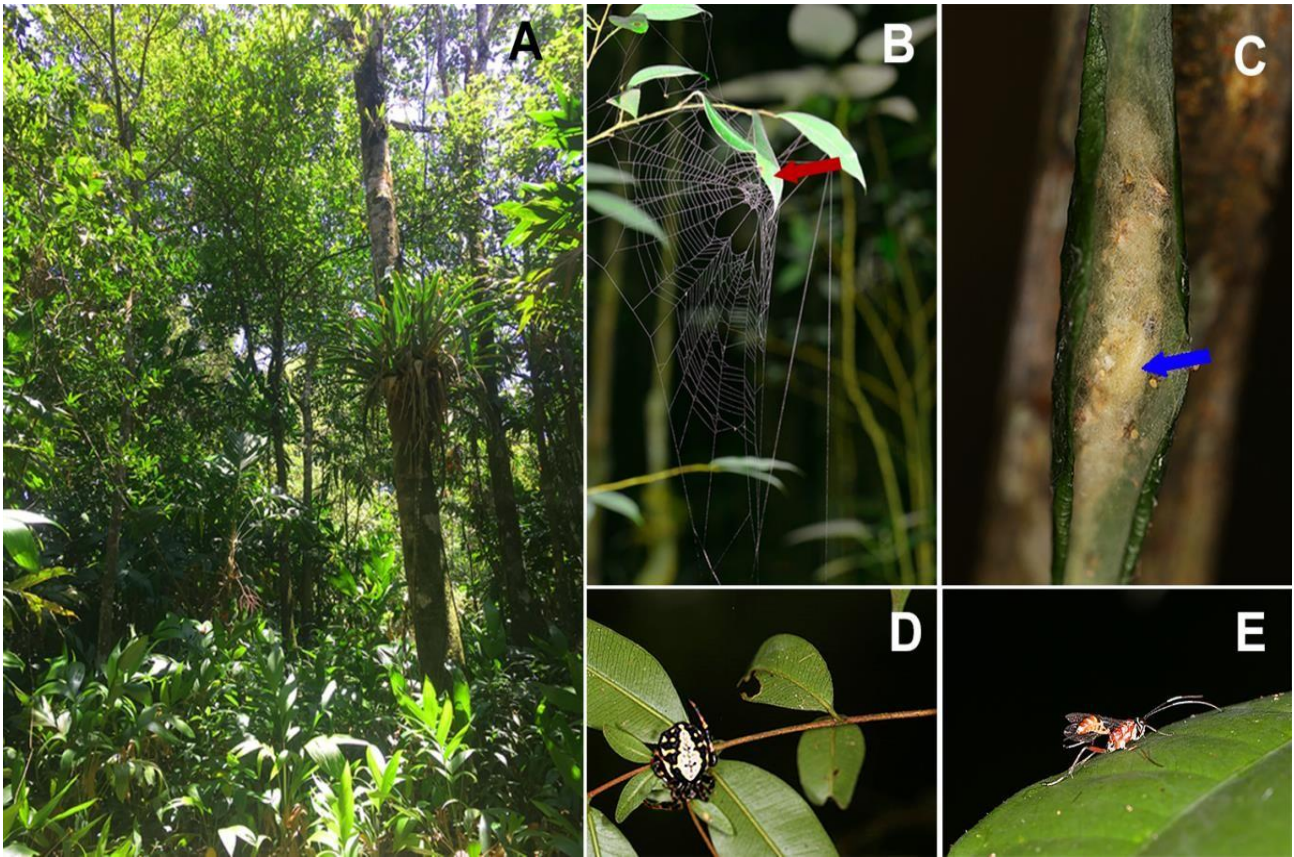


Figure 1. *Araneus vincibilis* and *Lymeon* sp. interaction. A) Montane semi-deciduous tropical forest in the Municipality of Pacoti, Ceará State, Brazil. B) Orbicular web of *A. vincibilis*, the red arrow indicates the leaf on which the eggs-sac is placed. C) Egg sac collected under the shelter sheet with wasp larvae developing (blue arrow). D) Adult female of *A. vincibilis* E) *Lymeon* sp. adult female wasp.

Table 1. Number of pupae of *Lymeon* sp. (Ichneumonidae: Cryptinae) found within the eggsacs of *Araneus vincibilis* during the month of April, on the trails of Hotel Remanso in Pacoti –Ceará, Brazil.

	Spider Eggs	Presence or no of female spider	<i>Lymeon</i> sp. individuals
Egg sac 1	230	without female	0
Egg sac 2	15	with female	5
Egg sac 3	304	with female	0
Egg sac 4	165	without female	0
Egg sac 5	331	without female	0