New host record for the enigmatic Neotropical mantidfly genus *Anchieta* Navás, 1909 (Neuroptera, Mantispidae), a mimic of wasps and stingless bees

Claus Rasmussen¹ & Adrian Ardila-Camacho²³

¹ Aarhus University (AU), Department of Agroecology. Tjele, Denmark. ORCID: http://orcid.org/0000-0003-1529-6548. E-mail: claus.rasmussen@agro.au.dk (corresponding author)

² Universidad Nacional Autónoma de México (UNAM), Instituto de Biología, Departamento de Zoología, Posgrado en Ciencias Biológicas. México, D.F., México. ORCID: http://orcid.org/0000-0002-3750-8671. E-mail: aardilac88@gmail.com

³ Universidad INCCA de Colombia (UNINCCA), Departamento de Biología, Grupo de Investigación en Biotecnología y Medio Ambiente. Bogotá, D.C., Colombia.

**Abstract.** Species of Symphrasinae (Neuroptera: Mantispidae) are ectoparasitoids of larvae and pupae of holometabolous insects, primarily of Hymenoptera in their larval stages. Herein we present the third case of an association between the mantidfly genus *Anchieta* Navás, 1909 with the order Hymenoptera. The hymenopteran species attacked by the as of yet undescribed species of *Anchieta* is *Montezumia dimidiata* Saussure, 1852 (Vespidae: Eumeninae), a predacious wasp that constructs mud nests. The association was observed in Peruvian Amazonia (near Tarapoto, San Martín), after rearing the mantidflies from a wasp nest. The biology and mimicry pattern with stingless bees of the reared *Anchieta* species is discussed.

**Keywords.** Ectoparasitoids; Symphrasinae; Mimicry; Neotropics.

**INTRODUCTION**

The insect family Mantispidae (Neuroptera: Mantispoidae), commonly known as mantidflies are remarkable insects which have raptorial forelegs, a complex trait shared with the Rhachiberothidae, and the extinct Dipteromantispidae (Lambkin, 1986; Aspöck & Mansell, 1994; Ohl, 2007; Liu et al., 2016; Engel et al., 2018). Their general appearance superficially resembles that of praying mantises (Insecta: Mantodea), but such condition is evidently a product of evolutionary convergence (Aspöck & Aspöck, 2007). Despite the interesting morphology of the adults, the mimicry with toxic or poisonous insects exhibited by several genera, and the complex postembryonic development (hyper metamorphosis) (Brauer, 1852, 1869, 1887) – in which their larvae may be ectoparasitoids, parasites, and spider-egg predators –, many aspects of mantidflies biology and taxonomy still need research (Redborg & MacLeod, 1985; Redborg, 1998; Snyman et al., 2020).

The Mantispidae species for which the biology is better known belong to the subfamily Mantispinae, whose larvae feed primarily on spider eggs, yet sometimes can feed temporarily on spider hemolymph, when the eggs are unavailable (Redborg & MacLeod, 1985; Redborg, 1998). Of the remaining smaller subfamilies, the New World Symphrasinae, which is composed of three extant genera, *Anchieta* Navás, 1909, *Plega* Navás, 1928 and *Trichoscelia* Westwood, 1852 have been reported as ectoparasitoids of larval Hymenoptera, Lepidoptera, Coleoptera, and possibly Diptera (Redborg, 1998; Hook et al., 2010; Maia-Silva et al., 2013; Snyman et al., 2020). Most of the hymenopteran records has been on *Polybia* Lepeletier, 1836 (Vespidae: White, 1841; Walker, 1853; Rogenhofer, 1862; Smith, 1863; Westwood, 1867; Hagen, 1877; Brauer, 1887; Berg, 1899; Parfin, 1958; Richards, 1978; Penny, 1982; Dejan & Canard, 1990), but also apoid wasps of the genus *Trypoxylon* Latreille, 1796 (Crabronidae: Parker & Stange, 1965; Buys, 2008), as well as various solitary bees, such as *Melitoma* Lepeletier & Serville, 1828 (Apidae: Linsley & MacSwain, 1955; Linsley et al., 1980), *Hylaeus* Fabricius, 1793 (Colletidae: Hook et al., 2010), and *Megachile* Latreille, 1802 (Megachilidae: Parker & Stange, 1965).

Both direct observation (Dejan & Canard, 1990) and circumstantial evidence (Linsley et al., 1980)
Hook et al., 2010) suggest that symphrasine females deposits their eggs near the host nest entrance, or near individual cells within the host nest. The newly hatched first instar mantispids then migrates into the cells while it is being provisioned, later the larva becomes attached to the surface of the host and remains attached until the host dies. The mantispid larvae feed on the host until completion of development when a mobile pupa chews its way out of the cocoon and emerges as a mobile pharate adult.

Anchieta is the smallest genus of Symphrasinae, including eight little-known species found from Panama to Southern Brazil, with most of the species distributed across the Amazon rainforest (Ardila-Camacho et al., 2018; Oswald, 2020). The genus is remarkable among the symphrasine genera, as all of the species mimic different groups of Hymenoptera (i.e., Apidae (Melioponini), Vespidae, and Braconidae), and is distinguished from other genera of the subfamily by having a prominent, blunt process on the fore trochanter, and a straight anterior radial cell of forewing (Ardila-Camacho et al., 2018).

The only previously reported host of Anchieta was the mud dauber Trypoxylon (Trypargilum) aestivale Richards, 1934 (Hymenoptera: Crabronidae) (Buys, 2008). From the mud nest of this wasp species, a single specimen of A. fumosella (Westwood, 1867) was reared out and presumably it had fed on the last instar larva or on the pupa of the wasp (Buys, 2008). Recently, further unspecified associations with wasps or bees were reported by Araújo et al. (2021).

Based on specimens of a new Anchieta species – referred here as Anchieta sp. nov. – which attacked mud nests of M. dimidiata, the purpose of the present paper is to provide the only second known and identified host record for the genus, as well as scattered observations on the biology and the mimicking of Anchieta.

MATERIAL AND METHODS

Irregular surveys for nests of Hymenoptera have been performed in San Martín since 2002 by the first author, including near “Uruku Estudios Amazonicos” educational center close to the Boca Toma of Rio Shilcayo, Tarapoto, Peru (06.4595°S, 76.3512°W, 410 m a.s.l.). The locality is adjacent to the local water reservoir of Tarapoto, within 100 m of the Shilcayo river, and represents an interesting transition area between lowland rainforest and lower montane rain forest, or cloud forest, in Peru. The high precipitation associated with the abrupt elevational gradient in the region of the “Cordillera Escalera” result in great environmental heterogeneity and a unique biological diversity (e.g., Rasmussen & Skov, 2006; Rasmussen, 2009; Rasmussen & Gonzalez, 2009). On this location a single adult female of the potter wasp Montezumia dimidiata Saussure, 1852 (Vespidae: Eumeninae) was observed resting on a mud nest plastered beneath a roof tile (Fig. 1A). The nest was collected the same day on July 10th, 2012 and left in a jar awaiting emergence (Figs. 1B, 1C). All observations hereafter were made as insects emerged from the jar left at room temperature.

Species identification of the emerging Anchieta was made by dissecting and clearing the abdomen, following the standard procedures with 10% Potassium Hydroxide solution (KOH). The external morphology and genital sclerites were compared with the types of all known species of Anchieta. All these structures were examined using a Zeiss Dicovery V8 stereomicroscope. Specimens were deposited at Museo de Historia Natural de Lima, Peru (MUSM) and Museum für Naturkunde, der Humboldt-Universität, Berlin, Germany (ZMB).

RESULTS AND DISCUSSION

Biology

The M. dimidiata nest was smaller but otherwise similar to two nests of the same species described from Colombia by Evans (1973), including the observation that individual cells were not obvious due to irregular plastering of mud covering the surface of the nest. The collected nest contained a total of five cells, three basal cells in parallel and adhered to the surface of the tile, followed by two additional cells in a second outer row. Of the three basal cells, the first was empty, possible damaged during the collection of the nest, and the second cell was the open and had a small 4 mm long turret at the entrance (Fig. 1B). No provision, egg, or larvae were observed in that cell, and it is possible that this cell was either ready for provisioning by the founding female wasp observed resting on the nest or, that the female outside was instead a recently emerged wasp from this very cell. However, the presence of a turret suggests that the female outside was the founding female, although it is unclear why the last cell to be provisioned would be the most basal cell in her construction. The last of the basal row cells is the one where all five mantispids cocoons were encountered together (Figs. 1C, 1E). The second row of cells both contained wasps, with one female M. dimidiata wasp later emerged while the wasp in the last cell was found dead. Cells measured internally about 9 by 24 mm. No provision for the wasps were encountered in this nest, but Evans (1973) reported microlepidoptera species as prey for M. dimidiata.

No egg chorions were found on the smooth inner walls of the cell and it is not clear when or where the eggs of the five mantispids were deposited, but the nest was collected on July 10th, 2012, and contained by then five cocoons with content. The adult mantispids emerged July 19th (female, Fig. 1D), July 22nd (male), July 28th (male, Fig. 2A), September 6th (male pupae, died), September 8th (male, Figs. 2C-2G). This is 9, 12, 18, 58, and 60 days after the encounter and collection of the nest. The emerging mantispids are identified as Anchieta, but does not correspond to any of the eight known species of the genus and will be described as a new species by Ardila-Camacho in a forthcoming taxonomic revision of the genus, so here we treat it as Anchieta sp. nov.
The mantispid cocoons (Fig. 2B) were only lightly attached to the cell wall and to each other, made of loosely woven silken threads, which upon maturing turned darker yellow until reaching the coloration of the pupae, including two dark spots presumably marking the eyes. The size of the cocoons were 6 by 3 mm (the four males) and a single larger, 8 by 4 mm (the single female), made from a darker (or older) thread.

Two of the emerging *Anchieta* sp. nov. were observed first actively moving around as exarate pupae or pharate adults (Fig. 2C-2E), but within hours of leaving the cocoon, shed the exuviae and then rested for hours (Fig. 2E) until the cuticle and wings had completely hardened and darkened (compare the coloration of the hind leg from the same individual in Figs. 2E and 2G). One of the exarate pupae did not survive and died be-
fore molting, although it can be observed that a complete adult is trapped beneath the exuviae of the pupae. While active and moving exarate pupae were not observed for the specimens, the exuviae were always found away from the nest cell and the cocoon where they had emerged, suggesting that they would leave the pupae with the exuviae still attached. The actual shedding of the exuvia took less than ten minutes on the single instance when it was observed, that is from the individual began moving and until the exuvia was removed.

Mimicking

An interesting observation on this new species was the immediate confusion of its identity by the first author upon emergence. Having collected the nest of a known species of potter wasp and expecting the emergence of this wasp, the surprise was that the first emerging insect had a close resemblance to the social stingless bee, *Ptilotrigona lurida* (Smith, 1854), both with respect to size, coloration of wings and body, and down to the imitation of the expanded hind legs, resembling the pollen basket

![Figure 2](image-url)
the abdomen inflated following the dried up condition (A and B).

Figure 3. *Anchieta* sp. nov. and *Ptilotrigona lurida* (Smith, 1854) next to each other. The former with the abdomen inflated following the dried up condition (A and B).
1889; Poulton, 1890). Other bees mimicking stingless bees of the genus *Melipona* Illiger, 1806 are for example *Megachile* Lateille, 1802 and *Anthidium* Belavadi, 2017 (Megachilidae) (C. Rasmussen, pers. obs.).

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**AUTHORS’ CONTRIBUTIONS**

C.R.: Fieldwork, Rearing, Methodology, Writing – original draft, Writing – review & editing. A.A.-C.: Identification, Methodology, Writing – review & editing. Both authors actively participated in the discussion of the results, they reviewed and approved the final version of the paper. Authors declare there are no conflicts of interest.

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