

Research Article

Nest description, new parasitoid associations and geographical range of *Trypoxylon (Trypoxylon) florale* Richards (Hymenoptera: Crabronidae)

Descripción de nido, nuevas asociaciones con parasitoides y rango geográfico de *Trypoxylon (Trypoxylon) florale* Richards (Hymenoptera: Crabronidae)

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Abstract. In this work the *Trypoxylon (Trypoxylon) florale* Richards, 1934 (Hymenoptera: Crabronidae) nest is described for the first time and the geographic ranges of *Trypoxylon (Trypoxylon) florale* and *Ceyxia latilabra* Andrade & Tavares, 2009 (Hymenoptera: Chalcididae) are extended about 500 km NE from the type locality and 2,800 km SE from Manaus (AM) and about 2,200 km S from Lago Verde (MA), respectively, the previously known records. Additionally are provided news data of associations between *Trypoxylon (Trypoxylon) florale* and *Ceyxia latilabra* and *Caenochrysis armata* (Mocsáry, 1889) (Hymenoptera: Chrysididae) based on the examination of exemplars collected at “Sertão do Cacau”, in São Sebastião municipality, São Paulo State, Brazil.

Key words: *Caenochrysis*, *Ceyxia*, Neotropical, Nesting, Parasitoids.

Resumen. En este trabajo se describe por primera vez el nido de *Trypoxylon (Trypoxylon) florale* Richards, 1934 (Hymenoptera: Crabronidae) y se amplían los rangos geográficos de *Trypoxylon (Trypoxylon) florale* y de *Ceyxia latilabra* Andrade & Tavares, 2009 (Hymenoptera: Chalcididae) a cerca de 500 km NE desde la localidad tipo, y cerca de 2.800 km SE desde Manaus (AM) y cerca de 2.200 km S desde Lago Verde (MA), respectivamente, los registros previamente conocidos. Además, se proporcionan nuevos datos de asociaciones entre *Trypoxylon (Trypoxylon) florale*, *Ceyxia latilabra* y *Caenochrysis armata* (Mocsáry, 1889) (Hymenoptera: Chrysididae) basadas en el examen de ejemplares recogidos en “Sertão do Cacau”, en el municipio de São Sebastião, São Paulo Estado, Brasil.

Palabras clave: *Caenochrysis*, *Ceyxia*, Neotropical, Ninho, Parasitoides.

Introduction

Trypoxylon Latreille, 1796 is a diverse and widespread genus of solitary wasps of the family Crabronidae (Hymenoptera). Among Crabronidae, *Trypoxylon* is the second largest genus in species number (Pulawski 2016) and comprises 630 species of spider-hunting wasps (Hanson and Menke 2006). These wasps build predominantly mud nests (Amarante 2005, 2006) on vegetation, crevices, and buildings or in pre-existing cavities and another wasps abandoned nests (Richards 1934; Hanson and Menke 2006). The genus is usually split into *Trypoxylon* and *Trypargilum* subgenera; the first widespread and, the second,

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restricted to the New World (Richards 1934; Hanson and Menke 2006), with circa of 70 and 90 species in Neotropical Region, respectively (Amarante 2002, 2005). There are 37 species of *T. (Trypoxylon)* and same number of *T. (Trypargilum)* recorded in 23 states and Federal District of Brazil (Amarante 2002).

Ceyxia Girault, 1911 (Hymenoptera: Chalcididae), with twenty-seven valid species, has mainly Neotropical distribution, occurring from southern United States to southern Brazil and northern Argentina (Andrade and Tavares 2009). Meanwhile in Brazil there are 24 recorded species, at 18 states and Federal District (Andrade and Tavares 2009).

The most of 50 valid species of *Caenochrysis* Kimsey & Bohart, 1981 (Hymenoptera: Chrysididae) (Hymenoptera Online 2016) also has Neotropical distribution with six species occurring in North America (Kimsey 2006a) and 25 recorded species in Brazil (Lucena and Zanella 2015).

Several genera of parasitoids of three orders and different families of insects are associated with species of *Trypoxylon*; among the Hymenoptera, the Chalcidoidea: *Ceyxia* (Chalcididae), *Melittobia* Westwood, 1848 (Eulophidae), *Aximopsis* Ashmead, 1904 and *Eurytoma* Illiger, 1807 (Eurytomidae), *Monodontomerus* Westwood, 1833 and *Torymus* Dalman, 1820 (Torymidae), *Dibrachys* Förster, 1856 and *Epistenia* Westwood, 1832 (Pteromalidae) (Molumby 1996; Fox *et al.* 2012; Yu *et al.* 2012; Coudrain *et al.* 2013; Noyes 2016); the Ichneumonoidea: *Bathythrix* Förster, 1869, *Dolichomitus* Smith, 1877, *Ephialtes* Gravenhorst, 1829, *Hoplocryptus* Thomson, 1873, *Nematopodius* Gravenhorst, 1829, *Perithous* Holmgren, 1859, *Poemenia* Holmgren, 1859, *Townesia* Ozols, 1962, *Eurycryptus* Cameron, 1901, *Messatoporus* Cushman 1929 and *Photocryptus* Viereck, 1913 (Ichneumonidae) (Aguilar and Santos 2009; Yu *et al.* 2012); the Evanioidea: *Gasteruption* Latreille, 1796 (Gasteruptionidae) (Pagliano and Scaramozzino 2000; Coudrain *et al.* 2013) and the Chryridoidea: *Caenochrysis*, *Chrysis* Linnaeus, 1761 and *Trichrysis* Lichtenstein, 1876 (Chrysididae) (Kimsey 2006a; Coudrain *et al.* 2013; Bogusch *et al.* 2015); among the Diptera: *Antrax* Scopoli, 1763 (Bombyliidae) and an unidentified species of Sarcophagidae (Molumby 1996; Santoni *et al.* 2009; Fox *et al.* 2012) and among the Coleoptera: *Megatoma* Herbst, 1792 and *Trogoderma* Dejean, 1821 (Dermestidae) and *Trichodes* Herbst, 1792 (Cleridae) (Coudrain *et al.* 2013).

The objectives of this paper is to describe the *Trypoxylon (Trypoxylon) florale* Richards, 1934 nest, reporting its new associations with hymenopterous parasitoids and providing new distribution records to *T. (Trypoxylon) florale* and to *Ceyxia latilabra* Andrade & Tavares, 2009.

Material and Methods

A nest of *T. (Trypoxylon) florale*, a species of the *tridentata* group, was collected in January 2016 from a wall of a vacation home (23°46'03.53"S / 45°37'59.48"W) located in the "Sertão do Cacau", in São Sebastião, State of São Paulo, Brazil (Fig. 1). The locality has an Af climate (Koeppen system), with an average temperature of 23.3 °C and 1,638 mm average annual rainfall (Alvares *et al.* 2013; ClimateData.Org 2016). The nest was carefully removed from the wall with the aid of a pocket knife and transported to the Laboratório de Sistemática e Bioecologia de Parasitoides e Predadores (LRRP) of the Instituto Biológico, Ribeirão Preto, São Paulo State, Brazil and kept in a clear plastic cage (12 cm in diameter x 7 cm height), at room temperature until the emergence of the adults. The collections were done under SISBIO license#16473-1.

The color images were obtained with a digital camera (DFC 295, Leica, Germany) attached to a stereomicroscope (M205C APO, Leica, Singapore). Serial images from different layers were combined with Helicon Focus software (version 5.3) and figures were prepared using Adobe Photoshop software (version 11.0).

A female and a male specimens of *T. (Trypoxylon) florale*, a female specimen of *C. latilabra* and a female specimen of *Caenochrysis armata* (Mocsáry, 1889) were deposited in



Figure 1. Map of Brazil showing State of São Paulo; the black dot indicate the place where the nest of *Trypoxylon* (*Trypoxylon*) *florale* Richards, 1934 was collected.

the Coleção Entomológica do Laboratório de Sistemática e Bioecologia de Parasitoides e Predadores (LRRP) do Instituto Biológico (Ribeirão Preto, SP, Brazil, Dr. N. W. Periotto, curator); a female specimen of *C. latilabra* in the Coleção Entomológica do Departamento de Ciências Biológicas, Universidade Federal do Espírito Santo (UFES) (Vitória, ES, Brazil, Dr. Marcelo Teixeira Tavares, curator) and a female specimen of *T. (Trypoxylon) florale* in the Coleção Entomológica Pe. Jesus Santiago Moure (DZUP), Universidade Federal do Paraná (Curitiba, PR, Brazil, Dr. Gabriel Augusto Rodrigues de Melo, curator).

Results and Discussion

The nest is composed of mud, with about 2 cm in diameter and with 13-15 cells (0.8 cm long and 0.3 cm wide) (Fig. 2). From the nest emerged two females and a male specimens of *T. (Trypoxylon) florale* (Fig. 3), two females specimens of *C. latilabra* (Fig. 4) and a female specimen of *C. armata* (Fig. 5).

Almost nothing is known about the biology and habits of *T. (Trypoxylon) florale*. The species was described by Richards (1934) and until this article was known from a single specimen, the female holotype, collected in Blumenau, Santa Catarina State, in 1885 and deposited in the Entomological Collection of the Natural History Museum of Vienna (NHMW) (Richards 1934). Thus this is the first documented record of *T. (Trypoxylon) florale* for São Paulo State and this finding extends its distribution range about 500 km NE from the type locality.

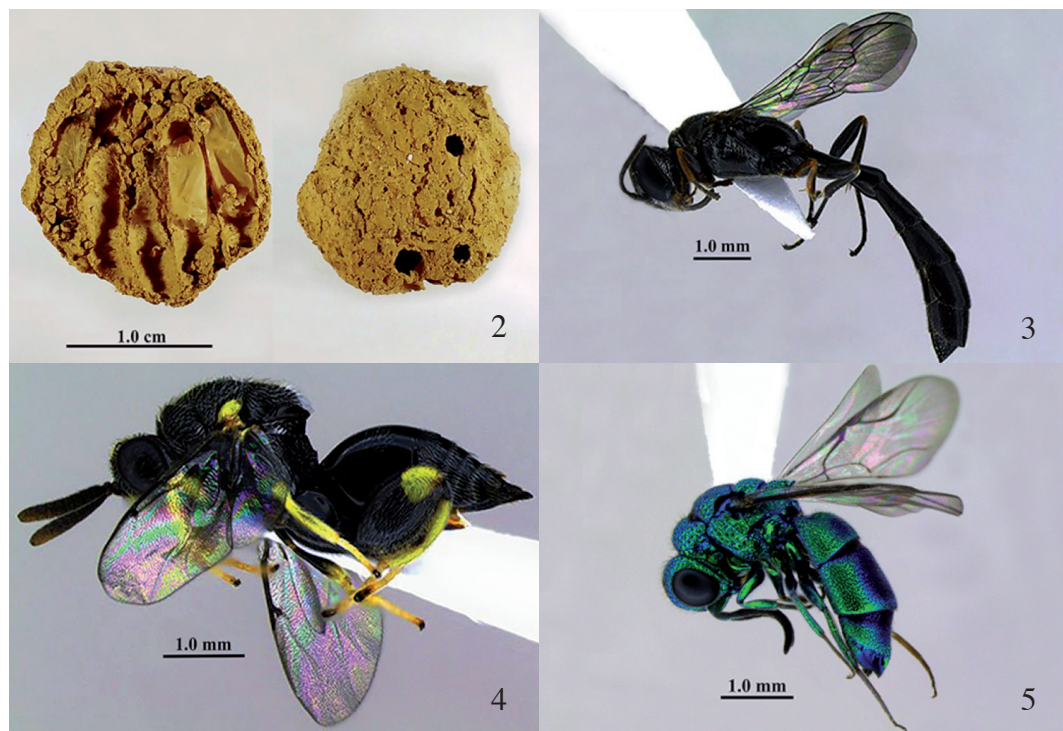
The association between *Ceyxia* and *Trypoxylon* species is well documented in the literature: *C. flaviscapus* Girault, 1911 is associated to *T. nitidum* F. Smith, 1856; *C. laticlipeata* Andrade & Tavares, 2009 to *T. fabricator* F. Smith, 1873; *C. perparva* Andrade & Tavares, 2009 to *Trypoxylon maidli bodkini* Richards, 1934; *C. villosa* (Olivier, 1790) to *T. albitarse* Fabricius, 1804 and *T. mexicanum* Saussure, 1867 (Burks 1960; Boucek 1992; Andrade and Tavares 2009). For the first time *C. latilabra* is associated as parasitoid of *T. (Trypoxylon) florale*. It has known distribution for Brazil (Amazonas and Maranhão States) (Andrade and Tavares

2009). Consequently, this finding extends the distribution range about 2,800 km SE from Manaus (AM) and about 2,200 km S from Lago Verde (MA), the previously known records.

There are references to species of *Brachymeria* Weswood, 1829 (Hymenoptera: Chalcididae) associated species of *Trypoxylon* (Peruquetti 2001; González and Matthews 2005; Yu *et al.* 2012; Noyes 2016). It is plausible that such organisms may be, in fact, species of *Ceyxia* given that Andrade and Tavares (2009), when studying the Neotropical species of Brachymeriini, grouped in *Ceyxia* those that show the presence of escrobo-malar carina, jaws typically elongated and tapered at the apex and are associated with wasps that inhabit nests of mud.

Caenochrysis armata is associated with *T. (Trypoxylon) florale* for the first time, but the exact association between them is not entirely clear. In general, Chrysidinae has been found as ecto or cleptoparasitoides (or both) of solitary Hymenoptera who build nests (Kimsey 2006b). Two species of *Caenochrysis* have been reported in association with species of *Trypoxylon*: *C. deversor* (Bohart, 1966) was reared from nests of *T. (Trypargilum) tridentatum* Packard, 1867 (Parker and Bohart 1966) and *C. doriae* (Gribodo, 1874) from nests of *T. (Trypoxylon) bidentatum* W. Fox, 1891 (Parker and Bohart 1966), *T. (Trypoxylon) frigidum* F. Smith, 1856; *T. (Trypargilum) collinum rubrocinctum* (Packard, 1867) (Krombein 1967) and *T. (Trypargilum) tridentatum* (Bohart and Kimsey 1982).

Finally, this study is searching increased the knowledge about the geographical distribution and associations among three species of Hymenoptera. More studies are essential because it's great our ignorance about the geographical distribution of the vast majority of the species of Hymenoptera and such scarcity makes activities such as collecting of specimens in the field and publication of new records essential to the establishment of bases for future biogeographical and ecological studies.



Figures 2-5. 2. Nest of *Trypoxylon (Trypoxylon) florale* Richards, 1934. (A) Ventral view. (B) Dorsal view. Scale bar: 1 cm. 3. *Trypoxylon (Trypoxylon) florale* Richards, 1934, female. Habitus, lateral view. 4. *Ceyxia latilabra* Andrade & Tavares, 2009, female. Habitus, lateral view. 5. *Caenochrysis armata* (Mocsáry, 1889), female. Habitus, lateral view.

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