

## Scientific Note

# Checklist of the Vespidae (Insecta: Hymenoptera) of an area with Cerrado and Atlantic Forest in Minas Gerais, Brazil

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**Abstract.** With the goal of knowing the vespidae fauna of the region, weekly samplings were carried out in the Estação Ambiental de Peti, São Gonçalo do Rio Abaixo, Minas Gerais, Brazil. This reserve is inside the Espinhaço Range and is marked by an ecotone formation of Cerrado and Atlantic Forest in its domain. Two Malaise traps were used: one was set in an Atlantic Forest area and the other in Cerrado vegetation. The collecting lasted one year, from April 2002 to April 2003. A total of 553 vespids of 28 species distributed in 11 genera were collected, of which 18 were Polistinae and 10 Eumeninae. The most frequent species were *Agelaea myrmecophila* (Ducke, 1905), *A. multipicta* (Haliday, 1836), *Polybia flavifrons* Smith, 1857 and *Mischocyttarus rotundicollis* (Cameron, 1912). The abundance was highest in the wet period only for the Polistinae in Atlantic Forest and Eumeninae in Cerrado. Another 18 species were found to occur in the area but were not collected by Malaise traps. The study revealed two species recorded for the first time in the State of Minas Gerais: *Pararhaphidoglossa confluenta* (Fox, 1899) and *Zethus dubius* Smith, 1857.

**Keywords:** Espinhaço Range, Malaise trap, potter wasps, social wasps.

The vespids comprehend six extant subfamilies, with over 250 genera and over 5,271 species (Piekarski et al. 2018). Only three of the subfamilies occur in Brazil: Polistinae, Eumeninae and Masarinae (Carpenter & Marques 2001). The first subfamily is commonly known as “marimbondos” in this country (Carpenter & Marques 2001). Vespidae, excluding Masarinae, are all predators, especially of lepidopteran larvae and may act as biological control of these groups (Carpenter & Marques 2001).

Biological surveys have firstly in mind knowing what species are in a certain area, therefore acknowledging the local biodiversity and this material becomes available to the research community once incorporated into a collection (such as museums and research institutes). The collected specimens may serve as data for other studies, such as community ecology, description of species, filling distribution gaps, determination of areas of endemism and priority protection areas (Bell 2003; Wen et al. 2015).

The Espinhaço Range is a Biosphere Reserve defined by Unesco that extends from central Minas Gerais State to Bahia State and is occupied by three biomes: Caatinga, Cerrado and Atlantic Forest. This complex provides formation of transition areas and occurrence of rare species (Andrade & Domingues 2012), making the area of great interest to conduct surveys and obtain knowledge of local fauna and flora.

So far, only two studies on vespids within this geographical formation have been carried out (Silva-Pereira & Santos 2006; Perillo et al. 2020). This leaves the great majority of the formation unexplored and thus, a survey in different areas presenting different biomes should bring about a greater idea of the species present in the Espinhaço Range.

The Estação Ambiental de Peti (EAP), a Private Reserve of the Natural Patrimony (RPPN), belongs to the Companhia Energética de Minas Gerais (Energy Company of Minas Gerais) - Cemig, and is situated in Santa Bárbara and São Gonçalo do Rio Abaixo Counties, 100 km East of Belo Horizonte, capital of Minas Gerais. It preserves on its domain a 606 ha (about half of its original extension) area around

Santa Bárbara River and four other streams belonging to the Doce River Basin. The EAP is situated in the southernmost area of the Espinhaço Range (CEMIG 2013).

The station is primarily covered by semideciduous seasonal forest (mesophytic forest), gallery forest and rupicolous vegetation (Pedralli & Teixeira 1997). There is a great number of arboreal individuals in the mesophytic forest that have not reached flowering/fructification, indicating a stage of secondary succession. Species typical to the Cerrado are observed in the semideciduous forest and an enclave of Cerrado vegetation is found within the reserve’s boundaries, turning evident the occurrence of an ecotone formation between Cerrado and Atlantic Forest (Pedralli & Teixeira 1997).

According to Koeppen’s classification, the local climate is Cwa, where the dry season has low temperatures (lowest average of 16,6°C in June) and reduced precipitation (lowest average of 30mm in August) and the wet season, elevated temperatures (highest average of 23.5°C in January) and high precipitation (highest average of 264mm in December) (IBGE 1977). The altitude is approximately 650m.

The samplings were performed using two Malaise traps according to the model proposed by Townes (1972) with collecting cups containing 70% alcohol. One trap was set in the Atlantic Forest (AF) area at 19°52’49”S and 43°22’07”W and another in the Cerrado (CE) area at 19°53’14”S and 43°22’06”W. Although treated as Cerrado, the sampling area of CE shows some modifications resulting from anthropological impact such as trails, access routes and presents a few trees characteristic of the Forest. The sampling lasted one year, from April 2002 to April 2003, with the traps remaining active 24 hours a day, every day in this period. Samples were collected weekly.

The voucher material is deposited in the Centro de Coleções Taxonômicas, Instituto de Ciências Biológicas of the Universidade Federal de Minas Gerais (CCT-UFMG) in Belo Horizonte, Minas Gerais, Brazil.

A total of 553 individuals were collected, distributed in 28 species of 11 genera of Polistinae (18 species) and Eumeninae (10 species)

(Tab. 1). No Masarines were collected.

**Table 1.** Species found in Estação Ambiental de Peti and their abundance and rounded relative frequency values for each area.

Species	Abundance (Relative Frequency - %)		
	CE	AF	Total
<b>POLISTINAE</b>			
<i>Mischocyttarus clypeatus</i> Zikán, 1935	0	6 (1.1)	6 (1.1)
<i>M. garbei</i> Zikán, 1935	2 (0.4)	2 (0.4)	4(0.8)
<i>M. rotundicollis</i> (Cameron, 1912)	31 (5.6)	20 (3.6)	51 (9.2)
<i>Agelaia multipicta</i> (Haliday, 1836)	60 (10.8)	39 (7.0)	99 (17.8)
<i>A. myrmecophila</i> (Ducke, 1905)	115 (20.8)	29 (5.2)	144(26.0)
<i>Parachartergus pseudapicalis</i> Willink, 1959	3 (0.5)	0	3 (0.5)
<i>Polybia bifasciata</i> de Saussure, 1854	29 (5.2)	1 (0.2)	30 (5.4)
<i>P. chrysothorax</i> (Lichtenstein, 1796)	3 (0.5)	8 (1.4)	11 (1.9)
<i>P. dimidiata</i> (Olivier, 1792)	17 (3.1)	4 (0.8)	21 (3.9)
<i>P. fastidiosuscula</i> de Saussure, 1854	13 (2.4)	2 (0.4)	15 (2.8)
<i>P. flavifrons</i> Smith, 1857	75 (13.6)	11 (2.0)	86 (15.6)
<i>P. ignobilis</i> (Haliday, 1836)	1 (0.2)	1 (0.2)	2 (0.4)
<i>P. jurinei</i> de Saussure, 1854	6 (1.1)	3 (0.5)	9 (1.6)
<i>P. occidentalis</i> (Olivier, 1792)	0	5 (0.9)	5 (0.9)
<i>P. platycephala</i> Richards, 1951	18 (3.2)	10 (1.8)	28 (5.0)
<i>P. scutellaris</i> (White, 1841)	14 (2.5)	0	14 (2.5)
<i>P. sericea</i> (Olivier, 1792)	4 (0.8)	0	4 (0.8)
<i>Protonectarina sylveirai</i> (de Saussure, 1854)	0	1 (0.2)	1 (0.2)
<b>EUMENINAE</b>			
<i>Hypancistrocerus dentiformis</i> (Fox, 1902)	2 (0.4)	0	2 (0.4)
<i>Omicron aurantiopictum</i> Giordani Soika, 1978*	1 (0.2)	0	1 (0.2)
<i>O. spegazzini</i> (Brèthes, 1905)	3 (0.5)	0	3 (0.5)
<i>O. aff. lacerum</i> Giordani Soika, 19778	1 (0.2)	0	1 (0.2)
<i>Pachymenes ghiliani</i> (Spinola, 1851)	3 (0.5)	0	3 (0.5)
<i>P. picturatus</i> (Fox, 1899)	3 (0.5)	0	3 (0.5)
<i>P. olympicus</i> (Zavattari, 1912)	1 (0.2)	2 (0.4)	3 (0.5)
<i>Pararhaphidoglossa confluenta</i> (Fox, 1899)*	2 (0.4)	0	2 (0.4)
<i>Zethus aff. plaumanni</i>	0	1 (0.2)	1 (0.2)
<i>Zethus sp. discoelioides</i> group	0	1 (0.2)	1 (0.2)
<b>TOTAL</b>	<b>407 (73.6)</b>	<b>146 (26.4)</b>	<b>553 (100)</b>

\*New record for Minas Gerais\*

Regarding other studies of Polistinae that used Malaise traps, EAP presents lower richness (18 species) when compared to most other surveys, which have richness over 30 species (Silveira 2002; Silveira et al. 2008; Silva & Silveira 2009; Somavilla et al. 2019). Somavilla et al. (2019) holds the highest richness collected through Malaise only, a total of 92 species. The above surveys are all from Amazon forest, a biome indicated to have a higher diversity of social wasps (Somavilla et al. 2019). Still, this study presents higher species number over Noll & Gomes (2009) work in Semideciduous Forest, in which seven species were collected.

Still, a greater richness of social wasps within the Espinhaço Range was recovered in relation to both studies already carried out in the area. However, six of the eleven species caught in the survey in “Campos Rupestres” of Bahia (Silva-Pereira & Santos 2006) and four of the thirteen species in mountainous forest fragments (Perillo et al. 2020) were not recorded for the EAP. This is expected since the altitude and main vegetation coverage are different, but still suggests that the wasp fauna varies greatly along the Range.

There are very few surveys of Eumeninae in Brazil. There is one from the Amazon wetlands (Silveira et al. 2008), three from Cerrado (Auko & Silvestre 2013; Grandinete & Noll 2013; Auko et al. 2017) and

one in Atlantic Forest (Hermes & Köhler 2004). The sampling retrieved lower richness for EAP when compared to these studies, being the Amazonian study (Silveira et al. 2008) with 14 species. In Cerrado, all surveys are from the state of Mato Grosso do Sul, having Auko & Silvestre (2013) recorded 20 species, Grandinete & Noll (2013), 21 species and Auko et al. (2017) recorded 66 species for several points in the State (some points comprising Chaco and not Cerrado), being the most species rich point with 30 species. As for the study in Atlantic Forest (Hermes & Köhler 2004), 37 species were recorded. Perillo et al. (2020) attempted to survey eumenines in the Espinhaço Range but collected only one unidentified specimen. Among the collected eumenines in the present study, *Pararhaphidoglossa confluenta* (Fox, 1899) consists of a new record for the Minas Gerais State and is the species’ southernmost record.

Still, there were 18 vespid species (8 Polistinae and 10 Eumeninae) that were deposited in the CCT-UFMG collection from EAP but were not captured in this experiment (Tab. 2). This sums up a total of 46 (26 Polistinae and 20 Eumeninae) species in the area, of which 39% were not captured with the Malaise trap. If we remove the Eumeninae, this number is reduced, leaving 31% of the social species not captured (Tab. 3). This is a reasonable percentage when compared to other works with Malaise traps (Tab. 3). Still, this number may decline if additional patterned methods, such as active collecting or attractive solution, were accomplished, since these additional species were collected with entomological nets on occasional trips to the station. This additional list brings another new record for Minas Gerais State, *Zethus dubius* Smith, 1857, and is, so far, regarded as the easternmost occurrence of this species.

**Table 2.** Species found in the Estação Ambiental de Peti deposited in the Centro de Coleções Taxonômicas - Universidade Federal de Minas Gerais that were not collected through the Malaise trap in this study.

Subfamily	Species
Polistinae	<i>Polistes versicolor</i> (Olivier, 1792)
	<i>Mischocyttarus socialis</i> de Saussure, 1854
	<i>Mischocyttarus cassununga</i> von Ihering, 1903
	<i>Mischocyttarus confusus</i> (Zikán, 1935)
	<i>Apoica flavissima</i> Van der Vecht, 1973
	<i>Polybia striata</i> (Fabricius, 1787)
	<i>Protopolybia exigua</i> (de Saussure, 1854)
	<i>P. sedula</i> (de Saussure, 1854).
	<i>Ancistroceroides</i> sp.
	<i>Hypancistrocerus</i> sp.
Eumeninae	<i>Montezumia azurescens</i> (Spinola, 1851)
	<i>Omicron gondwanianum</i> (Giordani Soika, 1978)
	<i>O. tuberculatum</i> (Fox, 1899)
	<i>Omicron</i> sp.
	<i>Pachodynerus nasidens</i> (Latreille, 1817)
	<i>Stenosigma allegrum</i> Zavattari, 1912
	<i>Zethus smithii</i> de Saussure, 1855
	<i>Z. dubius</i> Smith, 1857*

\* New record for the State of Minas Gerais.

As already highlighted by Silveira (2002), comparison between surveys are difficult due to different collecting methods and efforts. Still, the effort in Malaise trapping does not seem to follow any pattern regarding the amount of richness recovered in an area, as we can see that number of traps used or effort (in trap-days) bring different percentages of the richness (Tab. 3). For example, our study managed to obtain nearly 70% of the local species with only two traps (low number) and high effort (over 700 trap-days). However, Noll & Gomes (2009) with also a low number of traps, but a moderately high effort recovered less than 30% of the species (Tab. 3). On the other hand, Silveira et al. (2008) in Alvarães, with a large amount of traps and low

**Table 3.** Studies involving Malaise trapping of social wasps and other methods: The number of species registered in the study with all methods (ST), number of species captured in the trap (and their percentage according to ST), the most abundant species, number of traps used and capture effort (in trap-days).

Study	ST	Species in Malaise (%)	Most abundant species	Number of traps	Effort (trap-days)
Aragão & Andena (2016)	26	20 (76.9)	<i>Angiopolybia pallens</i> (Lepeletier, 1836)	3	1095
Noll & Gomes (2009)	7	2 (28.6)	<i>Agelaia vicina</i> de Saussure, 1854	1	455
Perillo et al. (2020)	13	12 (92.3)	<i>Polybia fastidiosuscula</i> de Saussure, 1854	14	392
Silva & Silveira (2009)	65	26 (40.0)	<i>Angiopolybia pallens</i> (Lepeletier, 1836)	26	260
Silveira et al. (2008)					
Mamirauá, AM	46	23 (50.0)	<i>Agelaia fulvofasciata</i> (DeGeer, 1773)	26	256
Alvarães, AM	42	29 (69.0)	<i>Agelaia fulvofasciata</i> (DeGeer, 1773)	12	180
Região dos Lagos, AP	31	0	<i>Polistes canadenses</i> (Linnaeus, 1758) <i>Synoecca surinama</i> (Linnaeus, 1767)	18	90
Silveira (2002)	78	28 (35.9)	<i>Polybia liliacea</i> (Fabricius, 1804)	16	640
Present Study	26	18 (69.2)	<i>Agelaia myrmecophila</i> (Ducke, 1905)	2	730

effort obtained nearly 70%, while in the same study, but in the Região dos Lagos a similar layout rendered no vespidae species at all (Tab. 3). Finally, although it is intuitive that a large number of traps with high effort would bring better representativity, Silveira (2002) recovered less than 40% of the local richness (Tab. 3).

Eumenines in CE and the polistines in AF have greater abundance from November to January, months with highest precipitation. Also, the smallest abundance and richness of collected wasps in both areas was from May to July, the period with least precipitation. Although August also had low precipitation, it presented an increase in abundance compared to the previous three months. Diniz & Kitayama (1998) also report greater vespidae abundance in wet seasons. However, according to Silveira (2002), too much rain during sampling can affect the wasp's foraging behavior, thus reducing the number of captures by traps.

The most frequent species in the EAP were *Agelaia myrmecophila* (Ducke, 1905) with 144 individuals (26%), *Agelaia multipicta* (Haliday, 1836) with 99 individuals (17.8%), *Polybia flavifrons* Smith, 1857 with 86 individuals (15.6%) and *Mischocyttarus rotundicollis* (Cameron, 1912) with 51 individuals (9.2%), that together represented almost 70% of the entire sample. In CE alone, *A. myrmecophila* was also the most frequent species, while in AF, it was *A. multipicta* (Tab. 1).

The greatest abundance in polistine surveys nearly always belongs to swarm-founding wasps, emphasizing the genus *Agelaia* Lepeletier, 1836 (Tab. 3). Colonies of this genus may grow exceptionally large, such as *Agelaia vicina* (de Saussure, 1854) that may develop a nest with over one million estimated wasps (Zucchi et al. 1995). In such cases, a trap set too close to a colony will unbalance the abundance, as well as other results dependent on that number, rendering biased statistical analyses.

The present study brings new information about the vespidae fauna in the Espinhaço Range and is one of the few studies including Eumeninae. Forty-six species have been recorded in the study area, of which 28 were captured in the Malaise trap, demonstrating that in spite of great effort, this method may leave a high amount of unsampled vespidae species. However, comparison with other studies reveal great variability in the proportional richness recovered by Malaise. Two species of Eumeninae consist of new records for the State of Minas Gerais, which is another addition in the attempt to fill in the sampling gaps of the group.

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