Abstract. With the goal of knowing the vespid 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 vespsids of 28 species distributed in 11 genera were collected, of which 18 were Polistinae and 10 Eumeninae. The most frequent species were Agelaia myrmecophila (Ducke, 1905), A. multipicta (Haliday, 1836), Polypia flavifrons Smith, 1857 and Mischocyttarus ratundicollis (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 vespsids 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 vespsids 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 of 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 semidecidual seasonal forest (mesophytic forest), gallery forest and ripudicous 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 semidecidual forest and an enclave of Cerrado vegetation is found within the reserve’s boundaries, turning evident the occurrence of an eocotuous 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).
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 |
| **POLISTINAE**                 |         |     |       |
| Mischoctyrtthus clypeatus Zikán, 1935 | 0       | 6   | 6 (1.1) |
| M. garbei Zikán, 1935          | 2 (0.4) | 2 (0.4) | 4 (0.8) |
| M. rotundicollis (Cameron, 1912) | 31 (5.6) | 20 (3.6) | 51 (9.2) |
| Agelaia multipecto (Haliday, 1836) | 60 (10.8) | 39 (7.0) | 99 (17.8) |
| A. myrmecophila (Ducke, 1905) | 115 (20.8) | 29 (5.2) | 144 (26.0) |
| Pararchtergus pseudopapilion Willink, 1959 | 3 (0.5) | 0 | 3 (0.5) |
| Polybia bifasciata de Saussure, 1854 | 29 (5.2) | 1 (0.2) | 30 (5.4) |
| P. chrysothorax (Lichtenstein, 1796) | 3 (0.5) | 8 (1.4) | 11 (1.9) |
| P. dimidiata (Olivier, 1792) | 17 (3.1) | 4 (0.8) | 21 (3.9) |
| P. fastidiusscula de Saussure, 1854 | 13 (2.4) | 2 (0.4) | 15 (2.8) |
| P. flavifrons Smith, 1857 | 75 (13.6) | 11 (2.0) | 86 (15.6) |
| P. ignobilis (Haliday, 1836) | 1 (0.2) | 1 (0.2) | 2 (0.4) |
| P. jurinei de Saussure, 1854 | 6 (1.1) | 3 (0.5) | 9 (1.6) |
| P. occidentalis (Olivier, 1792) | 0 | 5 (0.9) | 5 (0.9) |
| P. platyclepha Richards, 1951 | 18 (3.2) | 10 (1.8) | 28 (5.0) |
| P. scutellaris (White, 1841) | 14 (2.5) | 0 | 14 (2.5) |
| P. sericea (Olivier, 1792) | 4 (0.8) | 0 | 4 (0.8) |
| Protonectaria sylveirai (de Saussure, 1854) | 0 | 1 (0.2) | 1 (0.2) |

**EUMENINAE**

| Species                        | Abundance (Relative Frequency - %) |
|--------------------------------|-----------------------------------|
| Hypancistrocerus dentiformis (Fox, 1902) | 2 (0.4) | 0 | 2 (0.4) |
| Omicron aurantiopectrum Giordani Soika, 1978* | 1 (0.2) | 0 | 1 (0.2) |
| O. spegazzini (Brethes, 1905) | 3 (0.5) | 0 | 3 (0.5) |
| O. aff. lacerum Giordani Soika, 1977 | 1 (0.2) | 0 | 1 (0.2) |
| Pachymenes ghiliani (Spinola, 1851) | 3 (0.5) | 0 | 3 (0.5) |
| P. picturatus (Fox, 1899) | 3 (0.5) | 0 | 3 (0.5) |
| P. olympicus (Zavattari, 1912) | 1 (0.2) | 2 (0.4) | 3 (0.5) |
| Pararhaphidoglossa confluens (Fox, 1899)* | 2 (0.4) | 0 | 2 (0.4) |
| Zethus aff. pluemanni | 0 | 1 (0.2) | 1 (0.2) |
| Zethus sp. discoideoides group | 0 | 1 (0.2) | 1 (0.2) |

**TOTAL** | 407 (73.6) | 146 (26.4) | 553 (100)

*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 et al. 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 Rupetres” of Bahia (Silveira et al. 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 confluens (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 CTC-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 | Polistes versicolor (Olivier, 1792) |
|           | Mischocytartus socialis de Saussure, 1854 |
|           | Mischocytartus cassunungo von Ihering, 1903 |
|           | Mischocytartus confusus (Zikán, 1935) |
|           | Apoica florissima Van de Vecht, 1973 |
|           | Polybia striata (Fabricius, 1787) |
|           | Protopolybia exigua (de Saussure, 1854) |
|           | P. sedula (de Saussure, 1854) |
| Eumeninae | Ancistroceroides sp. |
|           | Hypancistrocerus sp. |
|           | Montezumia azurescens (Spinola, 1851) |
|           | Omicron gondwanium (Giordani Soika, 1978) |
|           | O. tuberculatum (Fox, 1899) |
|           | Omicron sp. |
|           | Pachodynerus nasidens (Latreille, 1817) |
|           | Stenosigma allegrum Zavattari, 1912 |
|           | Zethus smithii de Saussure, 1855 |
|           | Z. dubius Smith, 1857* |

*New record for the State of Minas Gerais*

As already highlighted by Silveira (2002), comparison between surveys is 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 Alvaraes, 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) | Angiopolybia palleni (Lepeletier, 1836) | 3 | 1095 |
| Noll & Gomes (2009) | 7 | 2 (28.6) | Agelaia vicina de Saussure, 1854 | 1 | 455 |
| Perillo et al. (2020) | 13 | 12 (92.3) | Polystya fastidiosuscule de Saussure, 1854 | 14 | 392 |
| Silva & Silveira (2009) | 65 | 26 (40.0) | Angiopolybia palleni (Lepeletier, 1836) | 26 | 260 |
| Silveira et al. (2008) | Mamirauá, AM | 46 | 23 (50.0) | Agelaia fulvofasciata (DeGeer, 1773) | 26 | 256 |
| Alvarães, AM | 42 | 29 (69.0) | Agelaia fulvofasciata (DeGeer, 1773) | 12 | 180 |
| Região dos Lagos, AP | 31 | 0 | Polistes canadenses (Linnaeus, 1758) | 18 | 90 |
| Silveira (2002) | 78 | 28 (35.9) | Polystya liliacea (Fabricius, 1804) | 16 | 640 |
| Present Study | 26 | 18 (69.2) | Agelaia myrmecophila (Ducke, 1905) | 2 | 730 |

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