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Community of social wasps (Hymenoptera: Vespidae) in areas of Semideciduous Seasonal Montane Forest

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Abstract

The composition of the fauna of social wasps in two areas of Semideciduous Seasonal Montane Forest in Southeastern Brazil was investigated. The collections were conducted between January 2011 and February 2013 with the use of two methodologies: bait traps and active collecting. Thirty-four species were recorded, distributed in 11 genera, namely, *Polybia* Lepeletier represented by 11 species (31%), followed by *Polistes* Latreille and *Mischocyttarus* de Saussure, both with seven species (20%); the other genera were represented only by one or two species. Three new records were done for Minas Gerais: *Mischocyttarus consimilis* Zikán, *Mischocyttarus ignotus* Zikán and *Mischocyttarus paraguayensis* Zikán. The similarity of the fauna of social wasps of the different studies conducted in Minas Gerais presented negative and significant correlation with the distance among the areas (r^2=0.1488, p= 0.02).

Introduction

Social wasps (Hymenoptera: Vespidae), known as marimbondos and/or cabas (Souza & Zanuncio, 2012), possesses cosmopolitan distribution, with the greatest diversity of species in the Neotropical region (Carpenter, 1981; Carpenter & Marques, 2001). In Brazil, the representatives of that group belong to the subfamily Polistinae, with around 319 species reported in 26 genera (Prezoto et al., 2007). They are found in natural environments (Elpino-Campos et al., 2007; Souza et al., 2012), both cultivated (Auad et al., 2010; De Souza et al., 2012) and man-modified areas (Jacques et al., 2012; Souza et al., 2013).

Social wasps play an important role in the communities, whether in the natural whether agricultural ecosystems by the predation pressure exerted on the populations of other organisms (Carpenter & Marques, 2001; Souza & Zanuncio, 2012). Another function which has been ascribed to those insects is the one of acting as important components of the guild of floral visitors in the Neotropics (Heithaus, 1979; Aguiar & Santos, 2007; Clemente et al., 2013).

In spite of the ecological importance of social wasps, a few species are potentially endangered of extinction, particularly in consequence of the human action by the destruction of the colonies, indiscriminate use of insecticides (Prezoto, 1999; Souza et al., 2012), in addition to the fragmentation and replacement of continuous forest areas, which has brought about the decrease of the nesting sites and food sources (Souza et al., 2010; Souza et al., 2014).

In that way, the knowledge of the fauna of those insects becomes urgent with the purpose of supporting conservation and management actions and programs which aim at the maintenance of those species and environmental services (Elpino-Campos et al., 2007).

In spite of several works of diversity of social wasps having been carried out in Minas Gerais in the latest years, are few the sampled areas of natural vegetation (Souza & Zanuncio, 2012).

In this context, the achievement of that study proposes to obtain information of the fauna of social wasps in two areas of Semideciduous Seasonal Montane Forest in Southeastern Brazil.

Material and methods

Study area

The data of the present study were obtained in the "Parque Estadual Serra do Brigadeiro" (PESB) and in the municipality of "São Gonçalo do Sapucaí".

The PESB is situated at 20º 43' S 42º 29' W, with altitudes reaching 1,900 m. The region's climate is of the type middle mesothermal (Cwb), with annual average rainfall of 1,300 mm and annual average temperature of 18 ºC (Engevix, 1995). The vegetation of the PESB is made up of Seasonal Semideciduous Forest, of Upper Montane Formation, with Campos de Altitude (altitude fields) occupying the isolated plateaus and the cliffs in some areas above the elevation height of 1,600 m (Veloso et al., 1991).

The municipality of "São Gonçalo do Sapucaí" (SGS) is situated at 21° 52′ S, 45° 35′ W, with altitude around 1,000 m. The climate of the region is of the type humid subtropical according to the Köppen climate classification. The vegetation of SGS is of the type Semideciduous Seasonal Montane Forest, Riparian Forest and Campo Cerrado.

Method

The species of social wasps were collected in "Parque Estadual Serra do Brigadeiro" in the period of January to December of 2011, with 20 days collection and in "São Gonçalo do Sapucaí", in the period of April of 2012 to February of 2013, with 20 days of sampling. The collections in both the areas were conducted by means of the active collecting and bait traps (Silveira, 2000; Souza & Prezoto, 2006).

The active collecting was performed in the interval between 7 hours and 17 hours in existing trails, on plants with flowers, rocky outcrops, areas close to the streams existing in the area, holes in tree trunks, broad-leafed vegetation, canopy (with the aid of binoculars), abandoned buildings, farms nearby farms and termite hills. It amounted to a sampling effort of 200 hours' collection per area.

The bait traps for collection of social wasp species were manufactured with translucent "pet" type plastic bottles of two litters with two triangular side openings (2 x 2 x 2 cm) (Souza & Prezoto, 2006).

Passion fruit (*Passiflora edulis f. Flavicarpa* Deg.; Passifloraceae), mango (*Mangifera indica* L.; Anarcadiaceae) and sardine (*Sardinella brasiliensis* Steindachner 1789) were used as baits,. For preparation of the baits we have used, 1 kg of fruit pulp, 200 grams of crystal sugar and two litters of tap water. For the sardine, 250 kg for each two litters of tap water were used. The attractants were prepared with the aid of a blender in order to obtain a homogenous blend. Eight sets of traps per area were set up, each set being made up of the three attractive substances (mango, sardine and passion fruit), suspended at 1.50m away from ground and 100 meters equidistant. For standardization purposes, in each trap 300 ml of the bait were placed. The traps were collected after a week in order to avoid the insects deterioration.

The identifications of the specimens were done on the basis of keys proposed by Richards (1978), Carpenter and Marques (2001), Carpenter (2004) and by comparison with the specimens of the collection of social wasps of IF-SULDEMINAS and those of the collection of the "Museu Paraense Emílio Goeldi", Belém, Pará. The vouchers were incorporated to the heritage of the IF-SULDEMINAS collection, Campus Inconfidentes, Minas Gerais (http://vespas.ifs.ifsuldeminas.edu.br) and in the Entomology Collection of the Museu Paraense Emilio Goeldi, Belém, Pará.

Literature Data

For the similarity analysis among the faunas of social wasps collected in the state of Minas Gerais, data of areas of Cerrado of the works of Elpino-Campos et al. (2007) in "Uberlândia" (15º57'S, 48º12'W and 19º09'S, 48º23'W) and Simões et al. (2012) in the "Reserva Biológica Unilavras-Boqueirão" (21º20'S e 44º59'W); "Campo Rupestre" of the works of Prezoto and Clemente (2010) in "Parque Estadual do Ibitipoca" (21º40'S e 43º52'W) and Souza et al. (2010) in the "APA São José" (21°05'S and 44°10'W); area of Evergreen Forest, Atlantic Forest of the work of Souza et al. (2012) in "Parque Estadual do Rio Doce" (19º38'S e 42º 31'W); transition area Cerrado Semideciduous Forest of the works of Souza and Prezoto (2006) e Souza et al. (2008) in "região da Mata do Baú" (21°12'S e 43º55'W) and man-modified area of the work of Jacques et al. (2012) on the "Campus da UFV" (20º46'S e 42º52'W) were utilized.

Data analysis

The comparison between the faunas of social wasps collected in the state of Minas Gerais was done by the cluster analysis (UPGMA) by means of the Jaccard similarity coefficient (Krebs, 1998), which takes into consideration the occurrence of the two species in each area.

In the similarity analysis were utilized only the species with identifications till the species level. Species listed only as "sp." in Souza et al. (2012), Elpino-Campos et al. (2007) and Jacques et al. (2012) were not included in the survey. The identifications at the subspecies level of the works of Elpino-Campos et al. (2007), Souza et al. (2008), Souza et al. (2010), Souza et al. (2012) were not taken into account in the survey.

The Pearson analysis (*r*) (Zar, 1999) was utilized to establish likely similarity relation among the faunas of social wasps of nine areas studied in Minas Gerais with their respective distances utilizing the software Statistica for Windows 5.0. In the analysis undertaken, the level of significance (α) of 0.05 was considered. The data of the distances (Km) among the areas were obtained by the tool "rule" of the Google Earth Pro.

Results and Discussion

During the period of study were recorded 34 social wasp species distributed into 11 genera, with representatives of the tribes Polistini (seven species), Mischocyttarini (seven species) and Epiponini (nine genera and 20 species) (Table 1).

Table 1. List of social wasp species recorded in the "Parque Estadual Serra do Brigadeiro" in the period from January to December 2011, and the municipality of "São Gonçalo do Sapucaí" in the period from April 2012 to February 2013, Minas Gerais, Brazil.

Species	PESB	SGS
Epiponini		
Agelaia multipicta (Haliday, 1836)	-	+
Agelaia vicina (De saussure, 1854)	+	+
Apoica gelida Van der Vecht, 1973	-	+
Brachygastra lecheguana (Latreille, 1824)	+	+
Parachartergus fraternus (Griboldo, 1892)	-	+
Polybia chrysothorax (Lechtenstein, 1796)	+	+
Polybia fastidiosuscula de Saussure 1854	+	+
Polybia ignobilis (Haliday, 1836)	+	+
Polybia jurinei Saussure, 1854	+	+
Polybia minarum Ducke, 1906	+	+
Polybia occidentalis (Olivier, 1791)	+	+
Polybia paulista Von Ihering 1896	+	+
Polybia platycephala Richards, 1978	+	-
Polybia punctata Buysson, 1908	-	+
Polybia scutellaris (Write, 1841)	+	+
Polybia sericea (Olivier, 1791)	+	+
Protonectarina sylveirae (Saussure, 1854)	+	+
Protopolybia sedula (Saussure, 1854)	+	+
Pseudopolybia vespiceps (Saussure, 1864)	-	+
Synoeca cyanea (Fabricius, 1775)	+	+
Polistini		
Polistes actaeon Haliday, 1836	-	+
Polistes billardieri ruficornis Saussure, 1854	-	+
Polistes cinerascens Saussure, 1853	+	+
Polistes ferreri Saussure, 1853	+	+
Polistes lanio lanio (Fabricius, 1775)	-	+
Polistes simillimus Zikán, 1951	+	+
Polistes versicolor (Olivier, 1971)	-	+
Mischocyttarini		
Mischocyttarus consimilis, Zikán 1949	-	+
Mischocyttarus ignotus, Zikán, 1949	-	+
Mischocyttarus atramentarius Zikan 1949	-	+
Mischocyttarus cassununga (Von.Ihering, 1903)	+	+
Mischocyttarus drewseni Saussure, 1857	+	+
Mischocyttarus paraguaensis, Zikán, 1935	+	+
Mischocyttarus rotundicollis (Cameron,1912)	+	+
Total	22	33

+ (Present in the area) and - (absent in the area).

The richness of species recorded in this study for tribe Epiponini when compared with Mischocyttarini and Polistini (Table 1) can be related to the fact of the species of the first tribe presenting founding of its colonies by swarming, which can build large nests containing a great deal of individuals (Jeanne, 1991; Carpenter & Marques, 2001), making this way the occurrence of a great deal species of that tribe frequent in the places where the nests are built (Locher et al., 2014).

The genus *Polybia* Lepeletier, 1836 was the most representative with 11 species (31%), followed by *Polistes* Latreille (1802) and *Mischocyttarus* de Saussure, 1853, both with seven species (20%), the other genera were represented by only one to two species (Fig 1). The greatest richness of species recorded in this study for the genus *Polybia* corroborates with other surveys done in Minas Gerais (Elpino-Campos et al., 2007; Souza et al., 2014) and other regions in Brazil (Diniz & Kitayama, 1994; Somavilla et al., 2014). Nevertheless, those results differ from those recorded by Silveira (2002) and Silva and Silveira (2009) who inventoried the stretch of Amazon Rainforest in Caxiuanã, PA and Souza et al. (2012) in an area of Campos Rupestres in Tiradentes, MG, in which the most representative genus was *Mischocyttarus*.

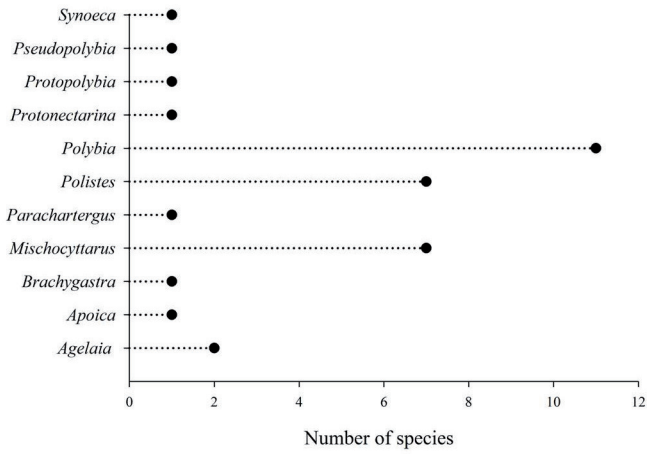

Fig 1. Number of species per genus of social wasps recorded in the "Parque Estadual Serra do Brigadeiro" in the period from January to December 2011, and the municipality of "São Gonçalo do Sapucaí" in the period from April 2012 to February 2013, Minas Gerais, Brazil.

Twenty-one species of social wasps were common to both areas. Twelve species were unique to "São Gonçalo do Sapucaí" and only one to "Parque Estadual Serra do Brigadeiro" (Table 1). The occurrence of particular species in the habitats can be related to the presence of substrates with conditions specific to nesting, in addition to the favorable conditions of temperature and humidity required to the development of the immature ones (Dejean et al., 1998; Kumar et al., 2009; Souza et al., 2010; Souza & Zanuncio, 2012).

Three new records were done for Minas Gerais, *Mischocyttarus consimilis*, Zikán 1949; *Mischocyttarus ignotus,* Zikán, 1949 in "São Gonçalo do Sapucaí" and *Mischocyttarus paraguayensis*, Zikán, 1935 in "Parque

Estadual Serra do Brigadeiro" (Souza et al., 2015). The record of new species of the genus *Mischocyttarus* is due to the sum of factors, such as the tiny size of their nests with few individuals, in addition to the fact forming the largest group of social wasps, with 245 species of nine subgenera, which added to the regions little investigated as areas of forest on the mountain tops in Minas Gerais, increases the chance of unprecedented records (Cooper, 1998; Silveira, 2008; Souza et al., 2012; Souza et al., 2015).

On the basis of the Jaccard similarity coefficient among faunas of social wasps, some surveys done in the state of Minas Gerais, it was possible to observe the formation of basically two groups. One formed by the "Parque Estadual do Rio Doce" region, area of evergreen forest, Atlantic Forest (Souza et al., 2012) and the other by the other areas (Elpino-Campos et al., 2007; Souza et al., 2008; Prezoto & Clemente, 2010; Souza et al., 2010; Jacques et al., 2012; Simões et al., 2012 and present study) (Fig 2).

Greater similarity value between the composiiton of the species of "Parque Estadual Serra do Brigadeiro" and "São Gonçalo do Sapucaí" was found, both present in the study, with around 65% of similarity, followed by "Mata do Baú" with "APA Tiradentes" (59%); "Mata do Baú" and "Reserva Biológica Unilavras-Boqueirão" (57%); "APA Tiradentes" and "Reserva Biológica Unilavras-Boqueirão" (54%); "Parque Estadual Serra do Brigadeiro" and "Mata do Baú" (54%); "Parque Estadual do Ibitipoca" and "Parque Estadual Serra do Brigadeiro" (51%). The other areas obtained similarity below 50%. "Parque Estadual do Rio Doce" presented smaller

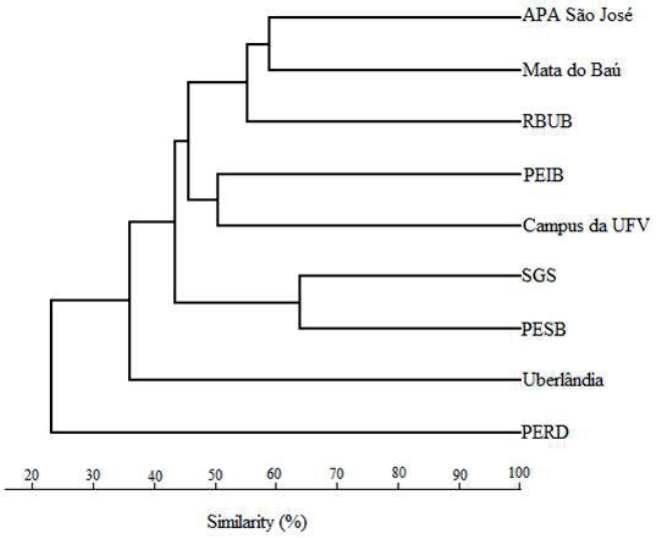

Fig 2. Dendrogram similarity Jaccard among the fauna of social wasps nine areas studied in Minas Gerais. Data retrieved from the regions of "Mata do Baú" (Souza & Prezoto, 2006; Souza et al., 2008), "Uberlândia" (Elpino-Campos et al., 2007), "Parque Estadual do Ibitipoca" (PEIB) (Prezoto & Clemente, 2010), "APA São José" (Souza et al., 2010), "Reserve Biológica Unilavras-Boqueirão" (RBUB) (Simões et al., 2012), "Parque Estadual do Rio Doce" (PERD) (Souza et al., 2012), "Campus da UFV" (Jacques et al., 2012) , "São Gonçalo do Sapucaí" (SGS) and "Parque Estadual Serra do Brigadeiro" (PESB) (this study).

similarity index with the all the other areas, which ranged from 16 to 32% (Fig 2). The similarity of the faunas of social wasps of the different studies conducted in Minas Gerais presented negative and significant correlation with the distance among the areas showing that the greater the distance, smaller the similarity (r^2=0.1488, p= 0.02) (Fig 3).

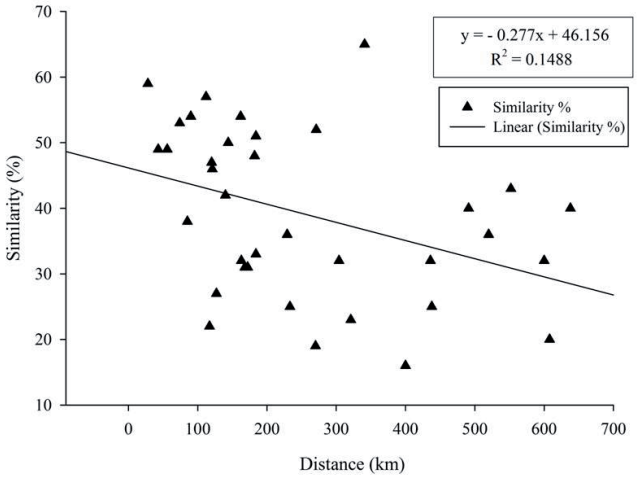

Fig 3. Correlation Pearson between the similarity (Jaccard) between the faunas of social wasps of nine areas studied in Minas Gerais with their respective distances.

The greatest similarity values between PESB and SGS, in the present study, can be explained by the vegetation structure of the two areas (Semideciduous Seasonal Montane Forest) as well as historical and geographical factors. However, for the low similarity of the "Parque Estadual do Rio Doce" region as well as the other areas, can be ascribed to the fact that the region of the park relates to ecosystems with unique vegetation and climate features, which are important factors in determining the composition of social wasp species which occur in a given area (Elpino-Campos et al., 2007; Santos et al., 2007; Souza et al., 2012).

The studies in Semideciduous Forest in the latter decade revealed eight new species of social wasps for the state of Minas Gerais and endemic to that ecosystem (Souza & Prezoto, 2006; Prezoto et al., 2009; Souza et al., 2015), which shows the importance of that site, even fragmented. Nevertheless, with advance of deforestation ad the few areas inserted into Conservation Units can take to the loss of those species, mainly those which need particular conditions for nesting (Souza et al., 2010; Souza et al., 2014).

The results point to a diversity of social wasps for Minas Gerais, showing that the region plays an important role in the distribution of this fauna for the Southeast region of Brazil.

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