

SOCIAL WASP FAUNA (HYMENOPTERA: POLISTINAE) FROM THE CAATINGA AND THE ATLANTIC FOREST OF THE STATE OF BAHIA, BRAZIL

FAUNA DE VESPAS SOCIAIS (HYMENOPTERA:
POLISTINAE) DA CAATINGA E MATA ATLÂNTICA DO ESTADO DA BAHIA, BRASIL

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Abstract

In this work, we carried out an inventory of social wasps (Hymenoptera, Polistinae) from remnants of Caatinga and Atlantic Forest from the central-south region of the state of Bahia. Nest sampling was carried out in the period from March 2010 to June 2011, using the method of active search. We obtained 90 nests and identified 22 species, three subspecies and one morphospecies of social wasp belonging to ten genera and eight subgenera. Five species were recorded for the first time in the state of Bahia, and the genus *Polybia* was the most frequent one, with seven identified species. The obtained results confirmed the diversity of the Atlantic Forest, and point to a rich fauna of social wasps in the Caatinga.

Key words: Inventory, Wasp diversity, Social wasp, Vespidae.

Resumo

Neste trabalho foi realizado um inventário da fauna de vespas sociais (Vespidae: Polistinae) em áreas de transição entre Caatinga e Mata Atlântica da região Centro Sul do Estado da Bahia, Brasil. As amostragens dos ninhos de vespas sociais foram realizadas no período de março de 2010 a junho de 2011. O método de amostragem foi o de busca ativa dos ninhos. Dos 90 ninhos coletados, foram identificadas 22 espécies, três subespécies e uma morfoespécie de vespas sociais pertencentes a dez gêneros e oito subgêneros. Cinco espécies foram registradas pela primeira vez para o estado da Bahia. O gênero *Polybia* foi o mais frequente com sete espécies identificadas. Os resultados obtidos nesse trabalho comprovaram a diversidade de espécies descritas para outras fitofisionomias do estado da Bahia.

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Palavras-chave: Inventário, Diversidade de vespas, Vespas sociais, Vespidae.

INTRODUCTION

Inventories of faunal species are an important step towards knowing the biodiversity of a region. Such studies are valuable and contribute information to wider studies on the ecological features of a habitat or ecosystem (MARQUES *et al.* 1993). The estimation of the number of insect species occurring in a biological community supports proposals of biodiversity conservation (STEWART *et al.* 2007).

The family Vespidae is monophyletic, widely distributed, and includes six subfamilies: Masarinae, Eumeninae, Polistinae, Euparagiinae, Stenogastrinae and Vespinae (CARPENTER 1981, 1993). From these, only the former three occur in Brazil, with Polistinae being particularly important owing to its high species diversity, as well as its observed behavioral and morphological variability, mainly in the Neotropical region (CARPENTER, 1991).

The world fauna of social wasps in the subfamily Polistinae is constituted by 26 genera and around 900 species. In Brazil, there are 21 genera and approximately 304 species, with 104 of them being endemic (CARPENTER, 2004). According to CARPENTER (1993), the Polistinae occurring in Brazil belong to three tribes: Polistini (*Polistes*), Mischocyttarini (*Mischocyttarus*) and Epiponini (remaining genera). The Epiponini constitute the most diverse tribe, corresponding to 19 genera (CARPENTER, 2004).

RICHARDS (1978) recorded the occurrence of 48 species of social wasps in the state of Bahia, although he did not inform the localities where collections were carried out. Recent inventories in different biomes raised the number of described species to 64. In the Atlantic Forest, it is worth mentioning the works of MARQUES *et al.* (1991), with six new species, and MENEZES (2009) and MENEZES *et al.* (2010), each with a new recorded species. In the Caatinga (i.e. Brazilian semi-arid biome), it is worth noting the contribution by SANTOS *et al.* (2009a), with a new catalogued species. In the Cerrado (i.e. Brazilian savannah), SANTOS *et al.* (2009b) found four new records, and in mangrove, Atlantic Forest and Restinga (i.e. Brazilian coastal vegetation), the work by SANTOS *et al.* (2007) reported three new records.

However, there is a gap in the knowledge on the diversity of these wasps in the central-south region of Bahia, particularly in the zones of transition between Caatinga and Atlantic Forest, whose phytophysionomies and climate conditions are distinct from those of the areas already studied. Areas of transition or ecotones feature an environment where different ecological communities meet (KARK and VAN-RENSBURG, 2006). Often, such regions feature high species richness and a variety of ecological niches, possibly including organisms of adjacent communities (ODUM and BARRETT, 2008). CARDOSO and QUEIROZ (2011) note that, although the Caatinga is among the most threatened decidual vegetation types in the

Neotropical Region, being affected by extensive destruction of natural areas, it is also underappreciated regarding biodiversity studies and has been supported by few conservationist endeavors, with the smallest protected area among all Brazilian biomes (LEAL *et al.* 2005). Recent studies have shown the Caatinga to be a region of high biodiversity and of great interest to studies of distribution in phylogenetic patterns (CARDOSO and QUEIROZ, 2011).

Thus, the current work aimed at carrying out an inventory of social wasp species (Vespidae: Polistinae) in fragments of Caatinga and Atlantic Forest in the central-south region of the state of Bahia.

METODOLOGY

The collections of social wasp nests were carried out between March 2010 and June 2011 in rural localities of the central-south region of the state of Bahia, namely in the municipalities of Brejões (S13°04'18.6"; W39°47'02.2"), Jequié (S13°52'03.7"; W40°09'26.6"), Jitaúna (S14°02'22.9"; W39°54'14.7"), Itagi (S14°09'46.0"; W40°00'21.0"), Ibirataia (S14°09'46.0"; W40°00'21.0"), Poçoões (S14°31'48.0"; W40°21'54.0") and Dário Meira (S14°26'09.0"; W39°54'28.0"), all in the surroundings or within areas between Caatinga and Atlantic forest (Fig. 1).

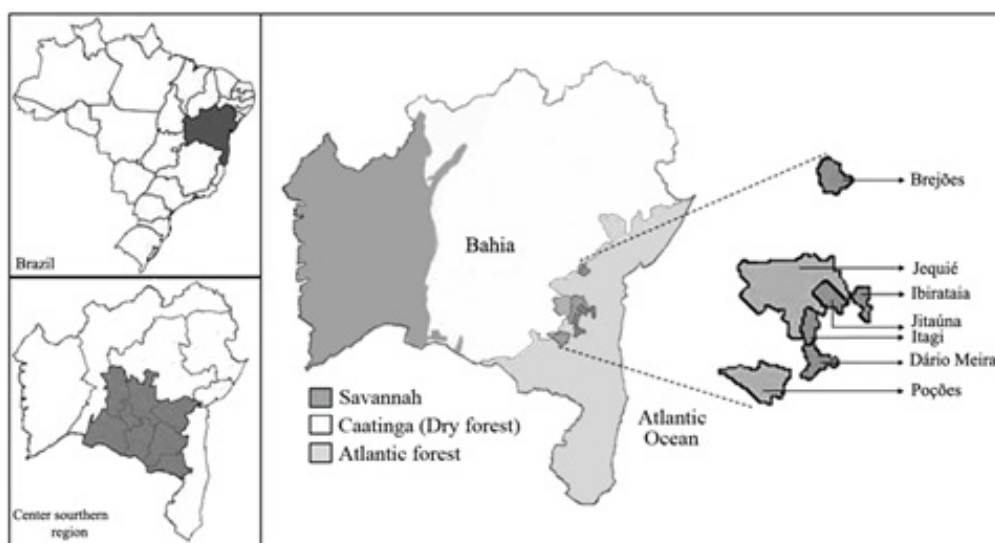


Fig. 01: Location of the sampling municipalities in the central-south region of Bahia Brazil.

In the municipalities of Brejões, Jequié and Poçoões, sampling was carried out in areas where the phytophysiology is typical of the dry, deciduous forests of Caatinga, with a typically branched, spiny shrub vegetation, plenty of bromeliads, spurge,

cacti and leguminosae, surrounded by areas with highly irregular and discontinuous rainfall (LEAL *et al.* 2005).

In the municipalities of Itagi, Jitaúna, Ibirataia and Dário Meira, there are remnants of montane, semideciduous seasonal forest, which are more closely related to the Atlantic Forest. Many of its species are quoted as being endemic of southern Bahia and northern Espírito Santo, and a few from the Caatinga (MACEDO, 2007 unpublished data).

The climate of the region is variable. In the transition between the dry forest (Caatinga) and the wet forest (Atlantic Forest), climate varies from sub humid to dry and semiarid, with annual mean temperature of 22.07°C and mean annual rainfall of 679.03mm (BAHIA, 2010, 2011a and 2011b). However, in the fragments of semideciduous seasonal Forest, climate varies from humid to sub humid and dry, with a mean annual temperature of 24.00°C and a mean annual rainfall of 1207.18mm (BAHIA, 2011b) Table 1.

Table 01: Climate data from the sampled areas belonging to municipalities in the central-south region of the state of Bahia.

MUNICIPALITY	Climate type	Mean annual temperature (°C)	Annual rainfall (mm)
Brejões	Sub humid to dry	21.2	936.6
Jequié	Semi-arid	24.3	617.5
Poções	Semi-arid	20.7	483
Mean	-	22.07	679.03
Jitaúna	Humid to subhumid	24.5	1315.6
Itagi	Humid to subhumid	24.5	1315.6
Ibirataia	Sub humid to dry	23.8	1088.1
Dário Meira	Sub humid to dry	23.2	1109.4
Mean	-	24.00	1207.18

We used active search of nests as sampling method, which consisted in looking for them in existing trails in the sampling areas. We focused on buildings, branches, trunks and leaves in the vegetation. Once a nest was found, it was collected, put into a plastic bag and transported to the Laboratory of Insect Biology (*Laboratório de Biologia de Insetos*) at the Jequié (BA) campus of *Universidade Estadual do Sudoeste da Bahia*. Adults were mounted in entomological needles or kept in individual tubes with ethanol in a freezer at -20°C. Insect identification was carried out under a stereomicroscope, with the aid of dichotomous keys by RICHARDS (1978), CARPENTER (2004), PICKETT and WENZEL (2007), SILVEIRA (2008) and ANDENA *et al.* (2009). The collected specimens were deposited in reference collections in Laboratory of Insect Biology (UESB) and in the Laboratory of Ecology

and Systematics of Pollinators (*Laboratório de Ecologia e Sistemática de Polinizadores*) at the *Universidade Federal do Maranhão*, São Luis/MA.

RESULTS

From the 90 collected nests, 22 species were identified, as well as three subspecies and one morphospecies of social wasps belonging to ten genera and eight subgenera. In the areas of dry, caducifolious forest, we identified 13 species and two subspecies, which represented 52.17% of the collected nests. In the areas of semideciduous, seasonal forests, in the domain of Atlantic Forest, we identified 14 species, two subspecies and one morphospecies, which represented 47.73% of the collected nests (Table 2).

Table 02: List of species, percentage of sampled nests and sampling locations of social wasps collected in areas of transition between Caatinga and Atlantic Forest.

Ecosystem / Tribe / Species	Percent	Collection Sites
DRY AND DECIDUOUS FOREST (CAATINGA)		
Epiponini		
<i>Apoica (Apoica) flavissima</i> (Van der Vecht, 1973)	4.44	Brejões and Jequié / BA
<i>Brachygastra lecheguana</i> (Latreille, 1824)	3.33	Brejões / BA
<i>Polybia (Formicicola) rejecta</i> (Fabricius, 1798)	1.11	Jequié / BA
<i>Polybia (Myrapetra) occidentalis</i> sp1	5.55	Brejões and Jequié / BA
<i>Polybia (Myrapetra) occidentalis</i> sp2	1.11	Poções / BA
<i>Polybia (Myrapetra) ruficeps xanthops</i> (Richards, 1978)	3.33	Brejões / BA
<i>Polybia (Trichothorax) chrysothorax</i> (Lichtenstein, 1796)	2.22	Brejões / BA
<i>Polybia (Trichothorax) ignobilis</i> (Haliday, 1836)	1.11	Brejões / BA
<i>Polybia (Trichothorax) sericea</i> (Olivier, 1791)	4.44	Brejões and Jequié / BA
<i>Protopolybia exigua</i> (de Saussure, 1854)	6.66	Jequié / BA
Total Epiponini	33.30	
Polistini		
<i>Polistes (Aphanilopterus) versicolor</i> (Olivier, 1791)	9.99	Jequié / BA
<i>Polistes (Aphanilopterus) canadensis borientalis</i> (Richards, 1978)	3.33	Jequié / BA
Total Polistini	13.32	
Mischocyttarini		
<i>Mischocyttarus (Monocyttarus) cearensis</i> (Ricards, 1945)	1.11	Jequié / BA
<i>Mischocyttarus (Mischocyttarus) rotundicolis</i> (Cameron, 1912)	2.22	Jequié / BA
<i>Mischocyttarus</i> sp1	2.22	Jequié / BA
Total Mischocyttarini	5.55	
Partial - Biome Caatinga	52.17	
SEMI-DECIDUOS SEASONAL FOREST (ATLANTIC FOREST)		

Ecosystem / Tribe / Species	Percent	Collection Sites
Epiponini		
<i>Angiopolybia pallens</i> (Lepeletier, 1836)	1.11	Itagi / BA
<i>Metapolybia decorata</i> (Gribodo, 1896)	5.55	Dário Meira / BA
<i>Parachartergus fraternus</i> (Gribodo, 1891)	1.11	Ibirataia / BA
<i>Polybia (Apopolybia) jurinei</i> (Saussure, 1854)	2.22	Itagi and Jitaúna / BA
<i>Polybia (Formicicola) rejecta</i> (Fabricius, 1798)	1.11	Ibirataia / BA
<i>Polybia (Myrapetra) catillifex</i> (Moebius, 1856)	3.33	Itagi and Ibirataia / BA
<i>Polybia (Myrapetra) sp. 4</i>	1.11	Dário Meira / BA
<i>Polybia (Myrapetra) occidentalis sp.1</i>	1.11	Jitaúna / BA
<i>Polybia (Myrapetra) occidentalis sp.2</i>	1.11	Ibirataia / BA
<i>Polybia (Myrapetra) platycephala</i> (Richards, 1978)	2.22	Itagi / BA
<i>Polybia (Trichothorax) chrysothorax</i> (Lichtenstein, 1796)	7.77	Itagi and Ibirataia / BA
<i>Polybia (Trichothorax) sericea</i> (Olivier, 1791)	2.22	Jitaúna and Dário Meira / BA
<i>Protopolybia</i> (de Saussure, 1854)	1.11	Ibirataia / BA
<i>Synoeca cyanea</i> (Fabricius, 1775)	2.22	Itagi and Ibirataia / BA
Total Epiponini	33.30	
Polistini		
<i>Polistes (Aphanilopterus) versicolor</i> (Olivier, 1791)	4.44	Jitaúna and Dário Meira / BA
Total Polistini	4.44	
Mischocyttarini		
<i>Mischocyttarus (Monocyttarus) cassununga</i> (R. von Ihering, 1903)	9.99	Dário Meira / BA
Total Mischocyttarini	9.99	
Partial - Atlantic forest Biome	47.73	
GRAND TOTAL	100	

We found that only six taxa were common to both studied ecosystems: *Polybia (Formicicola) rejecta*, *Polybia (Myrapetra) occidentalis sp.1*, *Polybia (Myrapetra) occidentalis sp.2*, *Polybia (Trichothorax) chrysothorax*, *Polybia (Trichothorax) sericea* and *Polistes (Aphanilopterus) versicolor*. In parallel, nine species were sampled only in the areas of dry forest and eleven others were solely sampled in areas of semideciduous seasonal forest.

Nests of wasps in the genus *Polybia* (Lepeletier) were the most frequent (41.07%), with 18.87% belonging to the subgenus *Myrapetra*, 17.76% to the subgenus *Trichothorax*, and 4.44% belonging to the subgenera *Apopolybia* and *Formicicola*. *Polybia* was also the most diverse genus, with eight identified species, three subspecies in the *occidentalis* group and one morphospecies, for a total of 12 taxa.

In this study, the species *Polybia (Myrapetra) occidentalis* was sampled in five of the eight investigated municipalities and had three subspecies, here treated as sp₁, sp₂ and sp₃. Species in the genera *Polistes* and *Mischocyttarus* accounted together for 33.3% of the collected nests.

DISCUSSION

The six taxa sampled in the studied ecosystems display a higher efficiency in the use of the contrasting ecological conditions of vegetation, temperature and resource availability in the two phytophysiognomies. The sampling of these species was expected, as the genera *Polybia* and *Polistes* have broad geographic distribution. The taxa sampled only in the areas of dry forest or in areas of wet forest may be more adapted to the environmental specificities of each phytophysiognomy.

Five species identified in this work constitute the first records of occurrence for the state of Bahia: *Apoica (Apoica) flavissima* and *Mischocyttarus (Monocyttarus) cearensis*, sampled in the Caatinga, as well as *Parachartergus fraternus*, *Polybia (Myrapetra) catillifex* and *Polybia (Myrapetra) platycephala*, sampled in the domain of Atlantic Forest. Literature data, together with the new records of occurrence mentioned in the present work, point to the current existence of around 70 species of Polistinae recorded for the state of Bahia.

The high diversity of the genus *Polybia* was already expected, considering that, from the 58 valid species distributed from southern United States to northern Argentina, 44 species have already been recorded in Brazil, 16 of them in the state of Bahia (RICHARDS 1978; MARQUES *et al.* 1993; SANTOS *et al.* 2007).

The three subspecies and the morphospecies in the genus *Polybia* that were not completely identified, belong to the subgenus *Myrapetra*, the largest among the *Polybia* genera. *Myrapetra* is treated as a subgenus of problematic classification, owing to the variety of colors found in its specimens and the apparent confusion of its morphological patterns. This is particularly true for those species and subspecies in the *P. occidentalis* group, which are differentiated by the yellow coloration of different parts of the body (RICHARDS, 1978), which constitutes a taxonomic character with little robustness.

Four species identified in this study have not been reported in recent inventories carried out in different phytophysiognomies in the state of Bahia: *Mischocyttarus (Mischocyttarus) rotundicollis* and *Polybia (Myrapetra) ruficeps xanthops*, which were sampled in the Caatinga, as well as *Polybia (Apopolybia) jurinei* and *Protopolybia sedula*, collected in the Atlantic Forest. These species have not been reported from studies in the state of Bahia since RICHARDS (1978).

The high frequency of nests of the genera *Polistes* and *Mischocyttarus* may be due to the fact that these wasps display the behavior of founding a primary nest followed by new, smaller nests around the original one (satellite nests) in due time, which are probably founded by daughters of the females that founded the original nest (RICHARDS, 1978; CARPENTER, 1991; NASCIMENTO, *et al.* 2008). The construction of satellite nests reinforces territorial behavior in many species of social wasps in which the distance between recently founded colonies and the mother one is short (JEANNE, 1980).

The species *Protopolybia exigua* (6.66%), *Brachygastra lecheguana* (3.33%) and *Synoeca cyanae* (2.22%) have already been recorded in the state of Bahia in inventories carried out by MARQUES *et al.* (1993), SANTOS *et al.* (2007) and SANTOS *et al.* (2009b). The species *Angiopolybia pallens* (1.11%) has also been recorded in the works by SANTOS *et al.* (2007) and SANTOS *et al.* (2009a). The species *Metapolybia decorata* (5.55%) has been recorded in the Atlantic Forest of southern Bahia by MENEZES *et al.* (2013). *Polybia (Myrapetra)* sp. 1 (1.11%) is probably an undescribed species.

The data obtained in this work corroborate the diversity of described species in different phytophysiognomies in the state of Bahia, as exemplified by the works of MARQUES *et al.* (1993), who identified 20 species in the domain of Atlantic Forest; SANTOS *et al.* (2007), who found 21 species in areas of mangrove, Atlantic Forest and Restinga; SANTOS *et al.* (2009a), who found 17 species in Caatinga; and SANTOS *et al.* (2009b), who found 19 in Cerrado.

These results point to a rich fauna of Polistinae in the studied region, especially regarding species in the genus *Polybia*, as these were the most abundant. These areas, by offering a greater variety of ecological niches, can attract species of social wasps from adjacent ecosystems and, perhaps, the insect fauna as whole. However, this will only be known by studies using other sampling methods that better characterize the faunal composition of the sampled areas.

Insect conservation has been hampered by a set of preconceived and essentially pejorative ideas about these organisms, which are reinforced by the paucity of ethnobiological studies and educational, conscientization activities (COSTA-NETO, 2000). In the particular case of social wasps, most are repelled by many people who are culturally inclined to eliminate them, often by burning their nests. Such aversion is related to the direct association of these animals to their painful sting (COSTA-NETO, 2004).

Nevertheless, it is worth noticing that the scientific community has given greater attention to the need for insect diversity conservation in recent years, by recognizing that many species are being extinct at a fast pace and by underscoring the important role that insects play in the maintenance of ecological processes (SAMWAYS, 2005). It is known that social wasps play the relevant role of generalist predators of larvae and other insect orders in the environment (JEANNE and TAYLOR, 2009), as well as effective pollination agents (CARPENTER, 1991). Thus, investigations that result in a more representative list of social insects, as well as studies on their biology, including threatened species, should be a priority as these can contribute to the elaboration of a basis for effective conservation strategies (CHAPMAN and BOURKE, 2001).

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