Sociobiology 61(1): 107-114 (2014) DOI: 10.13102/sociobiology.v61i1.107-114

Sociobiology

An international journal on social insects

RESEARCH ARTICLE - WASPS

Diversity of the Nests of Social Wasps (Hymenoptera: Vespidae: Polistinae) in the Northern Pantanal, Brazil

SM Almeida[1,3], SR Andena[2], EJ Anjos-Silva[3]

1 - Universidade do Estado de Mato Grosso, Nova Xavantina, Mato Grosso, Brazil.

2 - Universidade Estadual de Feira de Santana, Feira de Santana, Bahia, Brazil.

3 - Universidade do Estado de Mato Grosso, Cáceres, Mato Grosso, Brazil.

Article History
Edited by
Gilberto M M Santos, UEFS, Brazil
Received 11 October 2013
Initial acceptance 10 November 2013
Final acceptance 22 December 2013

Keywords
IndVal, cambarazal, pombeiral, campo limpo, wetlands

Corresponding author
Evandson José dos Anjos-Silva
Lab. de Abelhas e Vespas Neotropicais
Universidade do Estado de Mato Grosso
Departamento de Biologia
Av. Tancredo Neves s/n, Cavalhada
Cáceres, MT, Brazil 78200-000
E-mail: beevandson@uol.com.br

Abstract

Some species of wasps demonstrate plasticity with diverse nesting habits according to the environmental conditions and substrates used for building the nests, while others are restricted to habitats with specific conditions and may exhibit some degree of fidelity. The aim of this study was to estimate species richness and abundance of nests of Polistini and Epiponini wasps in four landscape units in the Pantanal of Poconé, Retiro Novo Farm, southwestern Mato Grosso state, Brazil. The nests of social wasps were sampled in four plant physiognomies locally known as cambarazal, landizal, pombeiral and campo limpo from August 25, 2011 to April 11, 2012, being recorded 308 nests of eight genera and 14 species of social wasps. The highest number of nests belongs to *Polybia ruficeps xanthops* (32.69%), *Poly*. *sericea* (24.27%) and *Synoeca surinama* (15.21%). The highest species richness was recorded in cambarazal and the highest abundance of nests in pombeiral, while campo limpo showed the lowest richness and abundance of nests. The nests of *S*. *surinama* were associated with cambarazal and landizal (IndVal = 93.3, *P* = 0.001), while the nests of *Poly*. *ruficeps xanthops* and *Poly*. *chrysothorax* were associated with cambarazal, landizal and pombeiral (IndVal = 97, *P* = 0.001). There was lower abundance and lower species richness of wasps in campo limpo. These results demonstrate that the maintenance of forest environments in the Pantanal is essential for the establishment and maintenance of social wasp nests.

Introduction

The most known social insects are the bees and the ants (Grimaldi & Engel, 2005; Melo et al., 2012), which belong to Apidae and Formicidae, respectively. The term "wasp" is applied to all other groups within the taxon (Melo et al., 2012). Most people, usually, have the perception that species of wasps live in a nest, sharing it with the other members of the colony, however only a small portion of the taxon is eusocial, in the sense that overlapping of generations, cooperative care over offspring and reproductive division of labor occurs. Actually, in wasps the eusociality is restricted only to Polistinae and Vespinae, both within Vespidae. Polistinae, which comprises the tribes Polistini, Mischocyttarini and Epiponini, is widely distributed in Neotropics with 25 genera and around 900 species recorded (Richards, 1978; Carpenter & Marques, 2001).

The social wasps play a vital ecological role as pollinators (see Prezoto & Machado 1999; Vitali-Veiga & Machado 2001; Silva-Pereira & Santos, 2006) and predators and act as natural agents of biological control (Clapperton, 1999; Carpenter & Marques, 2001; Hunt, 2007). Also they have frequently been used to test evolutionary models for the origin of social behavior because of their different levels of sociality from solitary to eusocial (West-Eberhard, 1978, 1996; Itô, 1986; Spradbery, 1991 as cited in Noll et al., 2004).

The nests can be the size of a thimble or more than a meter long, as durable as hard felt or more fragile than egg shells, more regular and uniform than the much-celebrated honeybee comb or wildly chaotic with an intricate mazelike interior (Wenzel, 1998). Except for four Neotropical species that build nests of mud, the nests are all made of vegetable fiber without wax or plant resins (Wenzel, 1998; Hunt, 2007).

Soil or glandular secretion may be used to reinforce or repair nests, but they rarely constitute the primary building material for mature colonies (Wenzel, 1998).

In a general sense, according to the shape, nests can be classified as: a) Phragmocyttarous, where the initial comb is fixed on substratum and covered by an envelope. A second comb is built by adding new cells at the bottom of the first envelope, and also is covered by an envelope. Each envelope has an entrance to the respective combs, b) Astelocyttarous nest, where a single comb is built directly on substratum and covered by an envelope with one entrance; and c) Stelocyttarous nest, where a comb or combs are suspended by stalks. They can or cannot have envelope and are called of calyptodomous and gymmodomous, respectively (Saussure, 1853; Richards and Richards, 1951, Richards, 1978, Carpenter & Marques, 2001).

The preference for nesting substrates is different, depending on the physical and biological characteristics of the environment (Dejean et al., 1998; Cruz et al., 2006). Nests can be built on natural substrate, such as plants rocks, cavities, besides termites and human constructions (Carpenter & Marques, 2001). Some wasp species have great ecological plasticity and varied nesting habits according to environmental conditions and substrates for nest building (Santos & Gobbi 1998). However, other species have lower ecological plasticity and are restricted to habitats with specific conditions, and may have some allegiance to such environments (Heithaus, 1979; Dejean et al., 1998; Cruz et al., 2006; Silva Pereira & Santos, 2006; Santos et al., 2009a; Souza et al., 2010). Such characteristics may elect wasps as bioindicators of environmental quality, as pointed out by Souza et. al (2010).

The choice of sites for nesting is more characteristic and less diverse than those for foraging (Richards, 1978), and the diversity of these insects is associated more to the nesting habitat and not necessarily to foraging habitat (Simões et al., 2012). The vegetation structure can favor the nesting of social wasps either by increasing the availability of physical support for nests or the number and diversity of available food resources, by imposing lower variability in microclimate characteristics (Lawton, 1983).

Studies on social wasps have been conducted in Brazilian areas of Cerrado (Richards 1978; Henriques et al., 1992; Diniz & Kitayama, 1994; Diniz & Kitayama, 1998; Silva-Pereira & Santos, 2006; Santos et al., 2009a; Santos et al., 2009b; Silva et al., 2011), Amazon Forest (Silveira, 2002; Silveira et al., 2005, 2012; Silva & Silveira 2009; Somavilla, 2012), Atlantic Forest (Santos et al., 2007) and Caatinga (Santos et al., 2009b). In areas of Cerrado 130 species were recorded (Richards, 1978; Diniz & Kitayama, 1994), while in the Amazon 20 genera and over 200 species were recorded (Silveira, 2002; Silva & Silveira, 2009). In the Cerrado of Mato Grosso, there are records of 88 species in Nova Xavantina (Richards, 1978) and 36 species in Chapada dos Guimarães (Diniz & Kitayama 1998).

Despite the importance of social wasps for the maintenance of ecosystems, this group still has little information in the literature (Prezoto et al., 2008) and for Pantanal of Mato Grosso there is shortage or no data on the social wasps. Given the importance of social wasps to ecological systems, the present study aimed at determining the species richness and abundance of Polistinae wasp nests in four different landscape units in the North Pantanal, Poconé, Mato Grosso.

Material and Methods

Study area

The Pantanal, considered the largest wetland in the world, is located in the middle of South America and covers parts of Brazil, Bolivia, Paraguay and Argentina. The pattern of flood inside the Pantanal is strongly influenced by rainfall (± 1.250 mm per year). The climate in this floodplain is hot with average annual temperature around 25° C, a pronounced dry climate period from May to September, and a rainy season from October to April (Junk et al., 2006; Fantin-Cruz et al., 2010; Fernandes et al., 2010).

The Pantanal of Poconé is a subregion belonging to the Northern Pantanal, located in the state of Mato Grosso (Fernandes et al., 2010), and it was the region chosen to develop this study conducted in the Retiro Novo Farm (16°15'12" S; 56°22'12" W), municipality of Poconé (Fig 1).

In this area of the Pantanal, the Cerrado dominates the landscape in the form of natural grasslands, but has also fea-

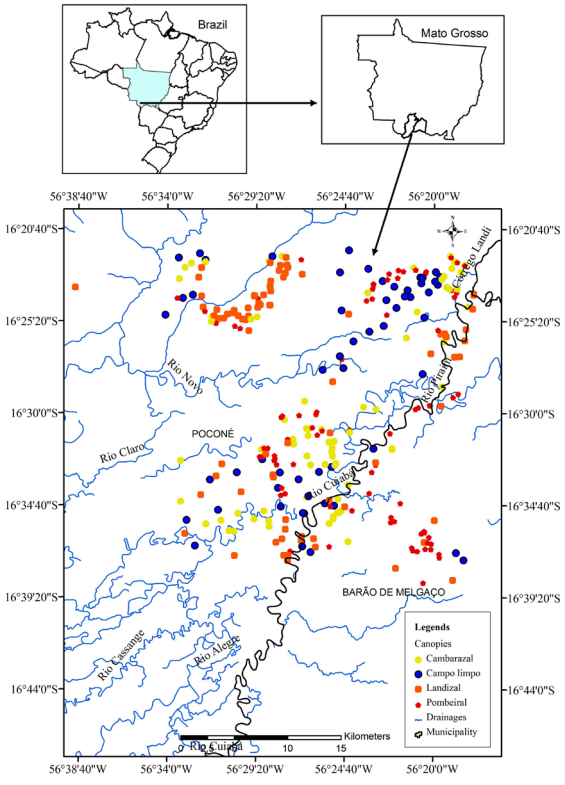

Fig 1. Study Area located at Pirizal District, Retiro Novo Farm, municipality of Poconé, Southwestern Mato Grosso state, Brazil.

tured forest formations, locally known as landizal, cambarazal and pombeiral (Nunes da Cunha et al., 2010) but can occur as forests mosaic areas as show in the Fig 1.

The cambarazal (Fig 2a) is a dense forest formation, semi-evergreen, in which *Vochysia divergens* Pohl (cambará), sometimes occurring in monospecific stands, dominates. *Vochysia divergens* is a characteristic species of the Pantanal. Dense stands develop in low-lying humid areas because this species is flood-tolerant and in multi-year wet periods spreads into surrounding savannas, creating serious problems for farmers. The expansion of cambarazal is counteracted by the wild fires of extremely dry years. Elongated and sinuous stretches of semi-evergreen forest in high-lying plains covered by cerrado vegetation point to the presence of landizal (Fig 2b). This can be explained by the fact the, in periodically drying drainage systems, floods last longer and water availability during low-water periods is better because of a high groundwater level (Nunes da Cunha et al., 2007). Landi refers to the regional name of *Calophyllum brasiliense* Cambess. (Calophyllaceae) trees, that forms the landizal plant life vegetation. The following species, which are also common in other seasonally flooded forests, are characteristic of this sub-type of forest: *Licania parvifolia* Huber (Chrysobalanaceae), *Erythroxylum anguifugum* Mart. (Erythroxylaceae), *Alchornea discolor* Poepp. (Euphorbiaceae), *C. brasiliense*, *Mouriri guianensis* Aubl. (Melastomataceae), *Ficus pertusa* L.F. (Moraceae), *Sorocea sprucei* (Baill.) Macbr. (Moraceae), *Eugenia florida* DC. (Myrtaceae), *Coccoloba ochereolata* Weed. (Polygonaceae), and *Triplaris gardneriana* Wedd. (Polygonaceae).

In pombeiral (Fig 2c), it is evident the abundance of *Combretum lanceolatum* Pohl ex Eichler. Scrubland with *C. lanceolatum* Pohl ex Eichler, which reaches a height of about four meters, is often monospecific. It is widespread in the Pantanal and occurs near permanent water bodies in areas subject to several months of inundation.

The campo limpo (Fig 2d), is characterized by low density of trees and shrubs, dominated by grasses and are open areas subject to periodic flooding, being the vegetation dominated by *Hyptis brevipes* (Lamiaceae), *Richardia grandiflora* (Rubiaceae) e *Axonopus purpusii* (Poaceae) (Nunes da Cunha et al., 2007; Nunes da Cunha et al., 2010).

Methodology

The search for nests of social wasps was performed from 25 August 2011 to 11 April 2012 in the landscape units known as landizal, pombeiral, cambarazal and campo limpo. In 68 days of field work (1024 hours of sampling), each of the four landscape units (17 days/locality) were visit using linear transects, about 3 km, from 7:00h to 17:00h, with a different landscape unit being sampled every day.

Sampling was carried out by two people who walked along the transect, extending about five meters on either sides of vegetation searching for nests. The nests and colony were

Fig 2. The four plant physiognomies found in the study area, Retiro Novo Farm, Pantanal de Poconé, Mato Grosso, Brazil. A – Cambarazal; B – Landizal; C – Pombeiral; D – Campo limpo, during flooded season.

taken off from the substrate. In nests that were located in substrates difficult to reach, a sample of 10 to 60 specimens were collected with telescopic entomological net.

The nests recorded in this inventory were georeferenced using GPS (Global Position System), being listed and individually marked with colored plastic tape. The height of nests above the ground was measured with the use of tape, recording the substrate used for nesting, such as termites, trunks, branches, thorns etc.

The specimens were identified following the keys of Richards (1978), Carpenter and Marques (2001), Andena and Carpenter (2012). Voucher specimens were deposited in the collection of the Laboratory for Neotropical Bees and Wasps (licence number # 18147), Department of Biology, Universidade do Estado Mato Grosso (UNEMAT), *Campus* Cáceres, in Mato Grosso; Museum of Zoology, Universidade Estadual de Feira de Santana (MZFS), Feira de Santana, Bahia; and Universidade Estadual Paulista Júlio de Mesquita Filho (UNESP), *Campus* São José do Rio Preto, São Paulo.

Data Analysis

The number of active colonies of wasps in the four plant physiognomies was used as a measure of abundance, each sampling day being considered a sample. We did a hierarchical ordering cluster analysis and classification from binary matrices (Cluster Analysis). Therefore, we used the Jaccard dissimilarity measure relating them to the plant physiognomies with wasps' species, through the connection method UPGMA (Legendre & Legendre, 2012).

To verify the occurrence of wasps' species that nest in specific physiognomies, the Indval method via indicspecies program package (R Development Core Team, 2011) was employed. Such a method combines the degree of specificity for a particular species to an ecological *status* such as, for exam-

ple, the habitat type, and its fidelity within status, measured by the percentage of occurrence.

This analysis gives a value of 0 to 100%, where 0% is equivalent to no indication of an indicator species for a particular environment, and 100% indicates that the occurrence of particular species is characteristic to the environment (Dufrene & Legendre, 1997). The analysis significance was performed by Monte Carlo test with 10,000 randomizations by accepting $P < 0.05$ as significant.

Results

A total of 308 nests of social wasps belonging to 14 species, distributed in eight genera were recorded in the four landscape units studied, with *Polybia* accounting for 69.57% of the nests sampled and 42.85% of the species. Except *Polybia* and *Brachygastra,* the other six genera, *Agelaia*, *Apoica*, *Chartergus*, *Parachartergus*, *Polistes* and *Synoeca* were represented by only one species each (Table 1).

The species with the highest number of nests cataloged were *Poly. ruficeps xanthops* (32.69%), *Poly. sericea* (24.27%) and *S. surinama* (15.21%). The highest number of nests recorded in cambarazal and pombeiral was of *Poly. ruficeps xanthops* 40.48% and 42.7% of nests, respectively. In landizal was recorded the highest number of nests of *S. surinama* (N = 35, 39.78%) while in campo limpo was recorded the highest number of *Poly. sericea* (N = 21; 44.68%) (Table 1).

The highest wasp species richness was recorded in cambarazal (S = 13) and highest abundance of nests in pombeiral (N = 89), landizal (N = 88) and cambarazal (N = 84), while campo limpo had the lowest richness (S = 7) and abundance (N = 47) (Table 1; Fig 3).

Fourteen species recorded nesting in the four landscape units sampled; nests of three species were associated to three landscape units. The nests of *S. surinama* were associated with cambarazal and landizal (IndVal = 93.3, $P = 0.001$), whereas nests of *Poly. ruficeps xanthops* were associated with cambarazal, landizal and pombeiral (IndVal = 97, $P = 0.001$), as well as nests of *Poly. chrysothorax* (IndVal = 77, $P = 0.014$).

The cluster analysis shows that cambarazal, pombeiral and landizal are more related than campo limpo, which is a distinct branch. The Cophenetic Correlation Coefficient (CCC) was 0.80, and this value demonstrates that the distance matrix is well represented (Fig 3).

The nests of wasps cataloged in this study were located, in average, at 2.0m (SD = 5.70) above the ground, those of *Agelaia* sp. 1 (N = 2) were at lower height, constructed in soil cavities; and those of greater height, *C. globiventris* nests (N = 12; mean = 5.44; min = 1.96m, max = 7.71m, SD = 1.96), exposed in the vegetation. Among the plants used as support by the wasps, 10.23% of the nests were associated with *Bactris glauscescens* Drude (Arecaceae).

Regarding the substrate used for building the nests,

Table 1. Absolute frequency (N), relative frequency (%), average height of the wasps nests from de soil (HS) and standard deviation (SD) at Pirizal District. Retiro Novo Farm, Pantanal de Poconé, Mato Grosso, Brazil.

Tribe / Species	Cambarazal N (%)	Landizal N (%)	Pombeiral N (%)	Campo limpo N (%)	Total	HS (m) (mean ± SD)
Epiponini						
Agelaia sp. 1	1 (1.19)		1 (1.12)		2 (0.64)	0
Apoica pallens (Fabricius. 1804)	2 (2.38)	1 (1.13)			3 (0.97)	2.0 ± 0.69
Brachygastra augusti (de Saussure, 1854)	2 (2.38)				2 (0.64)	0.6 ± 1.09
Brachygastra lecheguana (Latreille, 1824)	5 (5.95)	2 (2.27)		6 (12.76)	13 (4.21)	1.4 ± 1.25
Chartergus globiventris de Saussure, 1854	3 (3.57)		1 (1.12)	7 (14.9)	11 (3.56)	5.9 ± 1.96
Parachartergus fraternus (Gribodo, 1892)	7 (8.33)	2 (2.27)	2 (2.25)	4 (8.51)	15 (4.85)	3.2 ± 1.57
Polybia chrysothorax (Lichtenstein, 1796)	4 (4.77)	8 (9.1)	10 (11.24)		22 (7.12)	1.4 ± 0.41
Polybia ignobilis (Haliday, 1836)	1 (1.19)			2 (4.25)	3 (0.98)	0.8 ± 0.25
Polybia jurinei de Saussure, 1854	1 (1.19)		2 (2.25)		3 (0.98)	1.4 ± 0.96
Polybia gr. *occidentalis*	1 (1.19)	1 (1.13)	5 (5.62)	4 (8.51)	11 (3.56)	0.7 ± 0.31
Polybia ruficeps xanthops Richards, 1978	34 (40.48)	26 (29.54)	38 (42.7)	3 (6.38)	101 (32.69)	1.5 ± 0.57
Polybia sericea (Olivier, 1791)	12 (14.28)	13 (14.78)	28 (31.46)	21 (44.68)	74 (24.27)	2.5 ± 5.86
Synoeca surinama (L., 1767)	11 (131)	35 (39.78)	1 (1.12)		47 (15.21)	1.7 ± 0.66
Polistini						
Polistes versicolor (Olivier, 1791)			1 (1.12)		1 (0.32)	1.1
Total of nests	84	88	89	47	308	-
Richness	13	8	10	7	14	-

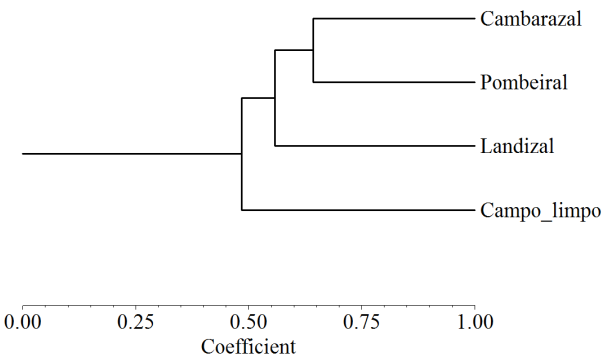

Fig 3. Dendrogram of Hierarchical Clustering Analysis classification according to vegetation types based on presence or absence of social wasp species (Hymenoptera: Vespidae) using UPGMA and Cophenetic Correlation Coefficient (CCC = 0.80), Retiro Novo Farm, Pantanal de Poconé, Mato Grosso state, from August, 2011 to April, 2012.

those of *Agelaia* sp. 1 and *Poly. ignobilis* were found in termite nests and fallen logs, while the nests of *S. surinama* were built directly on tree trunks. The nests of *C. globiventris*, *Par. fraternus* and *Poly. jurinei* were attached in branches of plants, while the nests of *Polistes versicolor* were among thorns of *B. glauscescens*, as recorded for *Poly. chrysothorax*, *Poly.* gr. *occidentalis*, and *B. lecheguana* and *B. augusti* also built their nests on the branches. The nests of *Poly. ruficeps xanthops* and *Poly. sericea* were found in pre-existing cavities, branches of plants and between spines of *B. glauscescens*.

Discussion

In this work 14 species of wasps, that represents 15.90% of the total of species recorded for the cerrado of Nova Xavantina, 88 species (Richards, 1978) and 38.88% when compared with the species collected in Chapada dos Guimarães, 35 species (Diniz & Kitayama,1998). Also in Chapada dos Guimarães Diniz & Kitayama (1994) found 100 nests, belonging to 30 species and 15 genera. Richards (1978) recorded 199 colonies comprising 51 species in 14 genera nesting in six habits in Nova Xavantina and Serra do Cachimbo. The species with the largest number of colonies was *Poly. ruficeps* (14%), followed by *Poly. occidentalis* (9%), *Poly. jurinei* (6%), *Poly. erythrotorax* (5%), *Poly. ignobilis* (5%), *Pa. fraternus* (4%) and *Epipona tatua (*4%). The genus *Polybia* represents 60% of the colonies reported from the two regions of Mato Grosso State, ranging from 67% in Nova Xavantina and Serra do Cachimbo to 45% in Rio Manso (Richards, 1978; Diniz & Kitayama, 1994).

The highest species richness of wasps in cambarazal may be related to vegetation structure and foliage density, once the cambarazal is a semi-deciduous forest and maintains much of the vegetation cover during the dry season (Nascimento & Nunes da Cunha, 1989). The campo limpo had the lowest species richness, while pombeiral and landizal showed intermediate values. Environments such as cambarazal, pombeiral and landizal are physiognomies with more structured vegetation and retain most of the vegetation cover in the dry season (Nunes da Cunha et al., 2007). Such environments may harbor more species of nesting social wasps in comparison to more open environments, such as grasslands, once the forest areas can provide greater protection, materials to build nests and substrates for attachment of wasp nests (Santos et al., 2009a; Santos et al., 2009b).

Studies on other animal groups, such as birds and beetles, in this region of the Pantanal, shows higher species richness in cambarazal (Pinho & Marini, 2012, Marques et al., 2010). In this study, conducted with birds in forestry environments in the area of the present survey, Pinho & Marini (2012) shows that the highest species richness and a greater number of bird nests were observed in cambarazal, suggesting some relationship with vegetation structure, food supply, protection from predators and suitable microclimate; being the cambarazal an important nesting habitat for several species that prefer forest habitats in this region of the Pantanal. The landizal in turn, despite maintaining much of the vegetation cover during the dry season is characterized by few species with low density in the understory (Pinho & Marini, 2012).

To edaphic beetles (Coleoptera), the highest abundance and species richness were also recorded in cambarazal, while the campo limpo had the lowest values of abundance and richness in this region (Marques et al., 2010). In this case, the type of vegetation determined the ecological condition such as microclimate, light, shelter, food supply, making it important to define the composition, richness and abundance of species of beetles (Marques et al., 2010).

Other studies that investigated the social wasps nesting in different landscape units in Brazil, also found higher species diversity in forest environments. For example, a study conducted in three landscape units of Cerrado (agricultural systems, campo sujo and Cerradão (arboreal plants), there were 19 nests of social wasps species, distributed in 13 genera, with the highest richness having been observed in Cerradão, and lower richness in agricultural systems (Santos et al., 2009a). A total of 319 nests belonging to 17 species of social wasps were recorded in three Caatinga vegetation types, the highest richness found in arboreal Caatinga, while agricultural systems and shrubby Caatinga showed similar species richness (Santos et al., 2009b).

In the present study, the highest number of wasp nests and the second highest number of wasp species have been recorded in pombeiral, invader vegetation of natural and artificial pastures, and that reduces the foraging ability of cattle, which led some farmers from Pantanal to try to eradicate it (Nunes da Cunha et al., 2007).

According to the Indval analysis, the nests of *S. surinama* were associated with landizal and cambarazal. Nests of *P. ruficeps xanthops* and *P. chrysothorax* in turn, were associated with landizal, cambarazal and pombeiral. However, no wasp species had nests associated with campo limpo in the

study area, despite *Poly*. *sericea* has presented a greater number of nests (44.58%) in this plant physiognomy.

Some wasp species are found nesting in environments with specific conditions, with some fidelity to these sites (Heithaus, 1979; Santos et al., 2009a). In the riparian forest of Rio das Mortes, Minas Gerais, the Indval analysis showed that *Pseudopolybia vespiceps* and *Polybia fastidiosuscula* were associated with more conserved sites, while *Mischocyttarus drewseni* was associated with disturbed areas and can be used as environmental indicators (Souza et al., 2010). Nests of *Mischocyttarus* (Mischocyttarini) were not found in the present study. According to Silva et al. (2011) smaller colonies like *Mischocyttarus*, or those camouflaged or built inside cavities (e.g. *Agelaia* spp.) may easily go unnoticed.

In the present study, nests of *S. surinama* were not record in campo limpo, just in forestry environments. This result can be attributed to the fact of *Synoeca* presenting arboreal and sessile nests, which are built directly on the trunk of trees and occupy a large area of the substrate (Wenzel, 1998). Open areas with few trees and shrubs, such as campo limpo, may not provide the necessary conditions for establishing *Synoeca* nests. In Bahia, nests of *S. cyanea* were not observed in agricultural systems, although many individuals have been observed collecting nectar and water in such environments (Santos et al., 2009a).

In the Cerrado *lato sensu* in Mato Grosso, despite *S. surinama* and *P. sericea* having been sampled foraging in different habitats, such as gallery forest, Cerrado *sensu stricto*, campo sujo and campo úmido, both nested only in gallery forests and Cerrado s*ensu stricto*, respectively (Diniz & Kitayama, 1994).

In this study, the wasp species with the highest number of nests recorded in campo limpo was *Poly. sericea,* species widely distributed throughout South America, especially in open areas like fields, and various types of Cerrado and dry forests (Richards, 1978). It is known that *B. lecheguana, Poly. sericea, Poly. ignobilis, Poly. occidentalis* have broad ecological tolerance and are generally dominant in open ecosystems and under adverse environmental conditions, being very important in simpler community structure and those subject to strict ecological conditions (Santos, 2000).

The nests of most social wasp species (85.71%) cataloged in this study were located at medium height compared to soils less than three meters, and only the nests of *C. globiventris and Pa. fraternus* were recorded at heights above. The behavior of nesting near the soil can benefit social wasps because this type of environment offers greater availability of substrates for nesting, low temperatures and high humidity (Raw, 1998).

Regarding the use of thorny plants as support for nests of social wasps, such as *B. glauscescens,* such behavior may be one of the strategies of social wasps to reduce nest predation, as noted in the study on the nest site selection in palm plants *B. simplifrons* and *Astrocaryum sciophilum* (Arecaceae) (Dejean et al., 1998).

The natural grasslands showed lower abundance and lower species richness in the study area, and none wasp species with nests associated with this vegetation type. These results show that maintaining forest environments in the Pantanal of Mato Grosso is essential for the establishment of social wasp nests and therefore, it is important for maintenance of wasp species in this region.

We hope that this work helps studies related to ecology, biology, distribution and abundance of social wasps in Northern Pantanal and stimulate additional surveys of social wasps in the Pantanal of Mato Grosso.

Acknowledgements

Financial support was provided by FAPEMAT (737955/2008; 285060/20010). We thank L.A. Castro for providing the map used in figure 1.

References

Andena, S.R. & Carpenter, J.M. (2012). A phylogenetic analysis of the social wasp genus *Brachygastra* Perty, 1833, and description of a new species (Hymenoptera: Vespidae: Epiponini). American Museum Novitates, 3753: 1-38.

Carpenter, J.M. & Marques, O.M. (2001). Contribuição ao Estudo dos Vespídeos do Brasil. Salvador, Universidade Federal da Bahia, Departamento de Fitotecnia. Série Publicações Digitais, v. 3, CD.

Clapperton, B.K. (1999). Abundance of wasps and prey consumption of paper wasps (Hymenoptera, Vespidae: Polistinae) in Northland, New Zealand. New Zealand Journal of Ecology, 23: 11-19.

Cruz, J.D., Giannotti, E., Santos, G.M.M., Bichara-Filho, C.C. & Rocha, A.A. (2006). Nest site selection and flying capacity of neotropical wasp *Angiopolybia pallens* (Hymenoptera: Vespidae) in the Atlantic Rain Forest, Bahia State, Brazil. Sociobiology, 47: 739-749.

Dejean, A., Corbara, B. & Carpenter, J.M. (1998). Nesting site selection by wasps in the Guianese rain forest. Insectes Sociaux, 45: 33-41.

Diniz, I.R. & Kitayama, K. (1994). Colony densities and preferences for nest habitats of same social wasps in Mato Grosso State, Brazil (Hymenoptera, Vespidae). Journal of Hymenoptera Research, 3: 133-143.

Diniz, I.R. & Kitayama, K. (1998). Seasonality of vespid species (Hymenoptera: Vespidae) in a central Brazilian cerrado. Revista de Biologia Tropical, 46: 109-114.

Dufrene, M. & Legendre, P. (1997). Species Assemblages and Indicator Species: the need for a flexible asymmetrical approach. Ecological Monographs, 67: 345-366.

Fantin-Cruz, I., Girard, P., Zeilhofer, P. & Collischonn, W.

(2010). Dinâmica de inundação. In I.M. Fernandes, C.A. Signor & J.M.F. Penha (Orgs.), Biodiversidade no Pantanal de Poconé. Cuiabá: Centro de Pesquisa do Pantanal. 196 p

Fernandes, I. M., Signor, C. A., Penha, J. (Orgs.) Biodiversidade no Pantanal de Poconé. Cuiabá: Centro de Pesquisa do Pantanal. 196 p

Grimaldi, D. & Engel, M.S. (2005). Evolution of the insects. Cambridge, New York, Melbourne: Cambridge University Press. 772 p

Heithaus, E.R. (1979). Community structure of neotropical flower visiting bees and wasps: diversity and phenology. Ecology, 60: 190-202.

Henriques, R.P.B., Diniz, I.R. & Kitayama, K. (1992). Nest density of some social wasp species in Cerrado Vegetation of Central Brazil (Hymenoptera: Vespidae). Entomologia Generalis, 17: 265-268.

Hunt, J.H. (2007). The evolution of social wasps. New York: Oxford University Press, 259 p

Itô, Y. (1986). On the pleometrotic route of social evolution in the Vespidae. Monitore Zoologico Italiano, 20: 241-262.

Junk, W.J., Nunes-da-Cunha, C., Wantzen, K.M., Petermann, P., Strüssmann, C., Marques, M.I. & Adis, J. (2006). Biodiversity and its conservation in the Pantanal of Mato Grosso, Brazil. Aquatic Science, 68: 278-309. doi: 10.1007/s00027-006-0851-4.

Lawton, J.H. (1983). Plant architecture and the diversity of phytophagous insects. Annals of the Entomological Society of America, 28: 23-39.

Legendre, P. & Legendre, L. (2012). Numerical Ecology. New York: Oxford, 853 p Marques, M.I., Souza, W.O., Santos, G.B., Battirola, L.D. & Anjos, K.C. (2010). Fauna de artrópodes de solo. In: I.M. Fernandes, C.A. Signor & J.M.F. Penha (Orgs.), Biodiversidade no Pantanal de Poconé (pp. 25-35). Cuiabá: Centro de Pesquisa do Pantanal.

Melo, G.A.R., Aguiar, A.P. & Garcete-Barrett, B.R. (2012). Hymenoptera. In J.A. Rafael, G.A.R. Melo, C.J.B. Carvalho, S.A. Casari & R. Constantino (Eds.), Insetos do Brasil: Diversidade e Taxonomia. (pp. 553-612). Ribeirão Preto: Holos Editora.

Nascimento, M.T. & Nunes-da-Cunha, C. (1989). Estrutura e composição florística de um Cambarazal no Pantanal de Poconé, MT. Acta Botanica Brasilica, 3: 3-23.

Noll F.B.,Wenzel, J.W. & Zucchi, R. (2004). Evolution of Caste in Neotropical Swarm-Founding Wasps (Hymenoptera: Vespidae; Epiponini). American Museum Novitates, 3467: 1-24.

Nunes-da-Cunha, C., Junk, W.J. & Leitão-Filho, H.F. (2007). Woody vegetation in the Pantanal of Mato Grosso, Brazil: a preliminar tipology. Amazoniana, 11: 159-184.

Nunes-da-Cunha, Rebello, C.L. & Costa, C.P. (2010). Vegetação e Flora: experiência pantaneira no sistema de grade. In I.M. Fernandes, C.A. Signor & J.M.F. Penha (Eds.), Biodiversidade no Pantanal de Poconé (pp. 37-57). Cuiabá: Centro de Pesquisa do Pantanal.

Pinho, J.B. & Marini, M.A. (2012). Using birds to set conservation priorities for Pantanal wetland forests, Brazil. Bird Conservation International, 22: 155-169. doi: 10.1017/S0959270911000207

Prezoto, F. & Machado, V.L.L. (1999). Ação de *Polistes* (*Aphanilopterus*) *simillimus* Zikán (Hymenoptera, Vespidae) no controle de *Spodoptera frugiperda* (Smith) (Lepidoptera, Noctuidae). Revista Brasileira de Zoologia, 16: 841-851.

Prezoto, F., Cortes, S.A.O. & Melo, A.C. (2008). Vespas: de vilãs a parceiras. Ciência Hoje, 48: 70-73.

R Development Core Team (2011) R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Retrieved from: http://www.R-project.org/.

Raw, A. (1998). Social wasps (Hymenoptera, Vespidae) of the Ilha de Maracá. In: J.A. Ratter J.A. & W. Milliken (Eds.), Maracá: Biodiversity and environment of an Amazonian Rainforest (pp. 311-325). Chichester: John & Sons.

Richards O.W., & Richards, M.J. (1951). Observations on the social wasps of South America (Hymenoptera, Vespidae). Transactions of the Royal Entomological Society, 102: 1-170.

Richards, O.W. (1978). The social wasps of the Americas, excluding the Vespinae. London: British Museum (Natural History), 580 p

Santos, G.M.M. (2000). Comunidades de vespas sociais (Hymenoptera-Polistinae) em três ecossistemas do estado da Bahia, com ênfase na estrutura da guilda de vespas visitantes de flores de Caatinga. Tese de doutorado, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto/USP, 129 p

Santos, G.M.M. & Gobbi, N. (1998). Nesting habits and colonial productivity of *Polistes canadensis canadensi*s (L.) (Hymenoptera-Vespidae) in a Caatinga area, Bahia State, Brazil. Journal of Advanced Zoology, 19: 63-69.

Santos, G.M.M., Bichara-Filho, C.C., Resende, J.J., Cruz, J.D. da & Marques, O.M. 2007. Diversity and community structures of social wasps (Hymenoptera: Vespidae) in three ecosystems in Itaparica Island, Bahia State, Brazil. Neotropical Entomology, 36: 180-185. doi: 10.1590/S1519-566X2007000200002.

Santos, G.M.M., Gobbi, J., Cruz, J.D. da, Marques, O.M. & Gobbi, N. (2009a). Diversidade de vespas sociais (Hymenoptera: Vespidae) em áreas de cerrado na Bahia. Neotropical Entomology, 38: 317-320. doi: 10.1590/S1519-566X2009000300003.

Santos, G..M.M., Bispo, P.C. & Aguiar, C.M.L. (2009b). Fluctuations in Richness and abundance of social wasps during the dry and wet seasons in three phyto-physiognomies at the tropical dry forest of Brazil. Environmental Entomology, 38: 1613-1617.

Saussure, H. de. 1853–58. Monographie des guêpes sociales ou de la tribu des vespiens. Paris: Masson. [1–96, 1853; 97–256, 1854]

Spradbery, J.P. (1991). Evolution of queen number and queen control. In: K.G. Ross and R.W. Matthews (Eds.), The Social Biology of Wasps (pp. 336-388). Ithaca, NY: Cornell Univ. Press.

Silva, S.S. & Silveira, O.T. (2009). Vespas sociais (Hymenoptera, Vespidae, Polistinae) de floresta pluvial Amazônica de terra firme em Caxiuanã, Melgaço, Pará. Iheringia, Série Zoologia, 99: 317-323.

Silva, S.S., Azevedo, G.G. & Silveira, O.T. (2011). Social wasps of two Cerrado localities in the northeast of Maranhão state, Brazil (Hymenoptera, Vespidae, Polistinae). Revista Brasileira Entomologia, 55: 597-602. doi: 10.1590/S0085-56262011000400017.

Silva-Pereira, V. & Santos, G.M.M. (2006). Diversity in bee (Hymenoptera: Apoidea) and social wasp (Hymenoptera: Vespidae, Polistinae) community in Campos Rupestres, Bahia, Brazil. Neotropical Entomology, 35: 165-174. doi: 10.1590/S1519-566X2006000200003.

Silveira, O.T. (2002). Surveying neotropical social wasps. An evaluation of methods in the "Ferreira Penna" Research Station (ECFPn), in Caxiuanã, PA, Brazil (Hymenoptera, Vespidae, Polistinae). Papéis Avulsos deZoologia, 42: 299-323. doi: 10.1590/S0031-10492002001200001

Silveira, O.T., Esposito, M.C, Santos, J.N. & Gemaque, F.E. (2005). Social Wasps and bees captured in carrion traps in a rainforest in Brazil. Entomological Science, 8: 33-39. doi: 10.1111/j.1479-8298.2005.00098.x

Silveira, O.T., Silva, S.S., Pereira, J.L.G. & Tavares, I.S. (2012). Local scale spatial variation in diversity of social wasps in an Amazonian rain forest, Caxiuanã, Pará, Brazil (Hymenoptera, Vespidae, Polistinae). Revista Brasileira Entomologia, 56: 329-346. doi: 10.1590/S0085-56262012005000053.

Simões, M.H., Cuozzo, M.D. & Frieiro-Costa, F.A. (2012). Diversity of social wasps (Hymenoptera, Vespidae) in Cerrado biome of the southern of the state of Minas Gerais, Brazil. Iheringia, Série Zoologia, 102: 292-297.

Somavilla, A., Oliveira, M.L. & Silveira, O.T. (2012). Guia de identificação dos ninhos de vespas sociais (Hymenoptera: Vespidae: Polistinae) na Reserva Ducke, Manaus, Amazonas, Brasil. Revista Brasileira Entomologia, 56: 405-414. doi: 10.1590/S0085-56262012000400003.

Souza, M.M., Louzada, J., Serrão, J.E. & Zanuncio, J.C. (2010). Social wasps (Hymenoptera: Vespidae) as indicators of conservation degree of riparian forests in Southeast Brazil. Sociobiology, 56: 387-396.

Spradbery, J.P. (1991). Evolution of queen number and queen control. In: K.G. Ross and R.W. Matthews (Eds.), The Social Biology of Wasps (pp. 336-388). Ithaca, NY: Cornell Univ. Press.

Vitali-Veiga, M.J. & Machado, V.L.L. (2001). Entomofauna visitante de *Gleiditsia triacantho*s L. – Leguminosae durante o seu período de floração. Revista Bioikos., 15: 29-38.

Wenzel, J.W. (1998). A generic key to the nests of hornets, yellowjackets, and paper wasps worldwide (Vespidae, Vespinae, Polistinae). American Museum Novitates, 3224: 1-39.

West-Eberhard, M.J. (1978). Temporary queens in *Metapolybia* wasps: non-reproductive helpers without altruism? Science, 200: 441-443.

West-Eberhard, M.J. (1996). Wasp societies as microcosms for the study of development and evolution. In: S. Turillazzi & M.J. West-Eberhard (Eds.), Natural history and evolution of paper-wasps (pp. 290-317). Oxford: Oxford University Press.

Wilson, E.O. (1985). The sociogenesis of insect colonies. Science, 228 (4704): 1479-1485.