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## Social wasps fauna (Vespidae) of semideciduous seasonal forest in southern Brazil

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**Abstract**

Social wasps are insects that perform numerous environmental services, with emphasis on pollination and predation of agricultural pests. However, despite the increase in efforts to know the social wasps geographical distribution and richness, there are still many areas and ecosystems with few studies of this nature, such as the Paraná State, Southern Brazil. To collaborate with these efforts, this work aimed to carry out an inventory of social wasps in semideciduous forest in the Ilha Grande National Park, an integral conservation unit in the Paraná State. The Sampling took place from February to November 2019, totaling 15 days and 60 hours, being carried out on six islands of the Paraná River, using the active search for species and colonies records. Fourteen species were registered, distributed in six genera. The study revealed a low species richness, which may be related to the area's usage history, as well as to other factors. This highlights the need for greater sampling efforts in other areas of this conservation unit.

**Keywords:** Atlantic forest, *Mischocyttarus*, *Polistes*, Polistinae, *Polybia*

**Introduction**

Social wasps are insects of the Hymenoptera order, Vespidae family, which is formed by six subfamilies, three of which are solitary (Euparigiinae, Eumeninae and Massarinae) and the other three eusocial (Stenogastrinae, Vespinae and Polistinae) <sup>[1]</sup>. Polistinae, with a cosmopolitan distribution and wide representation in the tropical region, is the only eusocial subfamily occurring in Brazil, being divided into three tribes (Mischocyttarini, Epiponini and Polistini), which encompasses 26 genera <sup>[1, 2]</sup>.

These insects perform various environmental services, such as predation of agricultural pests <sup>[1, 3, 4]</sup> and pollination, also acting as bioindicators of riparian forest conservation <sup>[5]</sup>. However, the natural environments changing, such as forest fragmentation, are negatively affecting their communities <sup>[6, 7]</sup>.

In Brazil, these environmental changes have been frequent in different biomes, and as a result, there is an increase in studies aimed at knowing the social wasps geographical distribution and richness, due to their importance in ecosystems <sup>[8, 9]</sup>. However, there are locations in the country where these studies are still scarce. In Paraná State, for example, the only records come from material deposited in biological collections <sup>[10]</sup> and a recent review study that counted 23 species for the state <sup>[9]</sup>.

In this state, the semideciduous seasonal forest, phytophysognomy of the Atlantic Forest domain <sup>[11]</sup>, occurs in the West, Northwest and North, being characterized by leaves loss of about 50% of the tree species in the winter period. In Brazil, the literature reports social wasps inventories in seasonal semideciduous forests in different states such as: São Paulo <sup>[12, 13, 14]</sup>, Minas Gerais <sup>[8, 15, 16, 17]</sup> and Mato Grosso do Sul <sup>[18]</sup>.

To contribute to the knowledge about this type of forest formation, the present work aimed to present the social wasps inventory from the semideciduous forest of the Paraná State, inserted in an integral conservation unit, the Ilha Grande National Park.

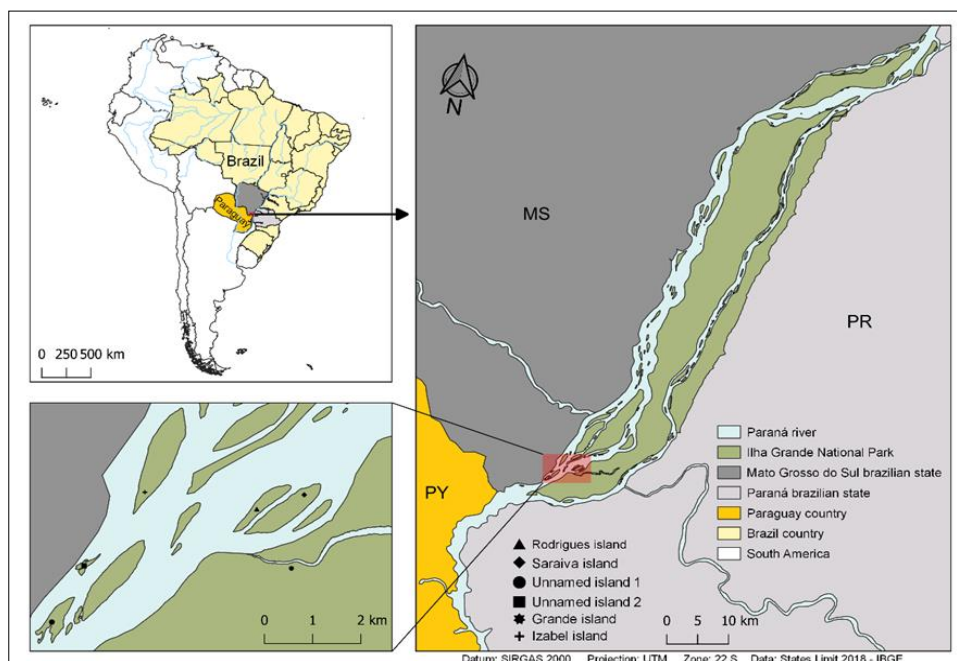
**Materials and Methods**

The Ilha Grande National Park (23°18' - 24°05'S and 53°41' - 54°16'W), located in the northwest of Paraná State, it borders with Mato Grosso do Sul State.

It belongs to the last stretch of Paraná River free of dams, which in turn makes up a complex of islands, islets and floodplains. It has phytophysiognomy of semideciduous seasonal forest and ombrophilous forest, belonging to the Atlantic Forest domain [19].

Studies estimate that in the last century the state's forest coverage corresponded to 83.41% of its territory [20]. However, these forests were losing space for different human activities, with emphasis on intensive agriculture and livestock. In the specific case of the semideciduous seasonal forest, there was a complete mischaracterization due to the advance of areas with secondary vegetation, so that, currently,

it is estimated that less than 5% of its total area remains [21]. The study, authorized by ICMBio through the license SISBIO 65047-1, was carried out during three collection campaigns carried out on three islands and three islets (Fig. 1), between February and November 2019, from 8 am to 5 pm, totaling 15 days and 60 hours of sampling. The specimens were collected through an active search, using an entomological net, and once captured, the individuals were stored in 70% alcohol. Social wasp richness was not measured for each island, but for the entire area, since the islands comparison have not been the object of this study.



**Fig 1:** Location of the islands where social wasps were collected in the Ilha Grande National Park, Paraná, southern Brazil. Qgis 3.10.2.

The material was screened, assembled and identified at the IFSULDEMINAS Zoology Laboratory, Campus Inconfidentes, Minas Gerais State. Complex identification species were sent to the Dr. Orlando Tobias da Silveira, Emílio Goeldi Museum, Belém, Pará State, for taxonomic confirmation. The material identified by the taxonomist Dr. Orlando Tobias Silveira is deposited in the social wasps collection of the Emílio Goeldi Museum.

## Results and Discussions

In this study, 14 species were registered, distributed in six

genera (Table 1), with *Mischocyttarus* (de Saussure) presenting greater richness (4). This genus comprises 253 described species, with cumulative distribution extending from southeastern Canada to northern Argentina [1, 22, 23]. In Brazil, about 124 species have been registered [22, 23], and the record of new occurrences is still common in ecosystems and states [24, 25]. This is due to the large number of species included in the genus and the fact that many environments and locations have not yet been sampled, even in areas of the Atlantic Forest, the best inventoried Brazilian biome [9].

**Table 1:** List of social wasp species from Ilha Grande National Park, PR

Tribo	Espécie
Mischocyttarini	<i>Mischocyttarus cerberus</i> (Richards, 1940)
	<i>Mischocyttarus drewseni</i> Saussure, 1857
	<i>Mischocyttarus rotundicollis</i> (Cameron, 1912)
	<i>Mischocyttarus frontalis</i> (Fox, 1898)
	<i>Mischocyttarus cassununga</i> (R. von Ihering, 1903)
Polistini	<i>Polistes simillimus</i> Zikán, 1951
	<i>Polistes versicolor</i> (Olivier, 1791)
Epiponini	<i>Apoica gelida</i> Van der Vecht, 1973
	<i>Brachygastra lecheguana</i> (Latreille, 1824)
	<i>Brachygastra augusti</i> (de Saussure, 1854)
	<i>Polybia occidentalis</i> (Olivier, 1791)
	<i>Polybia paulista</i> H. von Ihering 1896
	<i>Polybia sericea</i> (Olivier, 1791)
	<i>Protopolybia exigua</i> (de Saussure, 1854)

Despite this, the number of *Mischocyttarus* species observed in the present study was low, since the genus usually stands out in inventories [6, 26]. This may be a reflection of species having small and cryptic colonies, which makes their registration difficult [27], especially in a dense forest environment as in the areas of the present study, a type of environment that makes it difficult to register colonies for all wasp genera, which may explain the results obtained [26].

The species registered in this study are widely distributed in Brazil [10], such as: *Brachygastra lecheguana* that occurs in Cerrado areas in the states of Mato Grosso [28], Mato Grosso do Sul [29] and in Minas Gerais [30], being that, in this last one, the species also occurs in deciduous forest [31]; *Mischocyttarus cerberus* that occurs in Caatinga in the Ceará State [32] and agricultural areas associated with semideciduous forest in Minas Gerais [33]. On the other hand, *Mischocyttarus frontalis* has record only in perennial forests in Minas Gerais State [26] and in the states of Goiás and Mato Grosso [10].

Regarding the richness of social wasp species, similar results were observed by Souza *et al.* (2017) [34], in other semideciduous seasonal forest environments, where the richness varied from 13 to 45 species. However, the lowest values ( $n = 13$  and  $n = 19$ ) were recorded, respectively, in studies carried out in agricultural systems within forested areas [33, 35]. These results are similar to those observed in the present study, whose sampled islands have a history of anthropic occupation, and are still in the process of regeneration [36].

Studies with social wasps carried out on similar phytophysiognomies, registered a greater number of species [8, 15, 17, 27]. Greater social wasps richness seems to be related to environments with greater vegetation structural complexity, where there is greater food resources availability, as well as better temperature and air humidity conditions, which favors the establishment and survival of these insects [34, 37].

Another situation that indicates the forest regeneration process of the islands under study, and their condition still impacted, is the fact that different social wasp species were collected in expropriated and abandoned buildings within the Ilha Grande National Park. This shows synanthropy signs in these species, as it is the case of *Mischocyttarus cassununga*, *M. drewseni*, *Polistes simillimus* and *P. versicolor*, situation already reported by other authors [38, 39], forming a group of common species with wide geographical distribution. This may be due to the urbanization pressure on natural environments and because human constructions can act as a shelter against weather, besides reducing competition for nesting substrates with other species [40].

Still in relation to the low species richness, this may be related to the sampling method. In this study, the active search was used, which although it is considered the most efficient method for sampling social wasps [15], its use is less efficient in forest environments, such as in the studied islands, where the denser vegetation makes it difficult to register colonies and individuals. In these environments, it is suggested to use malaise-type flight intercepting traps [41].

The size of the sampled area must also be considered, since during the collection period only about 0.11% of the total area of the park was sampled. Thus, increasing the sampling effort and the adoption of attractive traps may increase the social wasp species number found in the Ilha Grande National Park, and consequently, the number of records in the Paraná State.

Analyzing the Paraguayan fauna, from the guide of Garcete-Barrett (1999) [42] and the new records of Garcete-Barrett

(2001) [43], specifically for species registered in phytophysiognomies similar to the Ilha Grande National Park, it is evident that a large number of species are shared with those observed in studies carried out in Brazil. This indicates that with an increase in the sampling effort and / or an increase in the collection area, possibly the species *M. paraguayensis*; *P. lanio lanio* and *P. platycephala sylvestris*, will also be recorded in the Paraná State.

The survey of social wasps is essential to verify the local diversity and its distribution in different environments [44]. In addition, these hymenoptera species have great relevance in the maintenance of food chains, both in agricultural systems and in natural environments [45, 46]. Therefore, studies carried out with wasps can be fundamental for the efficient implementation of conservation methods, as well as for the orderly use of environmental resources [5].

## Conclusion

In summary, this study provides a social wasps inventory from the semideciduous forest of the Paraná State, inserted in the Ilha Grande National Park, which is essential for implementing preservation and recovery measures for this conservation unit. However, further studies and greater sampling effort are suggested in this park, which can result in an increase in the number of social wasp species registered as well as increasing knowledge of its diversity and distribution.

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