

The sandfly fauna (Diptera: Psychodidae: Phlebotominae) of the Parque Estadual da Serra da Tiririca, Rio de Janeiro, Brazil

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Cutaneous leishmaniasis (CL) in the state of Rio de Janeiro is sporadic and can be characterised as a peridomestic transmission that occurs in modified natural environments. The aim of this work was to study the fauna and ecological characteristics of sandflies in an environmentally protected area (the State Park of Serra da Tiririca) within the remnants of the Atlantic Forest in the municipalities of Niterói and Maricá and their possible relationship with leishmaniasis. Captures were performed using light traps during the night once a month for one year in both sylvatic environments and areas surrounding homes near the park. A total of 1,037 sandflies were captured, belonging to nine genera and 12 species: Evandromyia tupynambai (34.1%), Migonemyia migonei (20.6%), Brumptomyia cunhai (13.8%), Micropygomyia schreiberi (9.7%), Psathyromyia lanei (6.5%), Brumptomyia nitzulescui (5.7%), Evandromyia edwardsi (5.4%), Nyssomyia intermedia (2.8%), Evandromyia cortelezzi (0.6%), Pintomyia bianchigalatae (0.5%), Lutzomyia longipalpis (0.2%) and Sciopemyia microps (0.1%). Both Mg. migonei and Ny. intermedia may be acting as vectors of CL in this area.

Key words: Phlebotominae - leishmaniasis - Atlantic Forest - Niterói - Maricá - Rio de Janeiro

Leishmaniasis are zoonotic diseases caused by various species of flagellate protozoans of the genus *Leishmania* Ross, 1903 (Gontijo & de Carvalho 2003) that are naturally transmitted by sandflies (Diptera: Psychodidae: Phlebotominae). In the state of Rio de Janeiro (RJ), cutaneous leishmaniasis (CL) is characterised as being peridomestically transmitted, mainly due to the adaptation of some species of its insect vectors to modified natural environments, thereby involving domestic animals in the transmission cycle (Brazil et al. 1991, Madeira et al. 2006). With respect to visceral leishmaniasis (VL), RJ is also classified as a sporadic transmission area where both human and canine cases have been diagnosed. Cases of VL have been recently reported in the cities of Angra dos Reis and Mangaratiba, demonstrating the spread of this disease to other regions of the state (Marzochi et al. 1985, Cabrera et al. 2003, Madeira et al. 2006). de Paula et al. (2009) reported the first autochthonous case of canine VL in the municipality of Maricá, providing information regarding the geographical distribution of *Leishmania (Leishmania) infantum* in RJ.

This work was aimed at studying the fauna and ecological characteristics of sandflies in an environmentally protected area within the remnants of the Atlantic Forest and their relationship with leishmaniasis in the metropolitan area of RJ.

The State Park of Serra da Tiririca (PEST) was recently created to protect remnants of the Atlantic Forest that were extremely threatened by real estate speculation and other human activities (Barros 2008). The PEST is situated between the municipalities of Niterói and Maricá (Supplementary data) in RJ (22°48' 23"00'S and 42°57' 43"02'W), located on the coastline of the Serra do Mar (Barros 2008), covering an area of 2,260 hectares.

Captures of sandflies were performed from May 2010-May 2011, averaging once a month, using HP light traps modified in accordance with the methods of Pinto et al. (2012). The traps were put in place in the afternoon and removed the following day. Each trap remained connected for at least 17 h and for a total of 204 h per trap. Eight HP traps were used, distributed in three areas. In area 1, two traps were located in the forest towards the park headquarters (Itaipuaçu), in Maricá. In area 2, four traps were set up in the forest of the park (Itacoatiara), in Niterói. In this area, most of the trails within the PEST are open to the public for tourism. However, we chose the side of the forest without open trails to minimise any anthropogenic changes. In area 3, two traps were set up within the peridomicile of a residence in Itaipu on the border of the Park. This residence includes a large field that limits the forest and the yard contains a small house, a few crops, fruit trees and a chicken coop (Supplementary data). Sandflies were identified following the taxonomic key provided by Galati (2003) and mounted specimens were deposited, in the collection of the National and International Sandfly Reference Centre, in Belo Horizonte. The nonparametric statistical chi-square test was used to investigate differences in density between the sexes. The frequency of each species was calculated via the constance index (CI) (Dajoz 1973). Species diversity was

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analysed with the Shannon index and the natural logarithmic base, in accordance with Matos et al. (1999).

Among the 1,037 captured sandflies, 552 were males (53.2%) and 485 were females (46.8%), which did not represent a significant difference. The sandfly fauna comprised 12 species (Table I): *Brumptomyia cunhai* (Mangabeira, 1942), *Brumptomyia nitzulescui* (Costa Lima, 1932), *Evandromyia cortelezzii* (Brèthes, 1923), *Evandromyia edwardsi* (Mangabeira, 1941), *Evandromyia tupynambai* (Mangabeira, 1942), *Lutzomyia longipalpis* (Lutz & Neiva, 1912), *Migonemyia migonei* (França, 1920), *Micropygomyia schreiberi* (Martins, Falcão & Silva, 1975), *Psathyromyia lanei* (Barretto & Coutinho, 1941), *Pintomyia bianchigalatiae* (Andrade Filho, Aguiar, Dias & Falcão, 1999), *Nyssomyia intermedia* (Lutz & Neiva, 1912) and *Sciopemyia microps* (Mangabeira, 1942). According to the CI, the species *Ev. tupynambai*, *Mi. schreiberi*, *Br. cunhai*, *Br. nitzulescui*, *Ev. edwardsi* and *Ps. lanei* were categorised as constant species (species present in 50% or more of the catches). The category of accessory species (found in 25-50% of the catches) included *Pi. bianchigalatiae*, *Lu. longipalpis*, *Mg. migonei* and *Ny. intermedia*, while the category of accidental species (present in less than 25% of the catches) included *Ev. cortelezzii* and *Sc. microps* (Table II, Supplementary data). Among the most abundant sandfly species, only *Mg. migonei* and *Ev. tupynambai* showed a peak during the summer season (data not shown).

All of the species found in this work have been recorded in other regions of RJ (de Aguiar et al. 1986, Rangel et al. 1990, Brazil et al. 1991, 2011, Oliveira et al. 1995, Souza et al. 2003, Alves 2007). *Evandromyia* was the most abundant genus in the collections, represented by the species *Ev. cortelezzii*, *Ev. edwardsi* and

Ev. tupynambai. The most representative species, *Ev. tupynambai*, has been associated with rodents by Mangabeira (1942); this species accounted for 34.1% of all of the sandflies collected. The record reported here is the first of this species in Niterói and Maricá. *Ev. tupynambai* was present in the traps located in both the forest fragments and the peridomicile. This finding leads us to suggest that this species be considered common and well adapted to the sylvatic environment, but that it appears to be eclectic with respect to food sources due to captures in a chicken coop (Figure). Another characteristic of the sampled sandflies was the capture of a greater number of females compared with males, which does not support the findings of de Aguiar et al. (1985), who collected a greater number of males in light traps. *Migonemyia* was the second most abundant genus and was represented only by the species *Mg. migonei*, which was the second most frequent. This species is widely distributed in all regions of Brazil and it has been recorded throughout almost the entire RJ (Rangel et al. 1986, Brazil et al. 1991, 2011, Souza et al. 2002, 2003).

Mg. migonei was found only in the chicken coop in Itaipu (Figure) and was classified as belonging to the accessory category. However, we emphasise that *Mg. migonei* was observed at in a higher density in this ecotope compared with the results of a recent study by our group performed in Saquarema. It was also one of the most abundant species around houses (Brazil et al. 2011). This finding agrees with those of Rangel and Lainson (2003), who showed that *Mg. migonei* displays a feeding habit characterised by a remarkable degree of anthropophily while also feeding on domestic animals, such as dogs. *Mg. migonei* has been demonstrated to be naturally infected by flagellates in the state of São Paulo (Pessoa & Pestana 1940, Pessoa & Coutinho 1941) as well as by *Leishma-*

TABLE I

Number and percentage of species males and females of sandflies distributed in forest areas and peridomicile in the park area of Niterói and Maricá, state of Rio de Janeiro

Species	Male (n)	Female (n)	Total n (%)
<i>Brumptomyia cunhai</i>	82	61	143 (13.8)
<i>Brumptomyia nitzulescui</i>	27	32	59 (5.7)
<i>Evandromyia cortelezzii</i>	3	3	6 (0.6)
<i>Evandromyia edwardsi</i>	21	35	56 (5.4)
<i>Evandromyia tupynambai</i>	113	241	354 (34.1)
<i>Lutzomyia longipalpis</i>	2	0	2 (0.2)
<i>Migonemyia migonei</i>	180	34	214 (20.6)
<i>Micropygomyia schreiberi</i>	51	50	101 (9.7)
<i>Nyssomyia intermedia</i>	23	6	29 (2.8)
<i>Pintomyia bianchigalatiae</i>	0	5	5 (0.5)
<i>Psathyromyia lanei</i>	49	18	67 (6.5)
<i>Sciopemyia microps</i>	1	0	1 (0.1)
Total	552	485	1,037 (100)

TABLE II

Total number of sandflies and constance index (CI) found in the municipality of Niterói and Maricá, state of Rio de Janeiro

Species	Total (n)	CI		Classification
		(%)		
<i>Evandromyia tupynambai</i>	354	100		Constant
<i>Micropygomyia schreiberi</i>	101	100		
<i>Brumptomyia cunhai</i>	143	75		
<i>Evandromyia edwardsi</i>	56	75		
<i>Brumptomyia nitzulescui</i>	59	62.5		
<i>Psathyromyia lanei</i>	67	62.5		
<i>Pintomyia bianchigalatiae</i>	5	37.5		Accessory
<i>Lutzomyia longipalpis</i>	2	25		
<i>Migonemyia migonei</i>	214	25		
<i>Nyssomyia intermedia</i>	29	25		
<i>Sciopemyia microps</i>	1	12.5		Accidental
<i>Evandromyia cortelezzii</i>	6	12.5		

nia (Viannia) braziliensis in Ceará Baturité (Azevedo et al. 1990, de Queiroz et al. 1991) and, recently, with *L. infantum* in the state of Pernambuco (de Carvalho et al. 2010). In RJ, Rangel et al. (1986, 1990) observed *Mg. migonei* to be the second most commonly recorded species in Vargem Grande and Mesquita. In Vargem Grande, *Mg. migonei* was shown to be predominantly feeding on dogs, leading the authors to suggest a possible role of this species in the transmission of the agent of canine CL, together with other vectors in that area.

Mg. migonei and *Ev. tupyngambai* together accounted for more than 50% of all species collected in this study and were present in all samples (Table I). *Ny. intermedia* is considered one of the main vectors of CL in Brazil and forms a species complex with *Nyssomyia neivai* (Marcondes 1996). *Ny. intermedia* exhibits a broad distribution in RJ, often being recorded as the most frequent species (Rangel et al. 1986, 1990, Brazil et al. 1991, 2011, Souza et al. 2003, Alves 2007). In the present study, this species was not found in sylvatic environments within the park, as observed in other sylvatic areas of the state (de Aguiar & Soucasaux 1984, Afonso et al. 2007). It was present only in captures made in the peridomicile area in Itaipu and was classified as an accessory species. *Ny. intermedia* has been implicated as a potential vector of *L. braziliensis* by Rangel et al. (1984), who recorded natural infections in areas endemic for CL in Jacarepaguá and Vargem Grande. This evidence regarding the predominance of *Ny. intermedia* in areas of CL and its frequency in domiciliary areas contribute to its implication as the main vector of this disease (Rangel et al. 1990, Alves 2007). In previous studies conducted in this area (Brazil et al. 1989, 1991), *Ny. intermedia* has always appeared as the dominant species and at high densities. However, it appears that *Mg. migonei* is now taking over as the dominant species in dwellings, with *Ny. intermedia* appearing at a lower density. The natural infection of both *Ny. intermedia* and *Mg. migonei* collected in the Park of Pedra Branca, RJ, with *L. (V.) braziliensis*, as determined through polymerase chain reaction analysis by de Pita-Pereira et al. (2005), strongly suggested that both

species can play a role as vectors in the studied region. In RJ, the distribution of *Lu. longipalpis* is restricted to a few municipalities. However, with the detection of VL cases in the municipality of Rio de Janeiro, its presence in other municipalities has also been observed (de Souza et al. 1981, Rangel et al. 1986, 1990, Brazil et al. 1989, 2011, Cabrera et al. 2003).

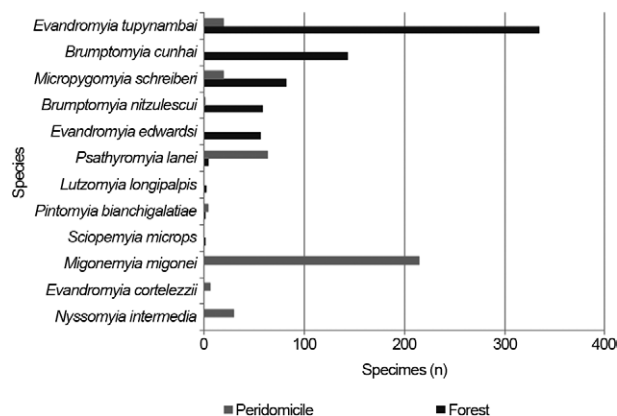
In the present study, only two specimens of *Lu. longipalpis* were captured in the forested area of Itacoatiara, representing the first report of this species in Niterói. This finding suggests that this population is predominantly sylvatic because it was never found in previous works in modified areas of this region (Brazil et al. 1991). However, *Lu. longipalpis* has previously been recorded in the municipalities of Rio Bonito and Saquarema (Brazil et al. 1989, 2011). Thus, further studies are needed to evaluate whether the population of *Lu. longipalpis* from Itacoatiara is actually an isolated population with an origin in the Atlantic Forest or displays a wider distribution in other regions of the state.

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Number of species found in both environments of the State Park of Serra da Tiririca from May 2010-May 2011.

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Map of the division of the state of Rio de Janeiro in municipalities (municipalities highlighted represent areas where the work was done).

Locations and environment type of the target areas
with description of all points (each with a trap) and their geographical coordinates

Area	Locality	Ambient	Collection points	Geographic coordinates
1	Itaipuaçu	Forest	1	S22°57'59.2'' O43°0'25.1''
			2	S22°57'55.9'' O43°0'24.0''
2	Itacoatiara	Forest	3	S22°58'22.9'' O43°1'33.7''
			4	S22°58'24.0'' O43°1'33.7''
			7	S22°58'22.6'' O43°1'34.0''
			8	S22°58'23.1'' O43°1'33.5''
3	Itaipu	Peridomicile	5	S22°56'46.9'' O43°0'52.9''
			6	S22°56'46.8'' O43°0'53.0''

Number of sandfly species and diversity index (DI) found in Itacoatiara and Itaipu, municipality of Niterói, and Itaipuaçu, municipality of Maricá, state of Rio de Janeiro

Species	Area 1	Area 2	Area3	Total (n)
	Itaipuaçu forest (n)	Itacoatiara forest (n)	Itaipu peridomicile (n)	
<i>Sciopemyia microps</i>	0	1	0	1
<i>Brumptomyia cunhai</i>	9	134	0	143
<i>Brumptomyia nitzulescui</i>	0	58	1	59
<i>Evandromyia cortelezii</i>	0	0	6	6
<i>Evandromyia edwardsi</i>	2	54	0	56
<i>Evandromyia tupynambai</i>	31	304	19	354
<i>Lutzomyia longipalpis</i>	0	2	0	2
<i>Migonemyia migonei</i>	0	0	214	214
<i>Micropygomyia schreiberi</i>	5	77	19	101
<i>Nyssomyia intermedia</i>	0	0	29	29
<i>Pintomyia bianchigalatae</i>	0	1	4	5
<i>Psathyromyia lanei</i>	1	3	63	67
Total	48	634	355	1,037
DI	1.04	1.43	1.27	-