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Bionomics and biology of bats (Mammalia - Chiroptera) in an Atlantic forest remnant: Parque Estadual da Pedra Branca (Rio de Janeiro, Brazil)

Bionomia e biologia de morcegos (Mammalia - Chiroptera) em um remanescente de Floresta Atlântica: Parque Estadual da Pedra Branca (Rio de Janeiro, Brasil)

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Resumo É apresentada uma lista de quirópteros do Parque Estadual da Pedra Branca (PEPB), uma área protegida da Mata Atlântica no Estado do Rio de Janeiro (Brasil). Trinta espécies de quatro famílias de morcegos foram registradas através de trabalhos de campo e da compilação de dados bibliográficos. Phyllostomidae mostrou-se a família mais representativa (vinte e três espécies), enquanto Noctilionidae, Molossidae e Vespertilionidae foram as menos frequentes. A presença de *Plathyrrinus recifinus* (Thomas, 1901), *Chiroderma doriae* Thomas, 1891 e *Mimon bennettii* (Gray, 1838) todos considerados em perigo de extinção no Estado do Rio de Janeiro, e o registro de *Lonchophylla peracchii* Dias, Esbérard & Moratelli, 2013, destacam a necessidade de proteção da área e o desenvolvimento de estudos mais detalhados sobre a quiropterofauna da região.

Palavras-chave: Quirópteros, Floresta tropical, Diversidade, Hábitos alimentares, Parasitologia

Abstract A list of bats from the Parque Estadual da Pedra Branca (PEPB), a protected area of the Atlantic Forest in the state of Rio de Janeiro (Brazil) is presented. Thirty species of four bat families were recorded through field work and compilation of bibliographic data. Phyllostomidae was the most representative family (twenty-three species), while Noctilionidae, Molossidae and Vespertilionidae were the least frequent. The presence of *Plathyrrinus recifinus* (Thomas, 1901), *Chiroderma doriae* Thomas, 1891 and *Mimon bennettii* (Gray, 1838), all considered endangered in the State of Rio de Janeiro, and *Lonchophylla peracchii* Dias, Esbérard & Moratelli, 2013, highlights the need for protection of the area and the development of more detailed studies on the chiropterofauna of the region.

Keywords: Chiropterans, Rain forest, Diversity, Food habits, Parasitology

Introduction

Rio de Janeiro State is known to congregate the highest diversity of bats in Brazil: 79 species, 43 genera and eight families are registered so far (Peracchi; Nogueira, 2010, Moratelli et al., 2011, Dias et al., 2013). The Massif of Pedra Branca (23º 53' 01"/ 23º 04' 29" S and 43º 22' 55"/ 43º 35' 21" W) covers an area of 17,500 ha in the Rio de Janeiro City and represents an important collection of Atlantic Forest elements. This massif includes the Parque Estadual da Pedra Branca (PEPB), 12,500 ha of preserved area created through a State Law on 1974 and currently managed by the Rio de Janeiro State Environmental Institute (INEA). This reserve contains the highest point of the city (Pedra Branca Peak; 1,025 metters high) and is surrounded by several residential districts in the region known as the West Zone of Rio de Janeiro. Early unpublished studies on the diversity of bats at Pedra Branca Massif were performed in 1994 by the Foundation for Environmental Engineering (FEEMA) and by Baptista (2001), where they report seven and 23 species, respectively. Dias et al. (2002) registered 25 species in the Pau da Fome, one of the PEPB sub-areas in the East slope. From 1994 to 2010, a long-term study focusing ecology and seed dispersal by chiropterans was conducted in the Eastern slope of the PEPB. The fieldwork allowed the collection of a great amount of data on biology, abundance and diversity of bats. Here we present biological data on species of bats congregated by our team aiming to contribute to a better understanding of these mammals in the Atlantic Forest of the Rio de Janeiro and to claim attention to the importance of the development of more long-term inventories in this State.

Material and Methods

The Parque Estadual da Pedra Branca is divided into three slopes: north, western and eastern, encompassing the dense hill sides of the Pedra Branca massif, located at an altitude of 100 m above sea level (INEA, 2018). The region's climate, according to the Köppen classification, is type *Af* (equatorial climate with mean rainfall of less than 60mm per month) (Missagia et al., 2014). According to Rizzini (1977) the area is covered by floristic elements typical of the lower montane rain forest. Despite being the largest urban park in Brazil and housing a high number of plant species that allow the existence of a great faunal diversity, animals from PEPB are well known by the local residents but still poorly documented (e.g. Dias et al., 2002, Oliveira et al., 2010; Missagia et al., 2014).

The study presented here is based on bat inventories at the eastern slope of the PEPB conducted monthly from March 1994 to September 2010 mainly in the waning and new moon lunar phases. Bats were collected using mist-nets at ground level from 18h00min to 24h00min on trails or natural clearings near flowering/fruiting plants, close to and over rivers and at grots entrances. All the five sub-areas of the slope were sampled: Pau da Fome, Colônia Juliano Moreira, Camorim, Vargem Grande and Guaratiba (Figure 1).

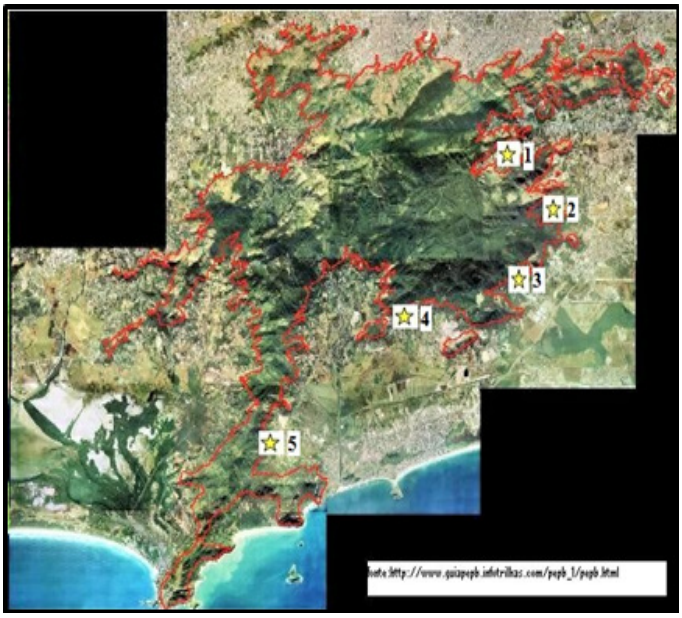

Figure 1. PEPB area (red line). Stars and numbers represent the five subareas included in this study: Pau da Fome (1), Colônia Juliano Moreira (2), Camorim (3), Vargem Grande (4) and Guaratiba (5).

All collected animals were kept in tissue (cotton) bags in order to obtain biometric data at the end of each working day. Exceptions were specimens in the reproductive period, immediately released after identification in the field and notation of relevant data. Standard external measurements (in millimeters) of the head-body length, tail length, hindfoot length, ear length and forearm length and body mass (in grams) were taken for all individuals captured.

Parasitological data was obtained whenever

possible. Ectoparasites were collected from living animals with forceps and placed in vials containing 70% ethanol, using a separate vial for each bat specimen. Endoparasites were studied from the specimens selected as voucher. Detailed procedures for collection and analysis of parasites are reported in Ferreira; Brasil-Sato (1998) and Almeida et al. (2011).

Vouchers were incorporated to the Adriano Lúcio Peracchi collection (ALP), currently housed in the Institute of Biology of the Federal Rural University of Rio de Janeiro (Seropédica, Rio de Janeiro, Brazil) and Acarological Collection in Oswaldo Cruz Institute, Fiocruz (Rio de Janeiro, Brazil). Authorization for activities with scientific purposes follows: IBAMA - 1598-1, 11598-2, 11666-1; ICMBio-18852-1 / 22393-1; INEA - 023/2011. Taxonomy of families and subfamilies follows Simmons (2005), being the species presented herein in alphabetical order.

Results

With an effort of sampling of 311,04 h.net, 1,928 individuals from 28 species and four families were captured (Table 1): Phyllostomidae, Noctilionidae, Vespertilionidae and Molossidae. A total of 144

Table 1. List of bat species captured from 1994 to 2010 Parque Estadual da Pedra Branca (Rio de Janeiro, Brazil) and respective number of specimens.

CHIROPTERA	N	%
PHYLLOSTOMIDAE		
Anoura caudifer (É. Geoffroy, 1818)	24	1.24
Anoura geoffroyi Gray, 1838	3	0.16
Artibeus fimbriatus Gray, 1838	221	11.46
Artibeus lituratus (Olfers, 1818)	833	43.21
Artibeus obscurus (Schinz, 1821)	41	2.13
Artibeus planirostris (Spix, 1823)	43	2.23
Carollia perspicillata (Linnaeus, 1758)	316	16.39
Chiroderma doriae Thomas, 1891	7	0.36
Chrotopterus auritus (Peters, 1856)	4	0.21
Desmodus rotundus (É. Geoffroy, 1810)	149	7.73
Diphylla ecaudata Spix, 1823	20	1.04
Glossophaga soricina (Pallas, 1766)	54	2.80
Glyphonycteris sylvestris (Thomas, 1896)	1	0.05
Lonchophylla peracchi Dias, Esbérard & Moratelli, 2013	4	0.21
Micronycteris megalotis (Gray, 1842)	7	0.36
Micronycteris minuta (Gervais, 1856)	10	0.52
Mimon bennettii (Gray,1838)	3	0.16
Phyllostomus hastatus (Pallas, 1767)	40	2.07
Platyrrhinus lineatus (É. Geoffroy, 1810)	9	0.47
Platyrrhinus recifinus (Thomas, 1901)	3	0.16
Sturnira lilium (É. Geoffroy, 1810)	70	3.63
Tonatia bidens (Spix, 1823)	13	0.67
Vampyressa pussila (Wagner, 1843)	17	0.88
NOCTILIONIDAE		
Noctilio leporinus (Linnaeus, 1758)	3	0.16

VESPERTILIONIDAE		
Eptesicus brasiliensis (Demarest, 1819)	1	0.05
Myotis nigricans (Schinz, 1821)	16	0.83
MOLOSSIDAE		
Molossus molossus (Pallas, 1766)	14	0.73
Molossus rufus (É. Geoffroy, 1805)	2	0.10
Total	1.928	100.00

Diversity

Phyllostomidae was the most diverse family in this study (23 species, 98.13%). The most frequent species was *Artibeus lituratus* (43.21%), followed by *Carollia perspicillata* (16.39%) and *Artibeus fimbriatus* (11.46%), being these species considered very common. The species *Desmodus rotundus* (7.73%), *Sturnira lilium* (Geoffroy, 1810) (3.63%), *Glossophaga soricina* (2.80%), *Artibeus planirostris* (2.23%),

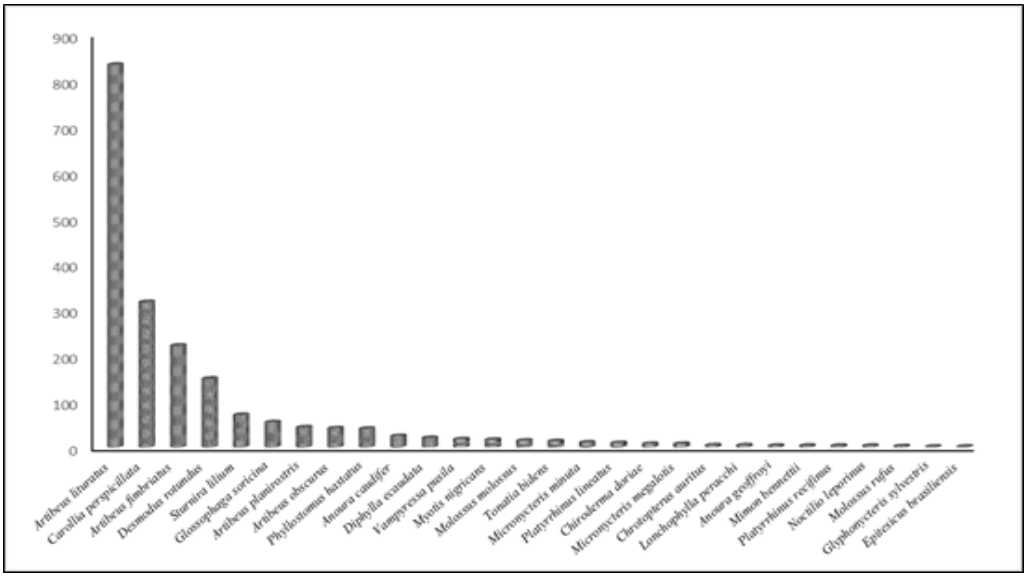

Figure 2. Frequency of capture for bat species at Parque Estadual da Pedra Branca from 1994 to 2010.

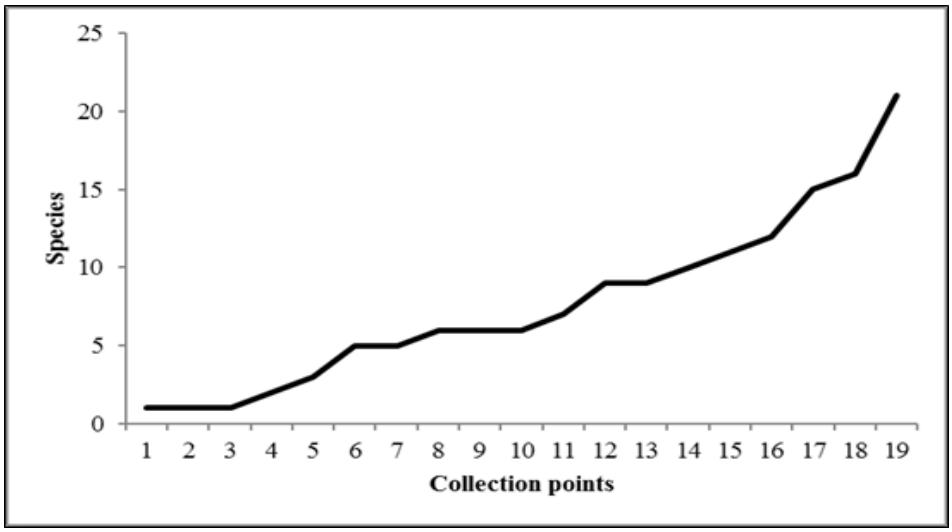

Figure 3. Species accumulation curve for bats from Parque Estadual da Pedra Branca (Rio de Janeiro, Brazil).

Artibeus obscurus (2.15%), and *Phyllostomus hastatus* (2.07%), were considered as common. Species that presented low frequency (less than 0.1%) were considered as rare species (Fig. 4). The curve of the collector has not yet stabilized (Fig. 5); since no studies were performed on the north and east slopes, it is expected an increase in the number of species for the area.

Biology

Biometric data and feeding guilds from the individuals are presented in Table 2.

Diet

Discussions about definition of bat guilds such as

Table 2. Biometric data and food guild of bats from Parque Estadual da Pedra Branca (Rio de Janeiro, RJ).

CHIROPTERA	Weight (g)	Forearm (mm)	Feeding Guild
PHYLLOSTOMIDAE			
Anoura caudifer	9.0 – 12.0	34.8 – 37.5	pollinivores/nectarivores
Anoura geoffroyi	12.5 – 13.5	41.8 – 44.4	pollinivores/nectarivores
Artibeus fimbriatus	47.5 – 61.0	60.1 – 69.1	frugivorous
Artibeus lituratus	65.8 – 81.5	62.0 – 76.6	frugivorous
Artibeus obscurus	31.0 – 43.0	56.7 – 66.3	frugivorous
Artibeus planirostris	61.0	63.3 -69.1	frugivorous
Carollia perspicillata	9.0 – 26.0	30.2 – 46.5	frugivorous
Chiroderma doriae	30.5 – 35.4	50.3 – 54.2	frugivorous
Chrotopterus auritus	84.0 – 93.0	80.5 – 85.7	carnivores
Desmodus rotundus	26.0 – 45.0	52.7 – 66.2	hematophagous
Diphylla ecaudata	20.0 – 33.0	51.6 – 54.9	hematophagous
Glossophaga soricina	8.4 – 13.5	33.7 – 37.3	pollinivores/nectarivores
Glyphonycteris sylvestris	11.3	41.1	insectivores
Lonchophylla peracchi	7.8 – 9.2	35.7 – 35.8	pollinivores/nectarivores
Micronycteris megalotis	6.5 – 12.0	34.0 – 37.4	insectivores
Micronycteris minuta	7.0 – 10.0	34.3 – 36.8	insectivores
Mimon bennettii	21.0 – 25.0	51.2 – 54.7	insectivores
Phyllostomus hastatus	95.2 – 118.5	83.7 – 92.6	omnivores
Platyrrhinus lineatus	21.0 – 27.0	44.9 – 48.1	frugivorous
Platyrrhinus recifinus	17.6 – 19.0	40.0 – 43.0	frugivorous
Sturnira lilium	15.4 – 27.0	39.4 – 48.6	frugivorous
Tonatia bidens	21.0 – 27.0	50.0 – 55.3	insectivores
Vampyressa pussila	9.8 – 14.0	31.1 – 34.9	frugivorous
NOCTILIONIDAE			
Noctilio leporinus	63.0	88.2 – 89.8	piscivores
VESPERTILIONIDAE			
Eptesicus brasiliensis	12.2	43.8	insectivores
Myotis nigricans	3.7 – 8.0	31.6 – 37.0	insectivores
MOLOSSIDAE			
Molossus molossus	12.5 – 18.3	37.0 – 40.7	insectivores

those proposed by Denzinger; Schnitzler (2013) argue that diet cannot be used as a classification of guilds because echolocation and foraging behavior are influenced by both habitat type and feeding mode. Here it followed the definition by Schnitzler; Kalko (1998, 2001), since the mode of feeding of PEBB bats could not be evaluated. Thus, seven feeding guilds were identified: insectivores (n=09), frugivorous (n=10), pollinivores/nectarivores (n=04), hematophagous (n=02), carnivores (n=01), piscivores (n=01) and omnivores (n=01). Gastric and fecal residues analyses showed that nectarivores and frugivorous bats widely used more than one type of food source: fruits, insects and nectar/pollen (Table 3).

Table 3. Food items used by bats in Parque Estadual da Pedra Branca (Rio de Janeiro, RJ)

PLANTS	BATS		
	Fruit	Nectar/Polen	Figs.
LEGUMINOSAE *Vicia* sp.		*P. hastatus*	A
Leguminosae *incertae sedis*		*P. recifinus* *L. peracchi* *A. caudifer*	B, C, D
LYTHRACEA Lythraceae *incertae sedis*		*P. hastatus*	
MALVACEAE *Pseudobombax grandiflorum* (Cav) A. Robyns		*P. hastatus*	A
Malvastrum sp.		*A. caudifer*	D
MORACEAE *Ficus pulchella* Schott.	*A. lituratus*		
Ficus enormis (Mart ex. Miq.)	*A. lituratus* *C. perspicillata*		F
Moraceae *incertae sedis*	*V. pussila* *C. perspicillata* *G. soricina* *P. recifinus*		
MYRTACEAE *Eugenia jambos* L.		*G. soricina* *L. peracchi*	C
Myrtaceae *incertae sedis*	*A. lituratus* *A. fimbriatus* *A. obscurus* *P. lineatus* *P. recifinus*	*G. soricina* *L. peracchi* *P. hastatus*	E, G
PIPERACEAE *Piper mollicomum Kunth.*	*C. perspicillata*		H
Piper rivinoides Kunth.	*C. perspicillata*		

SOLANACEAE *Solanum* sp.	*S. lilium* *A. lituratus* *A. obscurus* *C. perspicillata*		I
Solanaceae *incertae sedis*	*A. lituratus* *A. fimbriatus* *A. obscurus* *C. perspicillata*		
SCROPHULARIACEAE Scrophulariaceae *incertae sedis*	*C. perspicillata*		J
URTICACEAE *Cecropia glaziovii* Snethl.	*A. lituratus* *A. fimbriatus* *A. obscurus* *C. perspicillata* *V. pussila* *C. doriae*		K
Urticaceae *incertae sedis*	*C. doriae* *V. pussila* *S. lilium,* *P. hastatus*		
INSECTS (Hexapoda)	*A. caudifer, A. lituratus, A. fimbriatus, A. obscurus, C. auritus, C. doriae, C. perspicillata, G. soricina, L. peracchi, M. megalotis, M. minuta, M. bennettii, M. nigricans, M. molossus, P. lineatus P. hastatus, T. bidens, V. pussila*		

Parasites

Ectoparasites and Endoparasites

Of the total number of species registered (n = 28), 14 presented ectoparasites belonging to the Order Diptera (Hexapoda) to Subclass Acari (Arachnida) (ALMEIDA et al., 2011). According to the unpublished study of Ferreira (1996) and Ferreira; Brasil-Sato (1998) endoparasites were recorded in six bats species belonging to three families: Phyllostomidae, Molossidae and Vespertilionidae (Table 4).

Discussion

The State of Rio de Janeiro presents forested areas protected as Conservation Units that pose as refuges where several species of bats find shelter and foraging area. Due to this scenario, several authors were able to carry out studies on bat diversity in Rio de Janeiro. Baptista; Mello (2001) recorded 21 species at the Reserva Biológica Poço das Antas, located in Silva Jardim Municipality (RJ). Esbérard et al. (1996) developed their studies in the Reserva Biológica de Araras located in Petrópolis (RJ) where the authors registered 20 species of bats. In studies

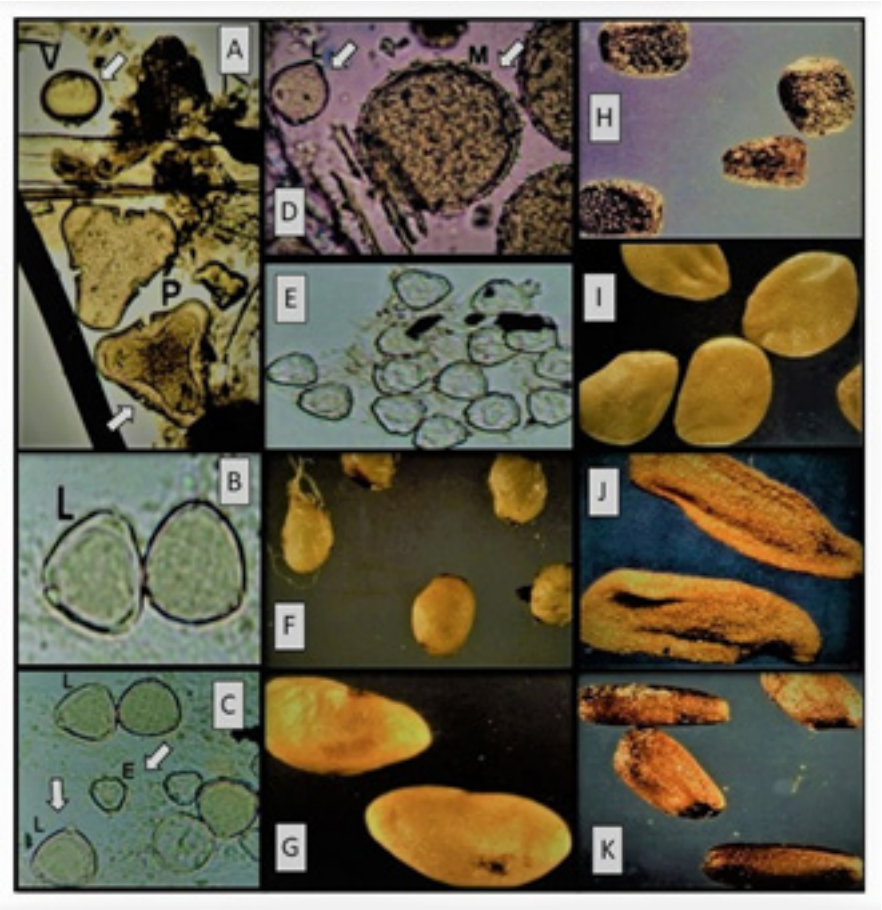

Figure 4. Food items consumed by bats in the Parque Estadual da Pedra Branca during the study period: pollen from *Vicia* sp. and *Pseudobombax grandiflorum* (A), Leguminosae *incertae sedis* (B), *Eugenia jambos* (C), *Malvastrum* sp. (D) and Myrtaceae *incertae sedis* (E). Seeds of *Ficus enormis* (F), Myrtaceae *incertae sedis* (G), *Piper mollicomum* (H), *Solanum* sp. (I), Scrophulariaceae *incertae sedis* (J) and *Cecropia glaziovii* (K) (Photos: Alexandre P. Cruz).

conducted in Atlantic Forest areas of Parque Estadual da Serra da Tiririca in Niterói and Maricá cities, Teixeira; Peracchi (1996) collected 20 species, belonging to two families: Phyllostomidae and Vespertilionidae. Differences between the diversity found by these authors and this study are basically the number of phyllostomids (19/24 species) and vespertilionids (00/02 species). Moreover, Teixeira; Peracchi (1996) listed *Trachops cirrhosus* (Spix, 1823), *Chiroderma* sp. and *Plathyrrinus* sp., species not recorded in the PEPB. All these mentioned studies were conducted in protected areas and show a species diversity lower than that reported to PEPB. The city of Rio de Janeiro presents three major forested regions: Pedra Branca, Gericinó-Mendanha and Tijuca. Silvares et al. (2011) listed 24 bat species from three families to occur at the Gericinó-Mendanha Massif, where the Parque Natural da Serra do Mendanha (PNSM) is inserted. Four species, namely *Pygoderma bilabiatum* (Wagner, 1843), *Sturnira tildae*, *Micronycteris microtis* Miller, 1898 and *Myotis levis* (I. Geoffroyi, 1824) were not recorded in PEPB. Another study carried out in the area of the PNSM by Menezes Jr. et al. (2015) reported 18 species - only *Sturnira tildae* La Torre, 1849 was not identified in PEPB. Lourenço et al. (2014a) registered 26 bat species to the Reserva Biológica do Tinguá (Municipality of Nova Iguaçú, Rio de Janeiro state); from these, *Micronycteris hirsuta* (Peters, 1869), *Phylloderma stenops* Peters, 1865, *Dermanura cinerea* (Gervais, 1856), *Pygoderma bilabiatum* (Wagner, 1843) and *Myotis riparius* Handley, 1960 were not collected in PEPB.

The first study on bat diversity at PEPB was conducted by Dias et al. (2002) as part of the project here presented and registered 25 species for the Pau da Fome sub area. With the continuation of studies by the research group, four species were added to the list: *Anoura geoffroyi* Gray, 1838, *Artibeus planirostris* (Spix, 1823), *Noctilio leporinus* (Linnaeus, 1758) and *Molossus rufus* (É. Geoffroy, 1805). The

Table 4. Summarized data on parasites found in association to bat species from Parque Estadual da Pedra Branca (Rio de Janeiro, RJ).

Species	Ectoparasites (flies and mites)	Endoparasites
Artibeus lituratus	Diptera - Streblidae: *Trichobius longipes*, *Trichobius tiptoni*, *Paratrichobius longicrus*.	*Vampirolepis* sp. *Litomosoides* sp.
	Acari - Spinturnicidae: *Periglischrus iheringi*, *Periglischrus torrealbai*. Macronyssidae: *Radfordiella desmodi*, *Radfordiella* sp., *Parichoronyssus* sp., *Macronyssoides kochi*.	
Artibeus obscurus	Diptera - Streblidae: *P. longicrus.*	
	Acari - Spinturnicidae: *P. iheringi.*	
Artibeus planirostris	Acari - Spinturnicidae: *P. iheringi*. Macronyssidae*: M. kochi.*	
Carollia perspicillata	Diptera - Streblidae: *T. tiptoni*, *Trichobius joblingi*, *Strebla guajiro*, *S. alvarezi.*	*Capillaria* sp. *Litomosoides brasiliensis*
	Acari - Spinturnicidae: *P. iheringi*. Macronyssidae: *M. kochi.*	
Desmodus rotundus	Diptera - Streblidae: *Trichobius furmani*, *T. joblingi*, *T. dugesioides*, *Strebla mirabilis.*	*Biacantha* sp.
	Acari - Spinturnicidae: *Periglischrus herreai*. Macronyssidae: *R. desmodi.*	
Diphylla ecaudata		Anosplostrongylinae *incertae sedis*
Micronycteris minuta	Diptera - Streblidae: *T. dugesioides.*	
	Acari - Spinturnicidae: *Periglischrus micronycteridis.*	
Micronycteris megalotis	Diptera - Streblidae*: Strebla alvarezi.*	
Mimon bennettii	Diptera - Streblidae: *P. longicrus.*	
	Acari - Spinturnicidae: *Periglischrus acutisternus.*	
Phyllostomus hastatus	Diptera - Streblidae: *T. longipes*, *T. tiptoni*, *P. longicrus.*	
	Acari - Spinturnicidae: *Periglischrus ojastii*, *P. torrealbai*.Myobidae*: Eudubasbekia* sp.	
Sturnira lilium	Acari - Macronyssidae: *Parichoronyssus euthysternum.*	

Tonatia bidens	Diptera - Streblidae: *T. dugesioides*; *Strebla hertigi.*	
	Acari - Trombiculidae: *Perissopalla ipeani.*	
Noctilio leporinus	Diptera - Streblidae: *Noctiliostrebla aitkeni.*	
Molossus molossus		*Ochoterenatrema diminutum*
Myotis nigricans	Diptera - Streblidae: *T. longipes.*	*Ochoterenatrema diminutum*

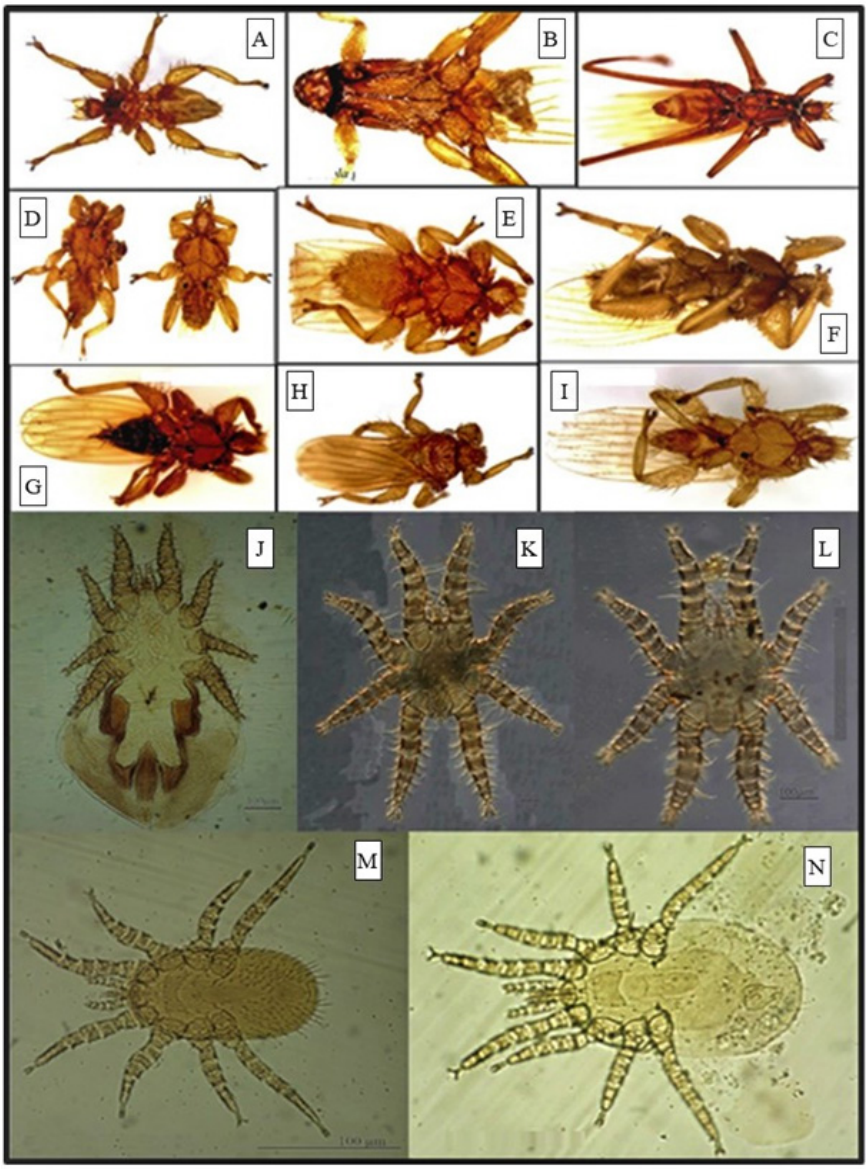

Figure 5. Ectoparasites collected in the bats of Parque Estadual da Pedra Branca (Rio de Janeiro, RJ) from 1994 to 2010. A: *Noctiliostrebla aitkeni*, B: *Strebla guajiro*, C: *Paratrichobius longcrus*, D: *Trichobius furmani* (♂ and ♀), E: *Trichobius dugesioides*, F: *Trichobius joblingi*, G: *Trichobius longipes*, H: *Trichobius tiptoni* (dorsal), I: T*richobius tiptoni* (ventral), J: *Periglischrus acutisternus* (♀), K: *Periglischrus iheringi* (♂), L: *Periglischrus torrealbai* (♂), M: *Macronyssoides kochi*, N: *Radfordiella desmodi* (Photos: Juliana C. Almeida).

Pau da Fome sub-area was the one with the highest number of species (n = 26), followed by the Vargem Grande sub-area with 19 species, Colonia Juliano Moreira with 18 species, Guaratiba with 10 species and Camorim with nine species. The low diversity in the Camorim sub-area may be due to the low capture effort and / or the selection of the points to be sampled. The total number of species obtained in each study site may not reflect the real quantity of species present in the area, since PEPB has a large geographical extension (12,500 ha); as seen in the collector curve, surveys in other areas, with an increase in the capture effort may add new species to the current list.

The predominance of phyllostomatids is typical of bats inventories in the Neotropics (SIMMONS; VOSS, 1998). Comparing the diversity of species found by the above mentioned studies and the results presented here (Table 2), the PEPB also presents a higher number of species of phyllostomids. The bat fauna found in PEPB is characterized by seven guilds; although the most numerous species were insectivorous, vespertilionids and molossids were less captured; this can be a consequence of the capture method used, the mist-nets installed in the sub-forest, which become selective by capturing more frugivorous bats (MACNAB, 1971; SIPINSKI, 1995, PEDRO; TADDEI, 1997). According to Carvalho; Fabián (2011) the installation of mist-nets in upper strata in Atlantic Forest considerably increases the richness of phylostomid and vespertilionid bats. Thus, for a better knowledge of the chiropterofauna the use of concomitant methods is necessary (PORTFORS et al., 2000; BERGALLO et al., 2003). The diversity recorded for the eastern slope of the PEPB corresponds, respectively, to 38% and 48% of the species and genera known in the state Rio de Janeiro (PERACCHI; NOGUEIRA, 2010, MORATELLI et al., 2011).

Of the total species registered for PEPB, three are considered as endangered: *Plathyrrinus recifinus*, *Chiroderma doriae* and *Mimon bennettii. P. recifinus* is also listed in the Brazilian List of Threatened Species of Extinction with the status of "Vulnerable" (CHIARELLO et al., 2008). The taxa *Tonatia bidens* and *Vampyressa pussila* are considered as "Data-Deficient" (BERGALLO et al., 2000, BARQUEZ; DIAZ, 2016, 2016a) and the other species are considered "least concern" by the IUCN.

The frugivorous diet presented by PEPB bats agrees with the previously described by several authors the preference for fruits of *Cecropia* spp. and *Ficus* spp. by bats of the genus *Artibeus* has already been reported by Fleming (1986), Galetti; Morellato (1994), Marinho-Filho (1992), Sazima et al. (1994) and Zortea; Chiarello (1994). According to Fleming (1986) and Passos et al. (2003) *Artibeus lituratus* is considered as a specialist in Cecropiaceae (= Urticaceae) and Moraceae fruits. Pinto; Ortêncio-Filho (2006) report that *A. lituratus* and *A. fimbriatus* presented a wide diet with preference for fruits of Moraceae and Cecropiaceae. Fruit consumption and the consequent dispersal of *Ficus pulchella* seeds by *A. lituratus* in the PEPB area is an important factor for conservation, since this plant is endemic to the Atlantic Forest and is found to be vulnerable by IUCN (CARAUTA, 1998). Other vegetables consumed by bats are of medicinal importance. Ethnobotanical studies on the *Piper* genus have shown many species with medicinal applications such as, the expectorant for the treatment of cough, bronchitis and asthma (YUNCKER, 1972). In this study, we identified *Piper mollicomum* and *Piper rivinoides*, both consumed and dispersed by Carollia perspicillata. These plant species have indications for use in gastrointestinal disorders (POTRICH et al., 2014) and as an antimicrobial in the treatment of *Candida albicans* and *Leishmania* spp. respectively (MOREIRA et al., 2016).

The association of ectoparasites with bats is widely known and there are few studies about this relationship (AZEVEDO et al., 2002, DANTAS-TORRES et al., 2009, SILVA et al., 2009). The first studies on ectoparasites (Diptera and Mites) in the city of Rio de Janeiro was performed by Almeida et al. (2011) at PEPB; later Lourenço et al. (2014b) and Pinheiro et al. (2014) conducted studies in some other municipalities in the state of Rio de Janeiro.

Concerning endoparasites, is noteworthy the occurrence of *Vampirolepis* Spasskij, 1954 (Cestoda) in *Artibeus lituratus*, reported previously by Rêgo (1962) for this same bat species. The specific identification of the parasites is being conducted in order to confirm if they belong to the same species reported by the author (V. elongate Rêgo, 1962). The presence of a specimen of *Litomosoides* sp. in the abdominal cavity of *A. lituratus* can be considered a new host record, not listed by the review of Santos; Gibson (2015). Necropsied specimens of *Carollia perspicillata* were infested by *Capillaria* sp. and Litomosoides brasiliensis, both occurrences reported by Santos; Gibson (2015). Three specimens of *Desmodus rotundus* pre-

sented individuals of *Biacantha* sp. in the intestine. The occurrence of helminths belonging to this genus in *D. rotundus* was reported only to Venezuela, Ecuador and Argentina (SANTOS; GIBSON (2015)), thus the record for the PEPB is the first for Brazil. Nematodes from the Subfamily Anosplostrongylinae were found in the intestines the one individual of *Diphylla ecaudata* selected as voucher, consisting in a new host record. The Trematoda species *Ochoterenatrema diminutum* was recorded in the gut of all *Myotis nigricans* and *Molossus molossus* vouchers, listed in the study of Ferreira, Brazil-Sato (1998).

Conclusion

Despite the importance of long-term studies such as the one presented here, data congregated should be interpreted as an underestimation considering the total length of the park. In this sense, studies on the other slopes of PEPB, mainly the north and west, are required to obtain a greater knowledge of the bats that inhabit the largest portion of the Atlantic Forest of Rio de Janeiro City. Due to the status of protected area, this Park was supposed to sustain a great variety of flora and fauna. However, recent speculative land selling at the surrounding areas has becoming a major challenge to the protection and preservation of these populations, what becomes dramatic since the data on fauna and flora accumulated so far is incipient.

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Appendix

Anoura caudifer (8): ALP 5665, ALP 5666, ALP 5743, ALP 5780, ALP 5788, ALP 5800, ALP 5805, ALP 5864.
Artibeus lituratus (15): ALP 5653, ALP 5655, ALP 5656, ALP 5659, ALP 5691, ALP 5705, ALP 5709, ALP 5711, ALP 5736, ALP 5753, ALP 5774, ALP 5789, ALP 5799, ALP 5803, ALP 5829.
Artibeus fimbriatus (30): ALP 5654, ALP 5657, ALP 5673, ALP 5674, ALP 5683, ALP 5695, ALP 5698, ALP 5700, ALP 5704, ALP 5710, ALP 5712, ALP 5713, ALP 5737, ALP 5740, ALP 5741, ALP 5751, ALP 5754, ALP 5757, ALP 5765, ALP 5769 ALP 5770, ALP 5778, ALP 5779, ALP 5781, ALP 5798, ALP 5806, ALP 5823, ALP 5824, ALP 5832.
Artibeus obscurus (10): ALP 5675, ALP 5682, ALP

5692, ALP 5696, ALP 5699, ALP 5763, ALP 5772, ALP 5782, ALP 5812, ALP 5830.
Carollia perspicillata (16): ALP 5660, ALP 5661, ALP 5667, ALP ALP 5668, ALP 5669, ALP 5672, ALP 5676, ALP 5680, ALP 5746, ALP 5755, ALP 5756, ALP 5801, ALP 5814, ALP 5822, ALP 5855, ALP 5857.
Chiroderma doriae (5): ALP 5684, ALP 5693, ALP 5714, ALP 5761, ALP 5784.
Chrotopterus auritus (2): ALP 5701, ALP 5854.
Desmodus rotundus (2): ALP 5681, ALP 5752.
Diphylla ecaudata (4): ALP 5745, ALP 5851, ALP 5852, ALP 5853.
Eptesicus brasiliensis (1): ALP 5825.
Glossophaga soricina (9): ALP 5202, ALP 5723, ALP 5726, ALP 5732, ALP 5787, ALP 5790, ALP 5818, ALP 5819, ALP 5863.
Glyphonycteris sylvestris (1): ALP 5856.
Lonchophylla peracchi (1): ALP 5820 ALP 5664, 5860.
Micronycteris megalotis (1): ALP 5679.
Micronycteris minuta (1): ALP 5813.
Molossus molossus (3): ALP 5658, ALP 5724, ALP 5725.
Myotis nigricans (5): ALP 5727, ALP 5742, ALP 5744, ALP 5821, ALP 5861.
Phyllostomus hastatus (5): ALP 5678, ALP 5775, ALP 5776, ALP 5785, ALP 5786.
Platyrrhinus lineatus (4): ALP 5690, ALP 5703, ALP 5827, ALP 5858.
Platyrrhinus recifinus (2): ALP 5662, ALP 5828.
Sturnira lilium (13): ALP 5689, ALP 5694, ALP 5718, ALP 5719, ALP 5720, ALP 5735, ALP 5738, ALP 5739, ALP 5762, ALP 5773, ALP 5809, ALP 5810, ALP 5811.
Tonatia bidens (2): ALP 5715, ALP 5826.
Vampyressa pussila (4): ALP 5716, ALP 5717, ALP 5731, ALP 5783.