

**Notes on the lesser white-lined bat, *Saccopteryx leptura* (Schreber) (Chiroptera, Emballonuridae),
from southeastern Brazil**

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ABSTRACT. *Saccopteryx leptura* (Schreber, 1774) is reported from two new localities in southeastern Brazil, both in Atlantic forest remains in the state of Rio de Janeiro. Analysis of food material showed that individuals from both localities had preyed on insects in the order Hymenoptera. Cheek contents were available from one specimen, and in this case identification of the food item (flying ants) achieved generic level (*Pheidole* Westwood, 1841). Aspects in the social behavior observed in a colony suggest that the same traits documented in Central American populations (small colonies, monogamic mating system, and retention of young for up to a year in the parental unit) may also characterize this species in the southernmost part of its range. In both external and craniodental selected measurements, specimens from Rio de Janeiro were close to the upper limits of the ranges known for the species.

KEY WORDS. Chiroptera, Emballonuridae, *Saccopteryx leptura*, morphometrics, feeding habits, social behavior, Rio de Janeiro, Southeastern Brazil

Currently, 20 Neotropical bat species, distributed in eight genera, can be recognized in the pantropical family Emballonuridae (JONES & HOOD 1993; SIMMONS & HANDLEY 1998; SIMMONS & VOSS 1998). With the exception of *Balantiopteryx* Peters, 1867, which is represented in South America by a single species (*Balantiopteryx infusca* (Thomas, 1897)) restricted to northwestern Ecuador, all other genera are present in Brazil (JONES & HOOD 1993). Amazonia is the richest Brazilian biome regarding these aerial insectivorous bats (7 gen., 15 spp.) (MARINHO-FILHO & SAZIMA 1998; SIMMONS & HANDLEY 1998), being followed by the endangered Atlantic Forest where at least five genera and eight species are known to occur (MARINHO-FILHO & SAZIMA 1998).

Although it has long been recognized that several widespread Neotropical emballonurids reach the southern limit of their distribution in southeastern Brazil (JONES & HOOD 1993), few records are currently available documenting the occurrence of these bats in this region. The lesser white-lined bat, *Saccopteryx leptura* (Schreber, 1774), which ranges from Chiapas, Mexico, southward to Peru,

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northern Bolivia, and eastern Brazil (KOOPMAN 1993; YANCEY *et al.* 1998a), is among these species. It has been recorded in the main Brazilian biomes (MARINHO-FILHO & SAZIMA 1998), but in the Atlantic Forest of southeastern Brazil only a few specimens have been reported until now, all of them from the state of Espírito Santo (VIEIRA 1942; RUSCHI 1952; PERACCHI & ALBUQUERQUE 1993).

In this paper descriptions of two new southeastern Brazilian records of *S. leptura*, both from Atlantic Forest remains in the state of Rio de Janeiro, are provided.

MATERIAL AND METHODS

The four specimens of *S. leptura* used in this study are deposited in the Adriano Lúcio Peracchi collection (ALP), stored at the Universidade Federal Rural do Rio de Janeiro (UFRRJ), state of Rio de Janeiro, Brazil. Two of them (ALP 5929 and 5930) are preserved as dry skin and skull, and the other two are stored in 70% alcohol, with their skulls removed. Body mass is provided only for those specimens that were received alive, and was recorded with a Pesola spring scale to the nearest 1 g. All linear measurements were taken by the same person (MRN) using a vernier caliper accurate to 0.05 mm. Some of these (total length, tail length, hind foot length, and ear length) were based on HANDLEY (1988), and all others, except condylobasal length (distance from the anteriormost point of the premaxillae to the posteriormost point of the occipital condyles), were taken as described by SIMMONS & VOSS (1998). Total length, tail length, and ear length were only taken from fresh specimens. Hind foot length, however, was taken from preserved specimens. Although based on reproductive criteria one female (ALP 5929) was categorized as subadult, all specimens presented closed phalangeal epiphyses (cartilage not detected in transilluminated wings) and were, therefore, included in the morphometric analyses.

To obtain data on the diet of *S. leptura* material stored in the cheeks of one specimen and fecal samples from the other three individuals were analyzed. Fecal samples were dried under natural conditions and kept in an airtight plastic bag, while the cheeks content were preserved in 70% alcohol. At the time of analysis, this material was placed in petri dishes containing 70% alcohol and examined under a dissecting microscope. As the material found in the cheeks was well preserved and included the main body parts of the insect prey, it was sent to a specialist after our order level identification. Diagnostic insect fragments in the fecal samples were identified using BRUES *et al.* (1954), BORROR & DELONG (1969) and LOUREIRO & QUEIROZ (1990). Material in which the identification of the food items was based is wet preserved (70% alcohol), as voucher, at the Laboratório de Mastozoologia, Instituto de Biologia, UFRRJ.

RESULTS AND DISCUSSION

New locality records and capture descriptions

The first specimen of *S. leptura* received (ALP 5927) came from the Campo Escoteiro Geraldo Hugo Nunes (CEGHN) (22°35' S, 43°02' W; ca. 50 m elevation), a 37 ha area of lowland Atlantic Forest located at the foot of the Serra dos Orgãos in the city of Guapimirim, state of Rio de Janeiro. It was collected in 1982 by the

ornithologist L.P. Gonzaga, who by quickly oscillating a wooden broomstick intercepted the bat while it was flying at dawn, close to the CEGHN seat. Although unusual (for a review of bat capture methods see KUNZ & KURTA 1988), this strategy made it possible to obtain food habit information at a level usually inaccessible when bats are captured with mist nets. As the specimen was probably knocked down during its foraging flight, its cheeks were completely full of relatively undamaged insect parts.

The other three specimens (ALP 5928, 5929, 5930) came from the metropolitan region of the state of Rio de Janeiro. On 28 October 1997, J. Berninzoni used an improvised hand net to capture these bats from their diurnal roost in a building at the campus of the American School of Rio de Janeiro (22°58'38"S, 43°14'45"W; 145 m elevation). Situated at the southeastern slope of the Maciço da Tijuca, in the city of Rio de Janeiro, this area is surrounded by the secondary Atlantic Forest vegetation that extends over the Maciço. The roost site in the building was no more than 30 m from the forest.

The record of *S. leptura* at the Maciço da Tijuca reinforces the importance of a combined and diversified sampling protocol so that more comprehensive bat inventories can be achieved (SIMMONS & VOSS 1998; LIM *et al.* 1999; OCHOA *et al.* 2000). This area was extensively sampled (> 10,000 captures) with ground-level mist nets set at a variety of localities and microhabitats (*e.g.* trails, streams, dams), but no emballonurid was captured (ESBÉRARD 1998). Specimens of *Saccopteryx bilineata* (Temminck, 1838) reported by PERACCHI & ALBUQUERQUE (1986) from a crevice among large granite blocks (at the Reserva Florestal do Grajaú, in accordance with A.L. Peracchi) constitute the only additional record of an emballonurid for the Maciço da Tijuca.

Although previous reports from Southeastern Brazil have only documented *S. leptura* in the state of Espírito Santo (LIMA 1926; VIEIRA 1942; RUSCHI 1952; PERACCHI & ALBUQUERQUE 1993), several distribution range maps have extended its occurrence southward through the state of Rio de Janeiro (JONES & HOOD 1993; YANCEY *et al.* 1998a; EISENBERG & REDFORD 1999). Specimens reported here give support to such extrapolations, representing an extension of 425 Km in the *S. leptura* distribution (from Santa Teresa, ES, to the southernmost record in the city of Rio de Janeiro).

Morphometrics

External and cranial dimensions obtained from the four *S. leptura* specimens reported here are present in table I. Females exhibited higher external dimensions than males, which is in agreement with the secondary sexual dimorphism previously reported for this emballonurid (BRADBURY & VEHRENCAMP 1976). In general, both external and cranial measurements of the specimens from Rio de Janeiro are closer to the upper side of the known range documented for the species (SANBORN 1937; HUSSON 1962; ANDERSON 1997; SIMMONS & VOSS 1998; LIM & ENGSTROM 2001). It's noteworthy, however, that some limit-values of selected external measurements used in keys to identify species of *Saccopteryx* were exceeded in our sample. To separate *S. bilineata* from its two congeners of lesser size, *S. leptura* and *Saccopteryx*

canescens Thomas, 1901, both JONES & HOOD (1993) and YANCEY *et al.* (1998b) used a forearm length of 43 mm. The two females reported here exceeded this value (Tab. I). YANCEY *et al.* (1998b) also used the head and body length, established at 45 mm, to separate these taxons. Although we did not take this measurement, by subtracting the tail length from the total length, again the females presented values above that expected for *S. leptura* (ALP 5929 – 49,92 mm; ALP 5930 – 48,85).

Table I. Selected measurements of *Saccopteryx leptura* from the state of Rio de Janeiro, southeastern Brazil.

Collection locality	Guapimirim		Rio de Janeiro	
Collection number (ALP)	5927	5928	5929	5930
Sex	Male	Male	Female	Female
Body mass	–	4.00	4.00	4.00
Total length	–	58.55	67.2	66.45
Tail length	–	14.25	17.70	17.60
Hind foot length	–	8.55	8.60	8.90
Ear length	–	14.00	14.00	13.95
Forearm length	40.50	41.10	43.80	43.55
Tibia length	16.65	16.70	19.20	19.10
Calcar length	15.35	18.30	16.60	15.70
Greatest length of skull	14.45	14.60	14.45	14.50
Condylacanthine length	12.50	13.05	12.95	12.85
Condylbasal length	12.75	13.40	13.35	13.20
Maxillary toothrow length	5.20	5.50	5.60	5.55
Mastoid breadth	7.60	7.55	7.75	7.75
Braincase breadth	7.50	7.10	7.15	6.90
Zygomatic breadth	9.25	9.30	9.35	9.30
Postorbital constriction	2.35	2.70	2.75	2.60
Breadth across upper molars	5.80	6.20	6.20	6.25
Breadth across upper canines	3.05	3.30	3.20	3.30

Conversely, measurements reported here for the two craniodental features used as diagnostic in JONES & HOOD's (1993) key, agree well with the range proposed by these authors (maxillary toothrow: 5,1-5,5 mm; width across molars: 5,9-6,3). With regards to the pattern of coloration in the dorsal pelage, which is another useful feature to recognize emballonurid species (JONES & HOOD 1993; YANCEY *et al.* 1998a,b; LIM & ENGSTROM 2001), adult specimens from Rio de Janeiro presented the characteristic uniformly brown coloration (slightly darker in the subadult female) with two distinct yellowish stripes. The ventral fur of all specimens followed the pattern described by LIM & ENGSTROM (2001): "basal three-quarters brown and the distal one-quarter with paler buffy tips".

Measurements of two other *S. leptura* from southeastern Brazil were provided by VIEIRA (1942) and RUSCHI (1952), but we avoid comparisons because these authors did not report measuring techniques and the sex of specimen 2287 reported by VIEIRA (1942) is not clear. It first appears as a male, but thereafter it is assigned twice as a female. In addition, RUSCHI (1952) analyzed the same 19 characters (11 external and 8 craniodental) used by VIEIRA (1942) but his specimen only differed from that reported by this latter author in three of these characters (length of forearm, tibia and 3rd metacarpal), and by one millimeter each. Consid-

ering that problems related to Ruschi's reports are recurrent, particularly in ornithology (PACHECO & BAUER 2001) where he concentrated his activities, such unusual similarity will require confirmation. The specimen reported by PERACCHI & ALBUQUERQUE (1993), a male with collection number ALP 4564, was available to us but this is a young individual with unclosed phalangeal epiphyses.

Diet

All insect fragments found in the fecal sample obtained from the specimens of *S. leptura* collected at the Maciço da Tijuca were identified in the order Hymenoptera. Also to this order belong the flying ants found in the cheeks of the specimen that was knocked down in Guapimirim. This bat had preyed on at least five female winged ants, all of them identified in the genus *Pheidole* Westwood, 1841 (Formicidae, Myrmicinae). Formicids are already known as a food item of several insectivorous bats (PINE 1969; WHITAKER & FINDLEY 1980; KUNZ *et al.* 1995; WHITAKER *et al.* 1999), and particularly the alate forms were consumed throughout the year by the vespertilionid *Pipistrellus mimus* Wroughton, 1899 in southern India (WHITAKER *et al.* 1999). Flying ants are also an important component in the diet of *Tadarida brasiliensis* (L. Geoffroy, 1824) (Molossidae), especially during lactation (KUNZ *et al.* 1995). REDFORD & DOREA (1984) analyzed the nutritional value of several invertebrates and showed that female flying ants are higher in fat content than most other insects.

The analysis of the diet of insectivorous bats is usually based on fecal pellets or stomach contents, whereby the material is generally too fragmented to allow identification in a taxonomic level lower than order or family (*e.g.* BRADBURY & VEHRENCAMP 1976; WHITAKER & FINDLEY 1980; WHITAKER *et al.* 1999). YANCEY *et al.* (1998a) emphasized that specific food habits of *S. leptura* are completely unknown, and the unique information that we have found is related to the consumption of coleopterans (REIS & PERACCHI 1987). The winged ants (*Pheidole* sp.) reported here were estimated to achieve at least 5 mm in length, which is double the mean size (*ca.* 2,6 mm) expected for the prey of this bat (BRADBURY & VEHRENCAMP 1976).

Roost use, social behavior and reproduction

Specimens of *S. leptura* from the American School of Rio de Janeiro roosted on the ceiling of the top floor of an open stairwell. Well-lighted roosts like this appear to be the preference of this emballonurid, which differs it from its congener *S. bilineata* that inhabits more shaded places (BRADBURY & VEHRENCAMP 1976; SIMMONS & VOSS 1998). The use of buildings as diurnal roosts does not appear to be so common in *S. leptura* (YANCEY *et al.* 1998a) as it is in *S. bilineata* (YANCEY *et al.* 1998b). Although *S. leptura* has been documented in a variety of roosts (*e.g.*, underneath mango and banana leaves, under palm fronds, within old ruins), as shown by YANCEY *et al.* (1998a), the most frequent type of roost reported for this bat in the literature is the exposed bole of live and dead trees (GOODWIN & GREENHALL 1961; BRADBURY & VEHRENCAMP 1976; PATTERSON 1992; SIMMONS & VOSS 1998).

Observations previous to the capture indicated that the three specimens from the American School of Rio de Janeiro composed a single colony. They remained

a few centimeters from each other; a distance that seems to be characteristic of this species (BRADBURY & VEHCAMP 1976). The colony was composed of the following: an adult male with well developed wing holding sacs and testis (left – 4,65 x 2,40 mm); a female in initial stage of pregnancy (confirmed after dissection); and a female with ossified epiphyses but categorized as a subadult based on reproductive criteria (tiny nipples and small ovaries and uteri, taken as a signal of nulliparity). This formation is in agreement with the social organization pattern described for *S. leptura* by BRADBURY & VEHCAMP (1976, 1977a,b). The mean size of 24 colonies studied for more than one year in Trinidad was 2,6 bats/colony, with a range of one to five individuals (BRADBURY & VEHCAMP 1976). Yet in Trinidad, GOODWIN & GREENHALL (1961) rarely found colonies of this emballonurid with more than five bats. This tendency was also observed in Paracou, French Guyana, where the maximum colony size documented by SIMMONS & VOSS (1998) was four individuals. Larger colonies, however, have been found in La Pacifica, Costa Rica, where the range in mean colony sizes among six monitored groups was two to nine bats (overall mean 4,6) (BRADBURY & VEHCAMP 1976).

The adult composition observed in the colony here reported, a male/female pair, supports the monogamous mating system that appears to be characteristic of *S. leptura* (BRADBURY & VEHCAMP 1977a; MCCrackEN & WILKINSON 2000). Monogamy is rare among mammals (ca. 3%) and has been reported in only 17 of the 66 bat species from which information on mating systems is available (MCCrackEN & WILKINSON 2000). If our nulliparity prediction concerning the subadult female is correct, another trait in the social behavior observed in Central American populations may also characterize *S. leptura* in the southernmost part of its range. It is related to the parental investment, which in this species can include the retention of young for up to a year within parental social units (BRADBURY & VEHCAMP 1976, 1977b). Nearly 50% of all *S. leptura* colonies larger than a single pair examined by BRADBURY & VEHCAMP (1976) in La Pacifica and Trinidad contained one female of adult size but with unused teats.

Assuming a gestation time of five months (BRADBURY & VEHCAMP 1977b), the parturition in the female found in initial stage of pregnancy would probably take place around March. This can be considered a favorable period for parturition because although there is not a defined dry season in the Maciço da Tijuca (SOUTO-MAIOR 1954), the precipitation is conspicuously reduced during the winter (June to August) (SETZER 1954; SOUTO-MAIOR 1954). All colonies studied by BRADBURY & VEHCAMP (1976) in La Pacifica and Trinidad produced young during the onset of the rainy season. Particularly in La Pacifica, *S. leptura* may produce up to two successive young in a year (BRADBURY & VEHCAMP 1976).

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