

Range extension of *Centronycteris maximiliani* (Mammalia: Chiroptera) for southern Amazonia

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ABSTRACT

Bat species of the genus *Centronycteris* are some of the rarest Neotropical Emballonuridae and fewer than 50 specimens have been deposited in scientific collections. The aim of this study is to extend the distribution of *Centronycteris maximiliani*. Three *C. maximiliani* specimens were recorded in the Brazilian Amazonia, providing the first record of the species for the state of Rondônia, the southernmost record of the species for the Amazon biome in Brazil, and an additional record for the state of Pará. Although these new records of *C. maximiliani* reinforce the idea that this species is widely distributed throughout the Amazon biome, its low capture rate reflects the rarity of this species, since only three specimens were collected during three to four year field effort.

KEYWORDS: Emballonuridae, distribution, rainforest, Brazil.

Extensão de distribuição geográfica de *Centronycteris maximiliani* (Mammalia: Chiroptera) para o sul da Amazonia

RESUMO

Espécies de morcegos do gênero *Centronycteris* são alguns dos mais raros Emballonuridae Neotropicais e menos de 50 espécimes foram depositados em coleções científicas. O objetivo deste estudo é estender a distribuição de *Centronycteris maximiliani*. Três espécimes de *C. maximiliani* foram registrados na Amazônia Brasileira, proporcionando o primeiro registro da espécie para o estado de Rondônia, o registro mais austral da espécie para o bioma Amazônia no Brasil, e um registro adicional para o Estado do Pará. Embora esses novos registros de *C. maximiliani* reforcem a idéia de que esta espécie é amplamente distribuída por todo o bioma amazônico, a sua baixa taxa de captura reflete a raridade da espécie, uma vez que apenas três espécimes foram coletados durante três a quatro anos de esforço de campo.

PALAVRAS-CHAVE: Emballonuridae, distribuição, floresta tropical, Brasil.

The pantropical sheath-tailed bat family Emballonuridae reaches its highest diversity at the Neotropical region (Koopman 1994), where it is represented by the tribe Diclidurini (Lim *et al.* 2008). A total of eight genera and 21 species of Emballonuridae are known for the Neotropics; however, the region remains poorly explored and distributional data is scarce for most species (Hood and Gardner 2008, Bernard *et al.* 2011).

Bat species of the genus *Centronycteris* are some of the rarest Neotropical Emballonuridae and fewer than 50 specimens have been deposited in scientific collections around the world by late twentieth century (Simmons and Handley 1998). This genus is currently composed of only two species, *Centronycteris centralis* Thomas, 1912 and *Centronycteris maximiliani* (Fischer, 1829), both restricted to the rainforests (Hood and Gardner 2008).

Based on morphology, Simmons and Handley (1998) validated *Centronycteris centralis* – previously considered by Sanborn (1937) a subspecies of *C. maximiliani* – which is now known from southern Mexico, east of Central America, Ecuador, Colombia and Peru. Thus those authors restricted the distribution of *C. maximiliani* to northern Peru, eastern Colombia, southern Venezuela, Guyana, French Guiana, Suriname, the central Amazon basin, and Atlantic coastal forests of Brazil (Simmons and Handley 1998; Hood and Gardner 2008). The aim of the present work was to extend the distribution of *C. maximiliani* in the Brazilian Amazonia. The three specimens reported herein were collected in faunal surveys carried out in the Amazonian region, between the years 2008 and 2010, with mist-nets, set on ground level, providing the first record of the species for the state of Rondônia, the southernmost record of the species for the Amazon biome in Brazil, and an additional record for the state of Pará.

The two males (MZUSP 35002, MZUSP 35003) were captured near the margins of Médio Rio Madeira, located in the Caiçara district, municipality of Porto Velho, state of Rondônia (9°28'S, 64°49'W) and one lactating female (MZUSP 35368) was collected at "Igarapé Mano", located in the city of Marabá, state of Pará (5°46'S, 50°30'W) (Figure 1). The latter was caught in a mist-net placed in front of the exit of its diurnal roost, a tree cavity located at approximately 1.8 m from the ground, in which no other bats were detected. Both areas are covered by the Alluvial Ombrophilous Dense Forest, a vegetation type characterized by medium and large trees, palms, woody vines, and epiphytes.

The specimens were handled in accordance with Sikes *et al.* (2011). They were fixed in formaldehyde 10% and preserved in ethanol 70%. The skull of MZUSP 35002 and 35003 was extracted. After recording external and cranial measurements, (Table 1) all three specimens were deposited at Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil

(MZUSP). External and cranial measurements (in millimeter) were taken as described by Simmon and Handley (1998).

Centronycteris can be distinguished from other Emballonuridae genera by the following set of characters: i) fur extends beyond the body onto both surfaces of the uropatagium; ii) dorsal fur is bicolored with dark gray-brown bases that blend gradually into paler brown or brownish-orange tips, ventral fur is slightly paler than dorsum and sharply bicolored, with fuscous bases and paler brown tips; iii) absence of dorsal stripes and wing sac; iv) wing attached to the metatarsals near base of toes; v) basisphenoid pit divided by well-developed median septum; vi) basioccipital longer than its minimum width; and vii) upper anterior premolar tricuspidate (Jones and Hood 1993; Simmons and Handley 1998; Hood and Gardner 2008). According to Simmons and Handley (1998) *C. maximiliani* differs from *C. centralis* in presenting: i) basisphenoid pit weakly divided into anterior and posterior sections with anterior section extending forward between pterygoid processes; ii) posterolateral margins of palate smoothly curved, without notches; iii) rostrum with dorsolateral swelling at base of postorbital process; iv) nasals constricted anteriorly (between medially expanded maxillae) and terminate at level of anterior borders of orbit; v) maxillary tooth row with a procumbent upper canines, a minute anterior upper pre-molar (about one-fourth of the posterior upper pre-molar), and a large gap between upper pre-molars (equal/larger than the crown length of anterior upper pre-molar); vi) robust mandible with an ascending ramus of coronoid process that rises in a gentle curve from immediately behind the last lower molar (Figure 2).

According to the present work and to the records summarized by Simmons and Handley (1998), the occurrence of *C. maximiliani* has been recorded in 26 localities, from which, three are located in the Atlantic Forest, whereas the other 23 are located in the Amazon region. The presence of this species in the Brazilian state of Rondônia extends the distribution quite considerably, reaching the southern portion of Amazonia (Figure 1), 680 kilometers away from its previous southernmost location. Although these new records of *C. maximiliani* reinforce the idea that this species is widely distributed throughout the Amazon biome, its low capture rate reflects the rarity of this species, since only three specimens were collected during three to four year field effort. Therefore this data corroborates Arita (1993), who categorized it as a rare but widely distributed species. Considering that the previous record of *C. maximiliani* occurred at Atlantic Forest by Deoclécio Guerra, in 1978 (UFPE 768), this could indicate that it might be even rarer in this biome.

Its wide distribution throughout two of the largest South American forests and the absence of records in dry forests (e.g. Chaco, Cerrado, and Caatinga) suggest the preference of this

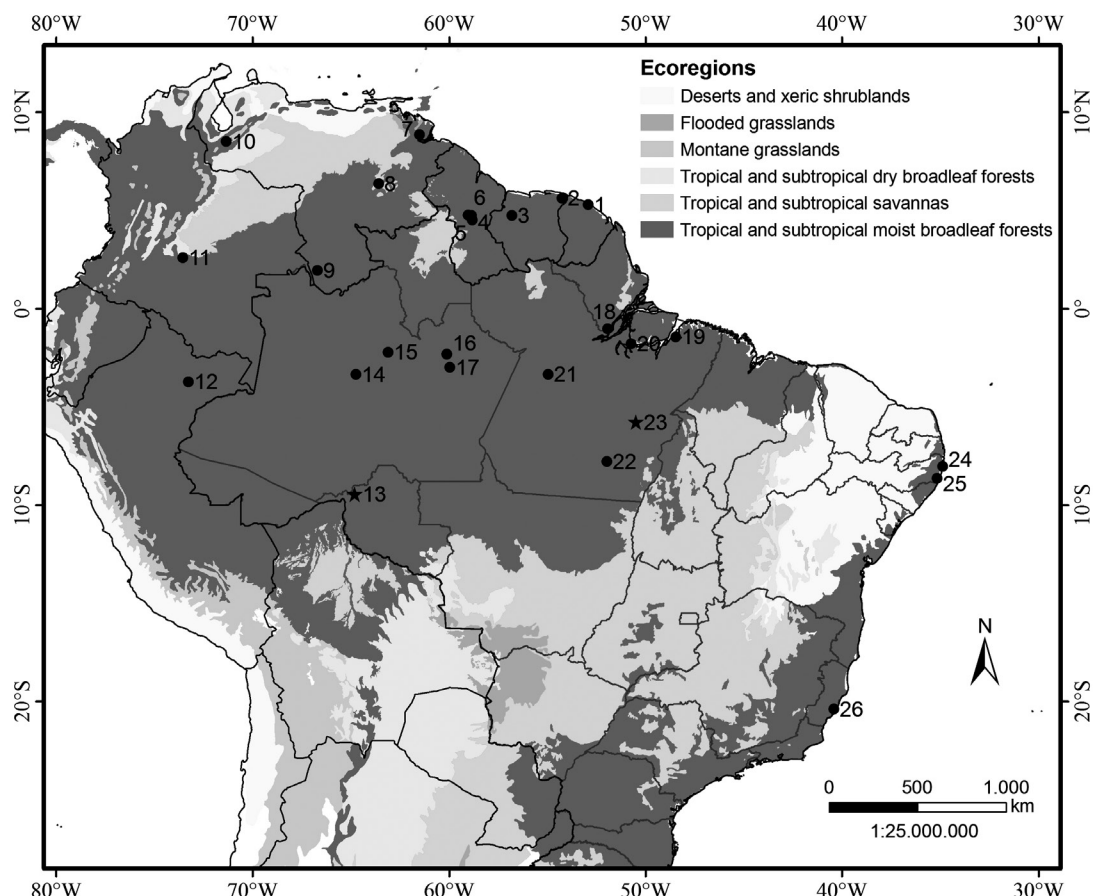


Figure 1. Geographic distribution of *Centronycteris maximiliani* (circles) and the new records (stars). For code numbers of localities, see Table 2.

Table 1. Body and cranial measurements of the *Centronycteris maximiliani* specimens collected during the present study and specimens from Simmons and Handley (1998). (a): Measurements are given in millimeters, except for weight that is given in grams; (b): Range (sample size).

Measurements ^a	Present Study ^a			Simmons and Handley (1998) ^b	
	MZUSP	MZUSP	MZUSP	♂ (n)	♀ (n)
	35002 - ♂	35003 - ♂	35368 - ♀		
Weight (g)	5	6	5	4.5 (1)	5.0 – 9.0 (4)
Tail length	19.8	21.5	19.0	26.0 (1)	20.0 – 23.0 (2)
Hind foot length	6.15	6.25	6.4	7.0 (1)	6.0 – 8.0 (6)
Ear length	17.75	18	18.1	17.0 (1)	14.00 – 17.0 (4)
Forearm length	43.5	44.4	43.9	41.5 (1)	42.2 – 44.7 (7)
Tibia length	18.8	19	18.7	16.6 (1)	17.0 – 18.3 (8)
Condylacanine length	14.8	14.1		13.38 - 14.11 (2)	12.8 – 14.39 (6)
Basisphenoid pit length	2.8	2.6		2.76 – 2.85 (2)	2.5 – 3.14 (5)
Interorbital breadth	2.95	2.98		2.95 – 3.30 (2)	2.9 – 3.2 (7)
Lacrimal breadth	6.4	6.38		6.42 – 6.66 (2)	6.07 – 6.64 (5)
Zygomactic breadth	9.1	9.1		8.93 (1)	8.7 – 9.31 (7)
Mastoid breadth	7.9	7.7		7.29 – 8.09 (2)	7.27 – 8.03 (6)
Maxillary toothrow length	6.1	6.0		5.57 – 5.67 (2)	5.62 – 6.00 (7)
Breadth across molars	6.75	6.7		6.73 (1)	6.2 – 6.77 (7)
Length of lower molar row	3.74	3.78		3.71 – 4.07 (3)	3.59 – 3.9 (5)

Table 2. Locality records for *Centronycteris maximiliani* in Brazil and in other South American countries. The code numbers refer to the points shown in Figure 1.

Country/ Point	Coordinates		Locality	Reference
	Lat y	Long x		
FRENCH GUIANA				
1	5.28333333	-52.91666667	Paracou Field Station	Simmons and Handley (1998); Simmons and Voss (1998)
SURINAM				
2	4.73333333	-56.8	Bakhuis	Lim (2009)
3	5.61666667	-54.25	Marowijine	Williams <i>et al.</i> (1983)
GUYANA				
4	4.5	-58.81666667	Iwokrama Forest - Potaro-Siparuni	Lim and Engstrom (2001)
5	4.75	-59.01666667	Pakatau Falls - Potaro-Siparuni	Lim <i>et al.</i> (1999)
6	4.73333333	-58.85	Clearwater Camp - Potaro-Siparuni	Lim <i>et al.</i> (1999)
VENEZUELA				
7	1.93333333	-66.7	Amazonas - Buena Vista	Simmons and Handley (1998); McCarthy and Ochoa (1991)
8	6.35	-63.58333333	Bolívar	Lim and Tavares (2012)
9	8.85	-61.5	Delta Amacuro	Lim and Tavares (2012)
10	8.5	-71.35	San Juan, Mérida	Lim and Engstrom (2001)
COLOMBIA				
11	2.58333333	-73.55	Serranía de La Macarena, Meta	Cuervo-Díaz <i>et al.</i> 1986
PERU				
12	-3.73333333	-73.26666667	Iquitos, Loreto	Hice <i>et al.</i> (2004); Hice and Solari (2002)
BRAZIL				
13	-9.46666667	-64.81666667	PortoVelho - RO	This study
14	-3.36666667	-64.73333333	Tefé - AM	Simmons and Handley (1998); Sanborn (1937)
15	-2.23333333	-63.1	Jaú National Park - AM	Barnett <i>et al.</i> (2006)
16	-2.33333333	-60.11666667	Biological Dynamics of Forest Fragments Project, AM	Simmons and Handley (1998); Bernard (2001)
17	-3	-59.95	Manaus - AM	Reis (1984)
18	-1.03333333	-51.93333333	Amapá National Forest - AP	Martins <i>et al.</i> (2006)
19	-1.45	-48.46666667	Belém - PA	Simmons and Handley (1998)
20	-1.8	-50.71666667	Estação Científica Ferreira Penna - Melgaço - PA	Marques-Aguiar <i>et al.</i> (2003)
21	-3.35	-54.95	Tapajos National Forest - PA	Castro-Arellano <i>et al.</i> (2007)
22	-7.8	-51.96666667	Kayapó Center for Ecological Research (Pinkaiti), Pará	Peters <i>et al.</i> (2006)
23	-5.8	-50.5	Marabá - PA	This study
24	-8.03333333	-34.86666667	Recife - PE	Simmons and Handley (1998)
25	-8.65	-35.15	Rio Formoso - PE	UFPE 768
26	-20.4	-40.4	Rio Jucú, Fazenda Coroaba (holotype of <i>Vespertilio calcarata</i>) - ES	Simmons and Handley (1998)

species for humid forest environments. Thus, its scarce records in the Atlantic Forest may characterize a disjunct distribution pattern, with two distinct population groups.

Graham (1987) proposes that, in the Amazon Basin, Emballonuridae bats start reproducing in the wet season. Hice and Solari (2002) reported one pregnant female in September and one lactating female in November, both captured in Peru. The lactating female described herein was captured in the state

of Pará in the dry season, which suggests that *Centronycteris* is polyestrus, as there are a number of other bat species from the tropics (Neuweiler, 2000).

The examination of the reproductive tract of the female MZUSP 35368 showed a bicornuate uterus, with a fetus in the early stage of development in its left side. Other Emballonuridae also present bicornuate uterus, such as *Peropteryx kappleri* (Rasweiler 1982) and *Rhynchonycteris naso*



Figure 2. Dorsal, ventral and lateral views of the skull and a lateral view of the mandible of *Centronycteris maximiliani* (MZUSP 35003). Scale bar: 5 mm.

(Carter and Mess 2008), which according to Carter and Mess (2008) it is also found in many species of bats. The authors posit that this type of uterus presents uterine horns that join internally to form the body, which communicates with the vagina through a common cervical canal.

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