



## Nota

# *Macrophyllum macrophyllum* (CHIROPTERA, PHYLLOSTOMIDAE) IN THE BRAZILIAN CAATINGA SCRUBLANDS: RIVER BASINS AS POTENTIAL ROUTES OF DISPERSAL IN XERIC ECOSYSTEMS

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**ABSTRACT.** We present the first record of *Macrophyllum macrophyllum* in the Brazilian Caatinga. The foraging strategy of this species, mainly over water, is consistent with the lack of records for the semi-arid Caatinga biome. During a survey in the municipality of Paripiranga, in northern Bahia, an adult male of *M. macrophyllum* was captured on 27<sup>th</sup> March 2012 (dry season) on the margin of the Vaza-Barris River. Given its ecological and behavioral adaptations, it seems likely that *M. macrophyllum* occurs only in association with the principal perennial rivers of the Caatinga. Further research may confirm that *Macrophyllum* is more widespread in the Caatinga, but likely restricted to local corridors of habitat associated with the region's perennial rivers.

**RESUMO.** *Macrophyllum macrophyllum* (Chiroptera, Phyllostomidae) na Caatinga brasileira: bacias hidrográficas como potenciais rotas de dispersão em ecossistemas xéricos. Nós apresentamos o primeiro registro de *Macrophyllum macrophyllum* na Caatinga. A estratégia de forrageio desta espécie, principalmente sobre a água, é consistente com a ausência de registros para o bioma semiárido brasileiro. Durante um levantamento no município de Paripiranga, no norte do estado da Bahia, um macho adulto de *M. macrophyllum* foi capturado em 27 de março de 2012 (estação seca) as margens do rio Vaza-Barris. Considerando sua adaptação ecológica e comportamental parece provável que *M. macrophyllum* ocorra apenas ao longo dos principais rios perenes da Caatinga. Futuras pesquisas podem confirmar se *Macrophyllum* possui uma distribuição mais ampla na Caatinga, embora provavelmente restrito a corredores de habitat associados com rios perenes.

**Key words:** Brazilian northeast. Long-legged bat. Perennial rivers.

**Palavras chave:** Morcego de pernas longas. Nordeste do Brasil. Rios perenes.

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*Macrophyllum macrophyllum* (Schinz, 1821) is the only representative of the phyllostomid genus *Macrophyllum* Gray, 1838, which is easily recognized by the longitudinal rows of dermal projections found on the ventral-distal portion of the uropatagium (Harrison, 1975). The species is distributed between Misiones in northern Argentina and southern Mexico (Williams and Genoways, 2008), although in Brazil, localities are concentrated in the Amazon and Atlantic rainforest biomes, with only a few records from peripheral areas of the Cerrado savanna (**Fig. 1**).

*Macrophyllum* is the only insectivorous phyllostomid that hunts over water (Weinbeer and Kalko, 2007). Its foraging behavior is characterized by long flights, which combine the typical gleaning habits of other insectivorous phyllostomids with the aerial hawking characteristic of the insectivorous bats of other families (Meyer et al., 2005). This combination of foraging techniques is unique among the phyllostomids, and enables *Macrophyllum* to locate and capture insects over bodies of water (Meyer et al., 2005).

A review of the available records (**Table 1**) indicates that *Macrophyllum* had not previously been reported from the semi-arid Caatinga scrublands of the Brazilian Northeast, presumably due to the fact that this species is associated with rainforest habitats and in particular, watercourses (Harrison, 1975; Williams and Genoways, 2008), which are scarce and intermittent in the Caatinga. The present study nevertheless presents evidence of the occurrence of *Macrophyllum* in the Caatinga, and discusses possible dispersal routes for the species within this biome.

The Caatinga is a mosaic of deciduous xeric thorn scrub and forest that covers most of northeastern Brazil. Given the intense anthropogenic impact over recent decades, most areas can be characterized as open woodland or scrub (Leal et al., 2005). During a survey in the municipality of Paripiranga (10°32'38.2" S, 37°57'22.8" W), in northern Bahia state, an adult male of *M. macrophyllum* was captured on 27<sup>th</sup> March 2012 (dry season) with mist nets (12.0 m x 2.5 m) set on the margin of the Vaza-Barris River at ground level. The region is

dominated by agricultural plantations (mainly cassava and maize), with some fragments of low Caatinga scrub (sensu Mares et al., 1981) mainly along the riverbanks (**Fig. 2**).

The specimen was handled in accordance with the recommendations of Sikes et al. (2011), being fixed in 10% formaldehyde and then preserved in 70% ethanol prior to the extraction of the skull. The standard body and cranial measurements were taken and the specimen was deposited in the mammal collection of the Federal University of Paraíba (UFPB 6552) in João Pessoa, Paraíba, Brazil.

The specimen presents all the diagnostic morphological characteristics of *Macrophyllum* described by Harrison (1975). The rostrum is short and the braincase wide and well developed, taking up approximately two-thirds of the total volume of the cranium. The nasal bone is short and rectangular and the zygomatic arches converge sharply towards the front. The palate is slightly rounded and extends slightly beyond the last upper molar. The foramen magnum is exceptionally large and the occipital condyles relatively small. In a lateral view, there is an abrupt elevation of the dorsal region after the nasal bones, the braincase having an extremely convex dorsal profile. The pre-maxillary bones extend beyond the nasal bones, and the mandible presents an elongated body with a straight ventral profile. The anterior edge of the coronoid process is slightly inclined and has a rounded vertex. The condyloid process is rounded and slightly above the main body of the mandible. The dental formula is I 2/2 C 1/1 PM 2/3 M 3/3. The internal upper incisors are spatulate, while the external incisors are diminutive and close to the former. The first premolar is much larger than the second. The molars have w-shaped cusps, and the M<sup>3</sup> is half the size of the other upper molars. The lower incisors are small with a trifid upper edge. The second lower molar is small and displaced labially in relation to the rest of the dental series (see illustration in Harrison, 1975). The molars have high cusps, and the m<sub>3</sub> is slightly smaller than the others (**Fig. 3**). The external and cranial measurements (in millimeters) are: body length = 37.4; tail length = 38.2; hindfoot length = 12.5; ear

**Table 1**Recording localities for *Macrophyllum macrophyllum*; code numbers refer to the points shown in Fig. 1.

Country	Locality	#	Source
Mexico	Monte Azules	1	Soriano (2000); Bernard and Fenton (2002)
Belize	Lamanai	2	Fenton et al. (2001)
Nicaragua	Consignuina	3	Genoways and Timm (2005)
Costa rica	La Selva	4	Voss and Emmons (1996); Soriano (2000)
Panama	Barro Colorado Island	5	Giannini and Kalko (2004)
Colombia	Santa Marta, Bonda	6	Allen (1900)
Colombia	Magdalena, Bonda	7	Williams and Genoways (2008)
Ecuador	Yasumi National Park	8	Bernard and Fenton (2002)
Peru	Ucayali region	9	Quintana et al. (2009)
Peru	Balta	10	Voss and Emmons (1996)
Peru	Manú National Park	11	Soriano (2000); Bernad and Fenton (2002)
Peru	Cocha Cashu/Pakitza	12	Voss and Emmons (1996)
Peru	Cuzco Amazónico	13	Voss and Emmons (1996)
Venezuela	San Juan de Manapiare	14	Soriano (2000); Lim and Engstron (2001) Bernard and Fenton (2002)
Venezuela	Cunucunuma River	15	Bernard and Fenton (2002)
Venezuela	Sierra Imataca	16	Soriano (2000); Bernad and Fenton (2002)
Guyana	Guyana	17	Engstrom and Lim (2002)
Guyana	Iwokrama Forest	18	Lim and Engstron (2001)
Suriname	Corentyne River	19	Lim and Engstron (2001)
French guiana	Paracou	20	Simmons and Voss (1998)
French guiana	Arataye	21	Voss and Emmons (1996)
Brazil	Loreto, Amazonas	22	Koopman (1978)
Brazil	Manaus	23	Reis and Suchbart (1979); Reis (1984)
Brazil	Km 160, Road Perimetral Norte, Amapá	24	Peracchi et al. (1984)
Brazil	Xingú River, Pará	25	Voss and Emmons (1996)
Brazil	Anajás-Muana, Marajó Island	26	Marques-Aguiar et al. (2002)
Brazil	Parque Ambiental de Belém, Pará	27	Marques-Aguiar et al. (2007)
Brazil	São Luís do Maranhão	28	Dias et al. (2009)
Brazil	Sapé, Paraíba	29	Feijo and Langguth (2011)
Brazil	São Lourenço da Mata, Pernambuco	30	Feijo and Langguth (2011)
Brazil	Tapacurá Ecologica Station	31	Feijo and Langguth (2011)
Brazil	São Cristóvão, Sergipe,	32	Rocha et al.(2010)
Brazil	Paripiranga, Bahia	33	This study
Brazil	Valença, Bahia	34	Faria et al. (2006)
Brazil	Santa Luzia, Bahia	35	Faria et al. (2006)
Brazil	Mucurí River, Bahia	36	Williams and Genoways (2008)
Brazil	Caratinga, Minas Gerais	37	Williams and Genoways (2008)
Brazil	Uberlândia, Minas Gerais	38	Stutz et al. (2004)
Brazil	Gipóia Island, Rio de Janeiro	39	Carvalho et al. (2011)
Brazil	Emas, São Paulo	40	Vieira (1955)
Brazil	East of Parana state	41	Miretzki (2003)
Brazil	Serra da Bodoquena National Park, Mato Grosso do Sul	42	Carmargo et al. (2009)
Paraguay	Amambay, Arroyo Tacuara, Potrerito	43	Wilson and Fox (1991)

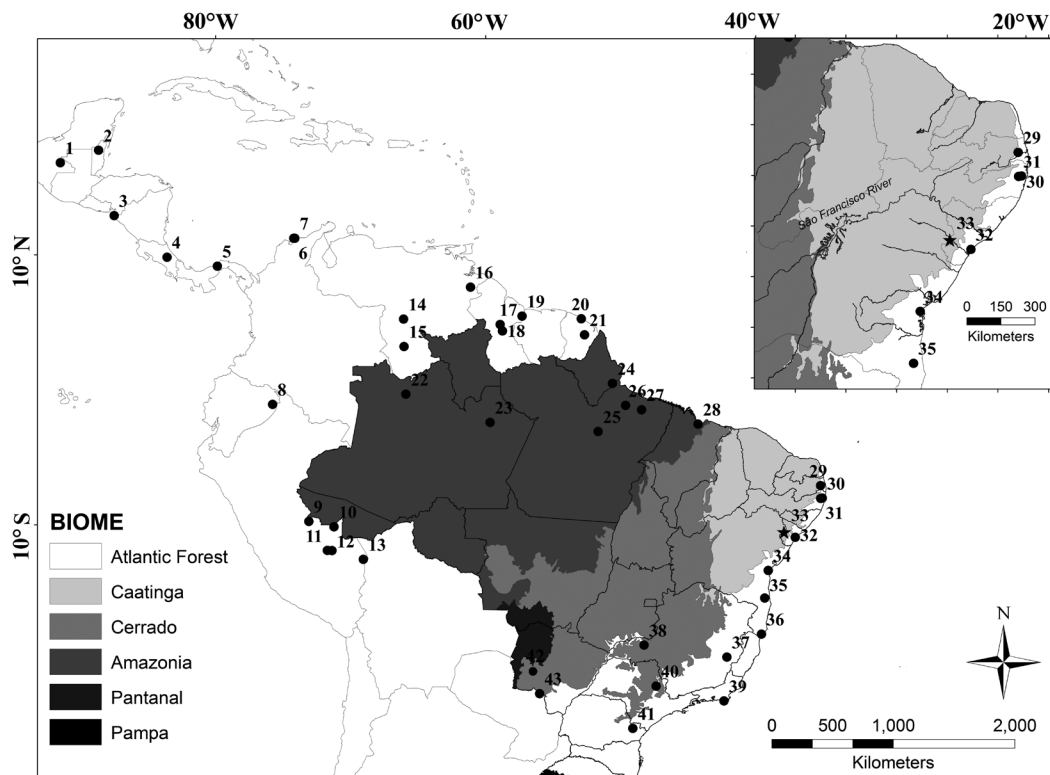


Fig. 1. Recording localities for *Macrophyllum macrophyllum* in relation to the principal rivers of northeastern Brazil; sites are numbered as in Table 1. Circles=previous records; star=new record in the Caatinga biome.



Fig. 2. Site of the capture of the *Macrophyllum macrophyllum* specimen on the Vaza-Barris River in Paripiranga, Bahia, Brazil (left) and typical gallery forest in the region (right).

length = 18.7; forearm length = 35; tragus length = 6.7; calcaneus length = 16.9; skull length = 15.9; condylobasal length = 13.6; palate length = 5.8; palate breadth = 3.2; mastoid breadth = 8.4; zygomatic breadth = 8.4; braincase breadth = 7.8; postorbital breadth = 3.3; breadth across canines = 3.1; breadth across molars = 6.0; maxillary tooththrow = 5.3; mandible length = 9.5; mandibular tooththrow = 6.2.

The species' habit of capturing prey over water is shared with only a few other Neotropical bats, including the noctilionids, the emballonurid *Rhynchonycteris naso*, and a few vespertilionids (Weinbeer et al., 2006; Weinbeer and Kalko, 2007), although their insect prey is typically smaller than that of other gleaners (Meyer et al., 2005). *M. macrophyllum* appears to forage exclusively over water, and there is no evidence that the species forages in other habitats, such as forests (Harrison, 1975; Meyer et al., 2005; Williams and Genoways, 2008). This habitat preference is consistent with the lack of records of the species from the semi-arid Brazilian Caatinga, where most rivers are not only small in size, but tend to dry up altogether during the prolonged dry season (Maltchik, 1999).

While *M. macrophyllum* has usually been associated with forest formations (Anderson and Webster, 1983; Williams and Genoways, 2008), the species has been recorded in deciduous dry forest in Panama (Handley, 1966) and Guatemala (Seymour and Dickerman, 1982), although it seems likely that the distribution of the species is limited by the availability of perennial rivers, as in the case of Paripiranga (Fig. 3). While the Vaza-Barris is a small river—approximately 50 m wide—it is perennial and inserted within a narrow strip of gallery forest, which presumably offers the local *Macrophyllum* population with favorable conditions for foraging and roosting.

Bats of this species may fly up to 50 km in a single night (Weinbeer et al., 2006), although home ranges appear to be of the order of 24 hectares (Meyer et al., 2005), and they roost in a variety of locations, including caves, roofs, and even drains (Williams and Genoways, 2008). Given its ecological and behavioral adaptations, it seems likely that *M. macrophyllum* may occur along the principal perennial rivers of the Caatinga, many of which, like the Vaza-Barris, cross the region's coastal rainforest ecosystems

to discharge into the Atlantic Ocean. While the Vaza-Barris extends for only another 200 km into the Caatinga, the nearby São Francisco River, which forms the northern border of Bahia state, is not only very much larger (2800 km long), but also traverses the Caatinga to reach the central Brazilian Cerrado savannas to the south and west (Fig. 1), thus providing a major potential corridor for the dispersal of the species.

It seems likely that further research will confirm that *M. macrophyllum* is more widespread in the Caatinga, although the species is probably



Fig. 3. Dorsal, ventral and lateral (right side) views of the skull and lateral (right side) of the mandible of *Macrophyllum macrophyllum* (UFPB 6552) collected on the Vaza-Barris River in Paripiranga, Bahia, Brazil; in detail, the frontal view of the skull. Scale bar = 4 mm.

restricted to local corridors of habitat associated with the region's perennial rivers. This distribution pattern may have contributed to the lack of records of this species in previous studies in the Caatinga. Ongoing deforestation in the region may not only be further reducing the habitat available for the species, but also contributing to the conversion of many perennial rivers to more intermittent watercourses, especially during the prolonged dry season (Maltchik, 1999), which would have a negative effect on *M. macrophyllum* populations. While *M. macrophyllum* is not under any risk of extinction (Rodríguez and Piñeda, 2008), deforestation is considered to be a threat to local populations, which may be accentuated in the fragile ecosystem of the semi-arid Caatinga.

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