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Notes on Geographic Distribution

First record of *Molossus molossus* (Pallas, 1766) (Mammalia: Chiroptera) in the state of Rio Grande do Norte, northeastern Brazil

Marília A. S. Barros

Universidade Federal do Rio Grande do Norte, Centro de Biociências, Campus Universitário Lagoa Nova s/no., 59.078-970 Natal, Rio Grande do Norte, Brazil.
Corresponding author. E-mail: *barrosmas@gmail.com*

Abstract: Here I report the first record of the bat *Molossus molossus* in the state of Rio Grande do Norte, northeastern Brazil. A colony of this species was recorded in the urban area of Lagoa Salgada, in the attic of a building. In January 2014, I captured 90 individuals of *M. molossus* using mist nets around the roost. The present record extends the distribution of *M. molossus* to far-northeastern Brazil and adds a new marginal occurrence site for this species.

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The insectivorous bat *Molossus molossus* (Pallas, 1766) (Chiroptera: Molossidae) is broadly distributed in the Neotropics, occurring from Mexico (Sinaloa and Coahuila) to northern Argentina (Simmons 2005). This species is widespread throughout Brazil and has been recorded for all Brazilian states, except Alagoas and Rio Grande do Norte (Peracchi *et al.* 2011; Reis *et al.* 2013). Rio Grande do Norte represents one of the most significant data gaps in our knowledge on the Brazilian bat fauna, since most of its territory has never been sampled for this group (Bernard *et al.* 2011). Here, I report the first record of *M. molossus* in the state of Rio Grande do Norte, northeastern Brazil, and provide information on its reproduction and body measurements.

Molossus molossus is relatively common in natural and urban areas in Brazil (Esbérard *et al.* 2006; Lima 2008; Pacheco *et al.* 2010; Alho *et al.* 2011), as well as in other regions within its geographic range (Simmons and Voss 1998; Barquez *et al.* 1999; Willig *et al.* 2000; Sampedro-Marín *et al.* 2008). These bats form colonies in hollow trees, rock crevices, caves, and man-made constructions, mainly roof linings, tunnels, and bridges (Barquez *et al.* 1999; Fabián and Gregorin 2007). I recorded this species in the state of Rio Grande do Norte when I was studying a bat colony in Lagoa Salgada, a municipality in the eastern region of the state (meso-region of Agreste Potiguar) (IBGE 1992). This city is located within the Caatinga biome, near the boundary with the Atlantic Forest (IBGE 2004). The bat colony is situated in the urban area of Lagoa Salgada, in a public school (Escola Municipal Patrícia Carla Pereira da Costa; 06°07′15″ S, 35°29′07″ W). The school is surrounded by houses with ornamental trees and shrubs, open areas with scattered trees, vegetation fragments, and a lake (Figure 1a). The school´s building is made of masonry (Figure 1b), and it has a clay-shingled roof and a wooden ceiling in part of the building.

The colony was found in the attic of the school by teachers and employees, who noticed feces and odor, and occasionally also observed bats directly in roof lining or tiles. On 30 January 2014, I captured bats using mist nets (permit SISBIO/ICMBio #42136-1) in order to collect information about species/individuals from the colony. Three mist nets (12×3 m, mesh 19 mm, Ecotone®) were set at ground level on both sides and back of the school building (Figures 1c and 1d), positioned close (@ 1 m) to possible roost exits. The nets were opened at 17:00 h and remained open for 2.5 h. For each individual captured, I recorded: age (following Brunet-Rossinni and Wilkinson 2009), sex and reproductive status (following Racey 2009), forearm length (with a digital caliper), and body mass (with a spring scale).

I captured 90 bats, all of them belonging to the species *Molossus molossus* (Figure 2). However, the colony is larger than that, because while there was enough light I observed at least 15 individuals leaving the roost without getting

Figure 1. Day roost of a *Molossus molossus* (Chiroptera: Molossidae) colony in a school building in the urban area of Lagoa Salgada, state of Rio Grande do Norte, northeastern Brazil, with a general view of the surrounding area (a) (Satellite image source: Google Earth®) and frontal (b) and lateral views (c and d) of the roost, where mist nets were set to capture bats.

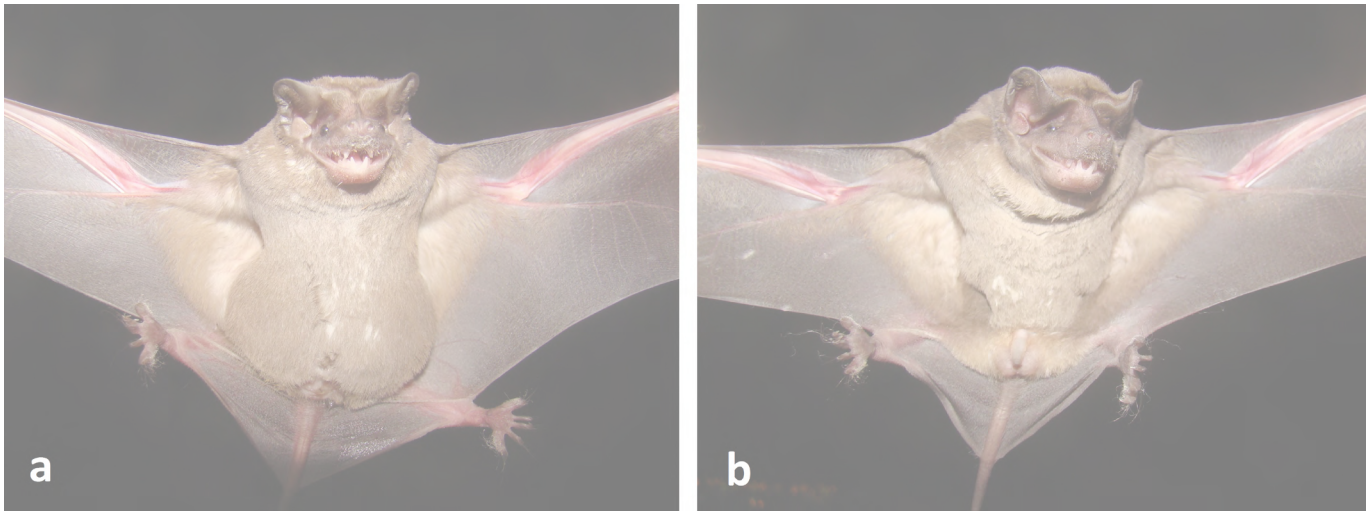

Figure 2. Pregnant female (a) and male with scrotal testes (b) of *Molossus molossus* captured in the urban area of Lagoa Salgada, state of Rio Grande do Norte, northeastern Brazil.

caught on the nets. Among the captured individuals, the sex ratio was close to 1:1 (46 males and 44 females) (Table 1). Approximately 32% of the individuals were juvenile, and among the adults 65% were reproductive. Of all adult females (N = 28), 35% were pregnant and lactating, 18% were pregnant, and 7% were lactating; of all adult males (N = 33), 70% had scrotal testes. The average forearm length of adults was 41.90 mm (standard deviation = 1.03) for males and 41.67 mm (standard deviation = 1.09) for females, and the average body mass was 15.1 g (standard deviation = 1.4) for males and 14.2 g (standard deviation = 1.2) for females.

The individuals were released at the capture site at the same night, except ten specimens (five males and five females) collected as vouchers. These specimens were killed by inhaling sulfuric ether, fixed in formaldehyde (10% solution), preserved in ethanol (70% solution), and deposited in the Mammal Collection of the Universidade Federal de Pernambuco (Numbers UFPE 3068, UFPE 3069, UFPE 3070, UFPE 3071, UFPE 3072, UFPE 3073, UFPE 3074, UFPE 3075, UFPE 3076, and UFPE 3077). The specimens were taxonomically identified according to the keys and descriptions of Gregorin and Taddei (2002), Gregorin *et al.* (2011), and Costa *et al.* (2013). The diagnostic features supporting the identification of these specimens as *M. molossus* include: (1) relatively large forearm length (39.25–43.34 mm) comparing to the others "small" *Molossus*; (2) elongated skull, narrow rostrum, and non-globose brain case; (3) infraorbital foramen opening more frontally than laterally; (4) elongated (non-spatulate) upper incisors with pincer-like tips; and (6) long (≅ 5 mm) dorsal hairs with a white basal band.

The present record extends the distribution of *M. molossus* in northeastern Brazil and provides a new

Table 1. Composition of a colony of *Molossus molossus* roosting in a building, in January 2014, in the urban area of Lagoa Salgada, state of Rio Grande do Norte, northeastern Brazil.

SEX	AGE CLASS	REPRODUCTIVE STATUS	N	FOREARM LENGTH (mm) MEAN ± SD (RANGE)	BODY MASS (g) MEAN ± SD (RANGE)
Females	Juveniles	—	16	41.5 ± 0.9 (40.0–43.4)	11.3 ± 1.4 (8.0–13.0)
	Adults	Inactive	11	42.2 ± 0.8 (41.0–43.3)	13.5 ± 0.5 (13.0–14.0)
		Pregnant and lactating	10	41.1 ± 1.3 (39.0–43.1)	15.0 ± 1.1 (13.0–17.0)
		Pregnant	5	41.6 ± 0.9 (40.3–42.5)	14.8 ± 1.3 (14.0–17.0)
		Lactating	2	41.7 ± 0.0 (41.7–41.8)	13.0 ± 0.0 (13.0–13.0)
		TOTAL (Adult females)	28	41.7 ± 1.1 (39.0–43.3)	14.2 ± 1.2 (13.0–17.0)
Males	Juveniles	—	13	41.5 ± 1.1 (39.8–42.9)	10.8 ± 0.9 (9.5–12.0)
	Adults	Scrotal testes	23	41.9 ± 1.1 (39.3–44.6)	15.5 ± 1.0 (13.5–18.5)
		Non-scrotal testes	10	41.9 ± 1.0 (40.3–43.5)	14.3 ± 1.7 (11.5–16.5)
		TOTAL (Adult males)	33	41.9 ± 1.0 (39.3–44.6)	15.1 ± 1.4 (11.5–18.5)

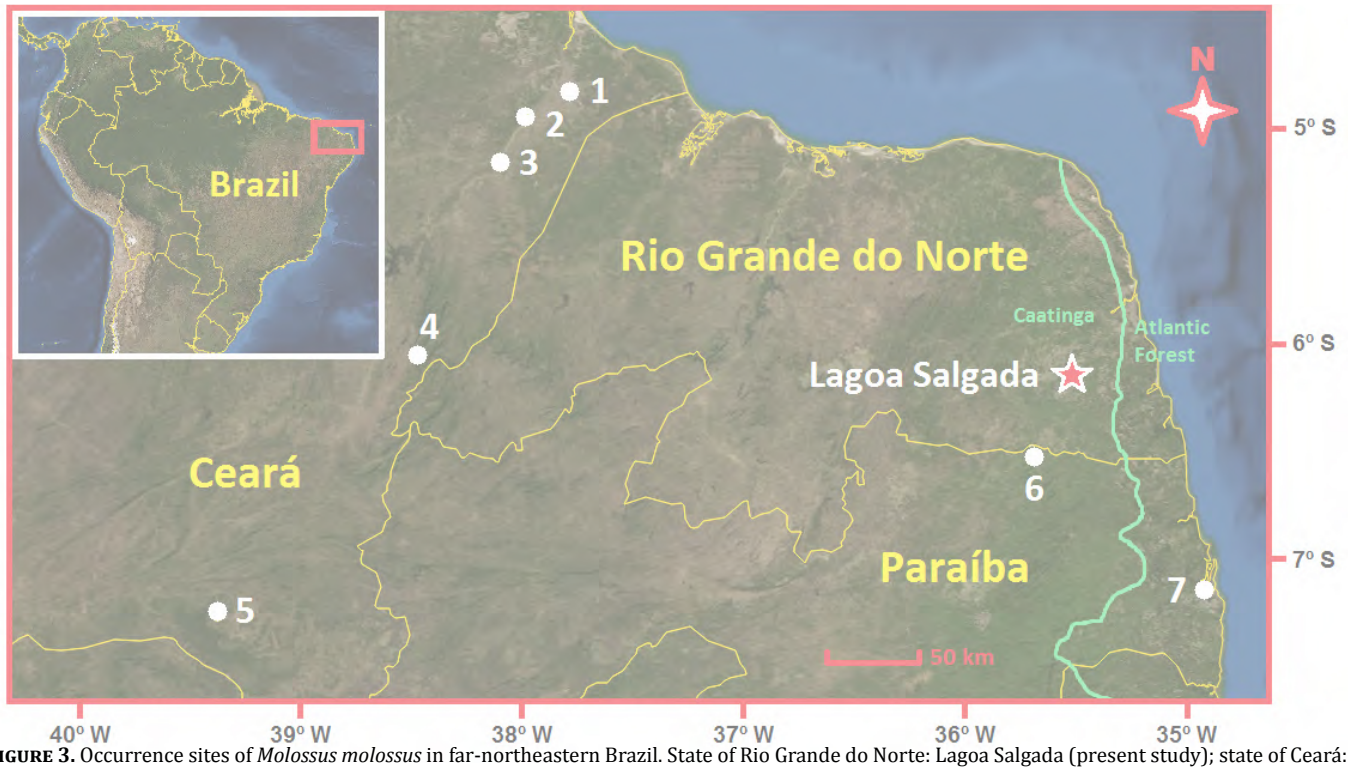

Figure 3. Occurrence sites of *Molossus molossus* in far-northeastern Brazil. State of Rio Grande do Norte: Lagoa Salgada (present study); state of Ceará: (1) Jaguaruana, (2) Russas, (3) Limoeiro do Norte, (4) Pereiro (Fabián 2008), (5) Crato (Mares *et al.* 1981); state of Paraíba: (6) Pedra da Boca State Park (Cruz *et al.* 2005), and (7) João Pessoa (Percequillo *et al.* 2007). (Satellite images source: ArcGIS Online®.)

marginal occurrence site for the species. In the state of Ceará, *M. molossus* has been recorded in several localities (Mares *et al.* 1981; Silva *et al.* 2001; Fabián 2008), including some spots close to the border with the state of Rio Grande do Norte, located between 290-330 km to the west-northwest from Lagoa Salgada; in the state of Paraíba, there is a record of the species on the coast (Percequillo *et al.* 2007) and on the boundary with the state of Rio Grande do Norte (Cruz *et al.* 2005) *ca.* 40 km to the south of the present record (Figure 3). These data indicate that the distribution of *M. molossus* probably includes the entire state of Rio Grande do Norte, which should be confirmed by further studies.

In the tropics, the reproduction of insectivorous bats is associated with rainfall, which influences prey availability (Racey and Entwistle 2000). Birth and lactation usually occur at the beginning and peak of the rainy season, respectively (Racey 1982). In the present study, the large number of pregnant or lactating females and males with scrotal testes suggests that *M. molossus* was at intensive reproductive activity in the end of January. This period corresponds to the end of the dry season, since the rainy season extends from March to June (Mascarenhas *et al.* 2005). These data are in accordance with information obtained in other Caatinga sites, where pregnant females of this species were captured from September to March, lactating females from November to May, and pregnant and lactating females from January to March, with a peak in January (Willig 1985). Apparently, *M. molossus* is a polyestrous species in several localities (Nowak 1994; Alberico *et al.* 2005; Barros *et al.* 2013). In the Caatinga it presents two reproductive seasons a year: one in the beginning of the rainy season (March–April) and the other in the dry season when sporadic rains can occur (November) (Fabián and Marques 1989). In the Agreste Potiguar microregion (where Lagoa Salgada is located), January corresponds to a period of sporadic rains during the dry season. Hence, *M. molossus* probably has a second reproductive peak in the state of Rio Grande do Norte in the rainy season.

Several studies provided information on body measurements of *M. molossus* in different countries (*e.g.*, Tamsitt and Valdivieso 1966; Dolan 1989; Simmons and Voss 1998; Lim and Engstrom 2001; Pedersen *et al.* 2003; Genoways *et al.* 2005) including Brazil (*e.g.*, Willig 1983; Dias *et al.* 2002; Dias and Peracchi 2008). According to these studies, the forearm length of *M. molossus* varies from 36.9 to 41.0 mm. The measurements obtained for *M. molossus* in the state of Rio Grande do Norte are relatively similar to those obtained in other regions of the Brazilian Caatinga, where the average forearm length is 40.95 mm for males and 39.95 mm for females, and the average body mass is 16.67 g for males and 15.15 g for females (Willig 1983). Apparently, *M. molossus* from the Caatinga are slightly larger than those of the Atlantic Forest of southeastern Brazil, where the average forearm length varies from 37.5 to 39.0 mm (Dias *et al.* 2002; Dias and Peracchi 2008). Body size may vary among populations of the same bat species according to biome type and latitude (Nargosen and Tamsitt 1981; Aspetsberger *et al.* 2003), and bat populations from the Caatinga often have larger body values comparing to populations from other Brazilian biomes, like Cerrado (Willig 1983), Pantanal, and Atlantic Forest (Louzada and Pessôa 2013).

Inventories are an important first step in conservation, and several studies with new records of bats for Brazilian states have been published in the past decade (Bernard *et al.* 2011). The bat fauna of Rio Grande do Norte, however, remains poorly known, and the little information available is based on punctual records of some species (Astúa and

Guerra 2008; Feijó and Nunes 2010; Oliveira *et al.* 2003; Peracchi *et al.* 2011). Therefore, I strongly recommend conducting further bat inventories in Rio Grande do Norte, as well as reviewing specimens from this state deposited in natural history collections.

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