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Notes on Geographic Distribution

Occurrence of *Phyllostomus elongatus* (Geoffroy St.-Hilaire, 1810) (Chiroptera, Phyllostomidae) in the Cerrado of Tocantins and a compilation of its Brazilian distribution

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Abstract: The lesser spear-nosed bat, *Phyllostomus elongatus*, is endemic of South America and in Brazil this species is recorded in Amazon, Atlantic Forest, Cerrado, and Pantanal. Here, we present a new record for *P. elongatus* in the savanna of central Brazil, known as the Cerrado. In January 2012, five individuals of *P. elongatus* were captured and recorded in a limestone cave in the Aurora do Tocantins county, Tocantins State. *Phyllostomus elongatus* has already been registered in 32 locations and 14 Brazilian states, and their records appear to be associated with humid habitats and forested areas.

The genus *Phyllostomus* Lacépède, 1799, is represented by four species, all of which occur in Brazil (Williams and Genoways 2008): *Phyllostomus discolor* Wagner, 1843, *Phyllostomus elongatus* (Geoffroy St.-Hilaire, 1810), *Phyllostomus hastatus* (Pallas, 1767), and *Phyllostomus latifolius* (Thomas, 1901). *Phyllostomus elongatus* is endemic of South America and distributed from Venezuela, Bolivia, Peru, Ecuador, Colombia, and the Guyanas to the southeast of Brazil (Baker *et al*. 1988; Williams and Genoways 2008). *P. elongatus* occurs east of the Andes, in lowlands, and its distribution is associated with tropical rainforests (Williams and Genoways 2008). Furthermore, an isolated population of this species is known to the west of the Andes, occurring in Colombia and Ecuador (Williams and Genoways 2008). This species occupies primary and secondary forests, disturbed areas, and karst environments (Fischer *et al*. 1997, Simmons and Voss 1998, Fregonezi *et al*. 2013). *P. elongatus* can form harems of more than 10 individuals or colonies composed of up to 50 non-reproductive males (Fregonezi *et al.* 2013). *P. elongatus* can be considered omnivorous like the other species of the genus, since their diet includes insects, nectar, fruits and small vertebrates (Tuttle 1970, Reis and Peracchi 1987, Fischer *et al.* 1997, Bernard 2002).

In Brazil, *P. elongatus* has been registered in four biomes: the Amazon (Handley 1967; Piccinini 1974; Marques 1985; Bernard *et al*. 2011a), the Atlantic Forest (Vieira 1942; Faria *et al*. 2006; Faria and Baumgarten 2007), the Pantanal (Bordignon and França 2009; Alho *et al*. 2011), and the Cerrado (Sousa *et al*. 2013). The first record assigned to the Brazilian Cerrado, the type-locality for the species (Rio Branco, Mato Grosso), is, in fact, a region that combines a set of different landscapes, characterized by presenting transitional vegetation between the Pantanal and the Cerrado (Eva *et al*. 2002). Records of this species in the Caatinga biome were mentioned by Marinho-Filho and Sazima (1998), however, this data was actually from an Atlantic Forest region in the northeastern Brazil (Vieira 1953, 1955; Souza-Lopes 1978; Souza *et al*. 2004; Nogueira *et al*. 2007). Thus, here we present the first record of *P. elongatus* for the central Cerrado and also for the Tocantins State, Brazil.

We recorded *P. elongatus* during a bat survey in a karstic area of the Aurora do Tocantins municipality, Southeast Tocantins State, Northern Brazil. The site has several karstic limestone complexes, each with dozens of caves. This karstic complex is inserted into a mosaic landscape composed of large remnants of the Neotropical savanna and farms with cattle ranching and maize, cassava, rice, and soybeans plantations. Aurora do Tocantins presents typical vegetation of the Cerrado *sensu strictu*, with enclaves of gallery forest (known as Cerradão, in Portuguese) in areas near the limestone massifs.

We conducted eight nights of bat surveys, with five nights consisting of twelve hour surveys (18:00–06:00 h) and three nights of six hour surveys (18:00–00:00h) using ten mist-nets (Zootech® 9 x 3 m, mesh: 20 mm), totalizing 21,260 m^2.h of sampling effort (Straube and Bianconi 2002). The mist-nets were placed (1) at cave entrances (6,390 m^2.h); (2) from a distance of 15 meters to cave entrances (6,380 m^2.h); (3) in edges, trails, and glades of Cerrado fragments (6,380 m^2.h); and, (4) around artificial ponds (2,110 m^2.h). Captured individuals were marked with a perforation-code in the dactilopatagium (Bonaccorso and Smythe 1972) and they were released afterwards at the same location of their capture sites. Some individuals were collected and deposited in the mammalian collection of the Museu Nacional do Rio de Janeiro (MN78389, MN78390, MN78385), which was authorized by the SISBIO/IBAMA (4028-1/28717). We followed the guidelines of Sikes *et al*. (2011) for handling the animals. Individuals were identified using the taxonomic characters proposed

by Simmons and Voss (1998), Lim and Engstrom (2001), Reis *et al*. (2007, 2013). The compilation of the distribution of *P. elongatus* in Brazil was made through records obtained from the scientific literature (see Reis *et al*. 2007, Williams and Genoways 2008).

Five individuals of *Phyllostomus elongatus* (Figure 1) were captured in areas around the caves Gruta dos Moura and Gruta do Urso (12°34′ 53″ S and 46°30′ 59″ W, ca. 400 m.a.s.l.) during a bat survey in Aurora do Tocantins, Tocantins State, northern Brazil. *P. elongatus* represented 0.96% of a total of 518 captures of 30 species. Four individuals were captured as they were leaving the Gruta dos Moura cave during the first hours after sundown. Another individual of *P. elongatus* was captured in a gallery forest area about one hour before dawn (Table 1).

According to Nogueira *et al*. (2007), *Phyllostomus elongatus* is a medium-sized bat, with a total body length between 99 and 115 millimeters (mm), and forearm between 61 and 71 mm. Additionally, *P. elongatus* has round-edged ears that are longer than its head length, which differentiates the species from its congeners. Furthermore, *P. elongatus*′ s calcaneus is longer than its foot length, which is an important characteristic that distinguishes it from *P. hastatus* and *P. discolor*, with *P. elongatus* having the longest calcaneus. In addition, *P. elongatus* can be distinguished from *P. latifolius* by its forearm length and for having a white spot on the tip of the wings (Koopman 1994, Fregonezi *et al*. 2013).

Figure 1. Adult male *Phyllostomus elongatus* (MN78390) captured in karstic area of Aurora do Tocantins, TO, northern Brazil. Photo: Roberto Leonan Morim Novaes.

Captures were conducted in a gallery forest that has similar physiognomic and abiotic characteristics to rainforests, such as high humidity and a canopy that can reach up to 12m in height (Oliveira-Filho and Ratter 2002).

Phyllostomus elongatus has been recorded in 32 Brazilian localities, distributed in 14 states, including the new record for the State of Tocantins (Table 2, Figure 2). Most of the records occur in the Amazon rainforest and the At-

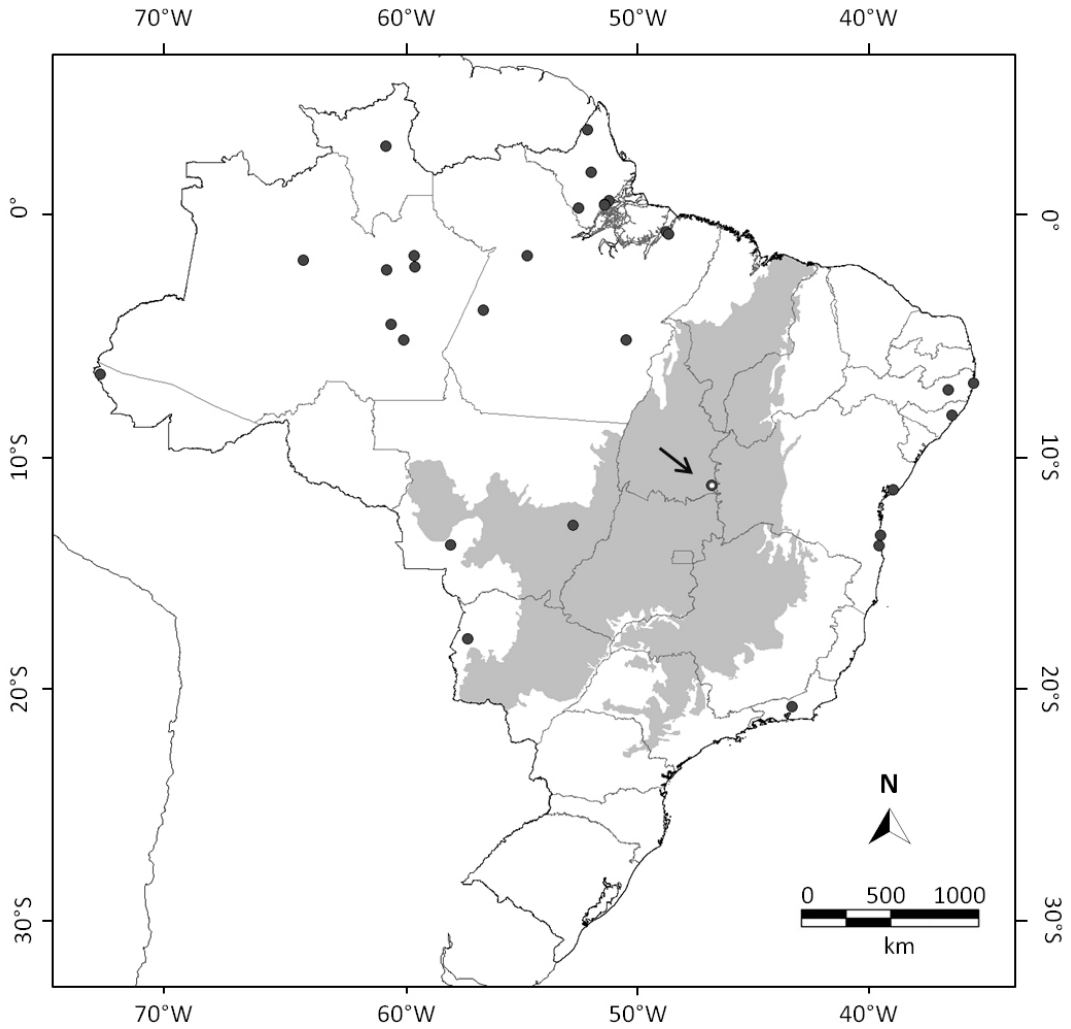

Figure 2. Geographic distribution of *Phyllostomus elongatus* in Brazil, including a new record from the Brazilian Cerrado (gray) of Tocantins State (hollow circle).

lantic Forest. Additionally, there is also a record for the Pantanal on an area of semideciduous forest (Bordignon and França 2009). The previous record of *P. elongatus* for the Cerrado was captured in a gallery forest in the transition between the Cerrado and Amazonia (Sousa *et al*. 2013). The compilation and revision of the geographic distribution of *P. elongatus* suggest that this species is more frequent on forested habitats with higher humidity. Williams and Genoways (2008) made a distribution review of *P. elongatus* noting the possibility of occurrence of this species in the Cerrado of Central Brazil, however the authors did not confirm its occurrence in this region.

Studies on the bat fauna of the Cerrado are very recent; the first ones were made in the early 1990' s (Aguiar and Zortéa 2008). Although knowledge about the diversity of bats in this biome is still limited and the information about the species distribution in the Cerrado is incipient (Bernard *et al*. 2011b), this biome presents a high bat diversity (Marinho-Filho 1996, Zortéa and Alho 2008). In addition, bat surveys are lacking or poorly conducted for many areas of the Brazilian Cerrado, including the state of Tocantins (Bernard *et al*. 2011b, Gregorin *et al*. 2011), which indicates that new species of bats can still be recorded for this biome.

Table 1. Individuals of *Phyllostomus elongatus* captured in Cerrado of Aurora do Tocantins, Tocantins State, Northern Brazil.

DATE	HOUR	INDIVIDUAL	SEX	REPRODUCTIVE STAGE	SKULL LENGTH	FOREARM LENGTH	BODY MASS
14/jan/12	19:30	MN78390	Male	Abdominal testes	27.8	63.9	44.0
17/jan/12	19:00	MN78388	Male	Abdominal testes	28.9	64.5	30.0
13/jan/12	18:00	MN78389	Female	Inactive	29.1	65.4	33.0
15/jan/12	04:10	Released	Female	Post-lactating	-	62.0	40.0
17/jan/12	19:00	Released	Female	Post-lactating	-	68.2	32.0

Table 2. Collecting localities of *Phyllostomus elongatus* in Brazil. Amazonia (Ama), Atlantic Forest (Atl), Cerrado (Cer), and Pantanal (Pan).

LOCALITY	STATE	BIOME	COORDINATES	REFERENCE
PN Montanhas do Tumucumaque	Amapá	Ama	03°12′ N, 52°01′ W	Martins *et al.* (2011)
EB Ilha de Maracá	Roraima	Ama	02°27′ N, 60°59′ W	Robinson (1998)
FLONA do Amapá	Amapá	Ama	01°18′ N, 51°52W	Martins *et al.* (2011)
Macapá	Amapá	Ama	00°02′ N, 51°04′ W	Mok *et al.* (1982)
Mazagão	Amapá	Ama	00°07′ S, 51°16′ W	Piccinini (1974)
Maruanum	Amapá	Ama	00°10′ S, 51°16′ W	Piccinini (1974)
RDS Rio Iratapuru	Amapá	Ama	00°18′ S, 52°26′ W	Martins *et al.* (2011)
Utinga	Pará	Ama	01°20′ S, 48°32′ W	Handley (1967)
Belém	Pará	Ama	01°27′ S, 48°25′ W	Mok and Lacey (1980)
Santarém	Pará	Ama	02°24′ S, 54°42′ W	Bernard (2001)
RDS Amanã	Amazonas	Ama	02°35′ S, 64°40′ W	Pereira *et al.* (2010)
PARNA da Amazônia	Pará	Ama	03°48′ S, 56°40′ W	Marques (1985)
Not provided	Rondônia	Ama	Not provided	Bernard *et al.* (2011a)
80km N of Manaus	Amazonas	Ama	02°24′ S, 59°43′ W	Sampaio *et al.* (2003)
Refúgio do Maruaga	Amazonas	Ama	02°54′ S, 59°41′ W	Fischer *et al.* (1997)
Manaus	Amazonas	Ama	03°01′ S, 60°07′ W	Reis and Guillaumet (1983)
Rio Madeira	Amazonas	Ama	05°27′ S, 60°45′ W	Bobrowiec (2012)
FLONA de Carajás	Pará	Ama	06°08′ S, 50°18′ W	Tavares *et al.* (2012)
Rio Aripuanã	Amazonas	Ama	06°08′ S, 60°11′ W	Bobrowiec (2012)
PARNA Serra do Divisor	Acre	Ama	07°40′ S, 73°40′ W	Nogueira *et al.* (1999)
Recife	Pernambuco	Atl	08°03′ S, 34°52′ W	Souza-Lopes (1978)
Caruaru	Pernambuco	Atl	08°21′ S, 36°01′ W	Souza *et al.* (2004)
Rio Largo	Alagoas	Atl	09°28′ S, 35°51′ W	Vieira (1953)
Aurora do Tocantins	Tocantins	Cer	12°34′ S, 46°30′ W	Present Study
Nova Xavantina	Mato Grosso	Cer	14°38′ S, 52°21′ W	Sousa *et al.* (2013)
Salvador	Bahia	Atl	12°47′ S, 38°27′ W	Vieira (1955)
Ilheus	Bahia	Atl	14°47′ S, 39°01′ W	Faria *et al.* (2006)
Rio Branco	Mato Grosso	Pan	15°14′ S, 58°07′ W	Type-locality
Una	Bahia	Atl	15°16′ S, 39°04′ W	Faria and Baumgarten (2007)
Maciço do Urucum	Mato Grosso do Sul	Pan	19°24′ S, 57°22′ W	Bordignon and França (2009)
Povoação Village	Espírito Santo	Atl	19°33′ S, 39°48′ W	Lage *et al.* (2013)
Teresópolis	Rio de Janeiro	Atl	22°25′ S, 42°57′ W	Vieira (1942)

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