



NEW RECORD OF THE RARE PEALE'S FREE-TAILED BAT, *Nyctinomops aurispinosus* (PEALE, 1848) (CHIROPTERA: MOLOSSIDAE), FOR THE CERRADO OF SOUTHEASTERN BRAZIL

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Abstract: Little is known about the natural history and distribution of the molossid bat *Nyctinomops aurispinosus* (Chiroptera, Molossidae) due to the rarity in which it is collected in fieldwork. In Brazil, this species is known for only nine localities, including the type-locality, 161 km from land on the coast of Cabo São Roque, state of Rio Grande do Norte, Brazil. Here we report a new record of *N. aurispinosus* for the municipality of Uberlândia, the second record of this species for the state of Minas Gerais in southeastern Brazil. We also present an updated distributional map for this molossid species in Brazil.

Keywords: free-tailed bats; range extension; urban bats.

Nyctinomops Miller, 1902 (Chiroptera) is a genus of molossid bat widespread in the Americas, ranging from the southwestern United States to northern Argentina and Uruguay (Simmons 2005). The genus was described by Miller (1902), but later, the name *Nyctinomops* was synonymized under *Tadarida* (Miller 1907, Shamel 1931). Freeman (1981) recognized *Nyctinomops* as a valid genus based on a morphometric study of Molossidae and the validity of the genus has also been recognized in recent studies based on molecular and morphological data (e.g., Ammerman *et al.* 2012, Dolman & Ammerman 2015, Gregorin & Cirranello 2016). Species of *Nyctinomops* can be distinguished from other Neotropical molossids by their large ears medially joined; antitragus longer than wide; a

small, rectangular tragus; wrinkled lips; the second phalanx of digit IV shorter than the first; narrow anterior palatal emargination; presence of two pairs of lower incisors; plagiocrest and protoloph paralleling each other in the first two upper molars; and the third commissure of M3 well-developed and as long as the second commissure (Freeman 1981, Gregorin & Taddei 2002, Eger 2008, Bianconi *et al.* 2009).

The genus currently comprises four species, *Nyctinomops femorosaccus* (Merriam 1889), which is restricted to the South of the United States of America and North of Mexico, and other three species that occur in the Neotropical region: *Nyctinomops laticaudatus* (E. Geoffroy 1805), *Nyctinomops macrotis* (Gray 1840), and

Nyctinomops aurispinosus (Paele 1848) (Eger 2008). The species within the genus shows great morphological similarity in external appearance, being distinguished from each other based mainly on size and cranial features (Knox-Jones & Arroyo-Cabrales 1990, Kumirai & Knox-Jones 1990, Dolman & Ammerman 2015). *Nyctinomops aurispinosus*, also known as Peale's Free-tailed Bat, has been found in northwestern Mexico, Honduras and South America, with records in the West of Venezuela, Colombia, Peru, Bolivia, and East of Brazil (Eger 2008, Espinal *et al.* 2016). This species was recorded for altitudes ranging from 0 to 3,150m, but mainly below 1,000m (Sampaio *et al.* 2008). The distribution of *N. aurispinosus* shows a disjunct pattern, however, it may reflect the difficulties in sampling the species (Sampaio *et al.* 2008). Like other species of aerial insectivores, free-tailed bats from the family Molossidae can fly high above the ground or canopy and also detect and avoid mist nets using their echolocation system (Kalko & Handley 2001).

The type-locality of *N. aurispinosus* is 161 km off Cape São Roque, municipality of Maxaranguape, state of Rio Grande do Norte, Brazil, or more precisely "on board the U.S.S. Peacock off the coast of Brazil, about 100 miles from land, south of Cape St. Roque" (Shamel 1931). However, even after 170 years of its original description and its widespread distribution, this species is known only by a handful of specimens from few reported localities in the Brazilian territory (Figure 1). In Brazil, there are records for this species in five states, plus the Federal District, covering three biomes: Caatinga, Cerrado and Mata Atlântica (Taddei & Garutti 1981, Silva *et al.* 1996, Pedro *et al.* 2001, Bredt 2003, Eger 2008, Bianconi *et al.* 2009, Tavares *et al.* 2010, Garbino 2016).

Here we report a new record of *N. aurispinosus* for Brazil, in the state of Minas Gerais, southeastern Brazil. An adult male (Figure 2) was collected inside an apartment in the urban area of the municipality of Uberlândia (18°55'33" S, 48°16'58" W, datum SAD69), in the western portion of the state, by the Center for Zoonosis Control, on 28 October, 2015. The specimen was sent to the Instituto de Ciências Biológicas of Universidade Federal de Minas Gerais where it had sample tissues collected, was fixed in formaldehyde 10%, had its skull removed and is preserved as a wet

skin in alcohol 70% at the Mammals Collection at the Centro de Coleções Taxonômicas of the Universidade Federal de Minas Gerais (CCT-UFMG) under the catalog number UFMG 6940. The specimen was diagnosed as rabies-negative, and there are no records of rabies for *N. aurispinosus* in Brazil (Sodré *et al.* 2010).

To help properly identify the specimen UFMG 6940, we compared external and cranial characteristics to those described for the species and we also compared it to specimens of *N. laticaudatus* and *N. macrotis* housed at the CCT-UFMG, Coleção Zoológica de Referência of the Universidade Federal de Mato Grosso do Sul (CHI-ZUFMS) and Laboratório de Estudo de Quirópteros of the Universidade Federal do Espírito Santo (LABEQ-UFES). Furthermore, we compared the morphometric measures of the specimen UFMG 6940 with measures of other specimens of *N. aurispinosus* from the literature and specimens of *N. laticaudatus* and *N. macrotis* (Table 1). Twelve external and craniodental linear dimensions were taken using a digital caliper: head-body length (HBL), tail length (TA), forearm length (FA), length of metacarpal III (LM3), length of metacarpal IV (LM4), length of metacarpal V (LM5), ear length (EL), breadth across upper molars (BAM), breadth across upper canines (BAC), maxillary tooththrow length (MTL), mandibular length (ML) and mandibular tooththrow length (MATL).

The specimen UFMG 6940 was identified as *N. aurispinosus* by morphological and morphometric features. As it is described for *N. aurispinosus*, UFMG 6940 is a medium size *Nyctinomops* when compared to the other species, with a forearm length (FA) of 51.67 mm. This specimen is smaller than *N. macrotis* (FA longer than 55 mm) and larger than *N. laticaudatus* (FA 40-46 mm) and *N. femorosaccus* (FA 45-49 mm). The specimen also possesses shallow basisphenoid pits when compared to the deep basisphenoid pits found in *N. macrotis* and *N. femorosaccus*, which *N. aurispinosus* resembles the most in external appearance. Although *N. aurispinosus* also shares the shallow basisphenoid pits with *N. laticaudatus*, they can be distinguished based on external and cranial characters. *Nyctinomops aurispinosus* is larger than *N. laticaudatus* and has a larger and more robust skull, with a longer maxillary tooththrow (MTL) (larger than 7.9 mm in *N. aurispinosus*,

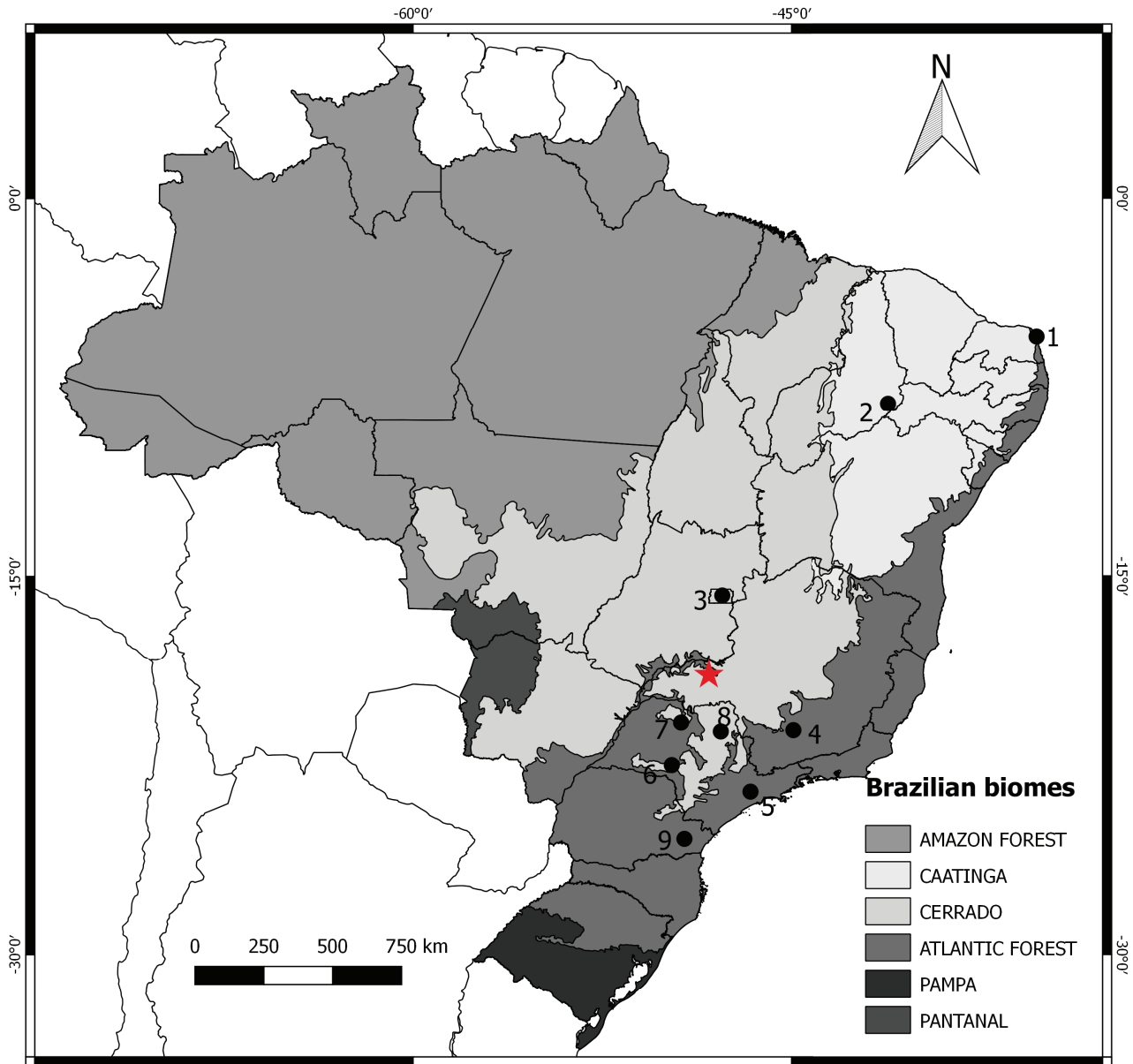


Figure 1. Distribution of *Nyctinomops aurispinosus* (Chiroptera, Molossidae) in Brazil. Star: new record in the municipality of Uberlândia, state of Minas Gerais. Dots: previous records. 1) Cabo São Roque, state of Rio Grande do Norte (Shamel 1931; type locality); 2) municipality of Paulistana, state of Piauí (Eger 2008); 3) Distrito Federal, Brasília (Bredt 2003); 4) municipality of Lavras, state of Minas Gerais (Tavares *et al.* 2010); 5) municipality of São Paulo, state of São Paulo (Silva *et al.* 1996); 6) Estação Ecológica dos Caetetus, state of São Paulo (Pedro *et al.* 2001); 7) municipality of São José do Rio Preto, state of São Paulo (Taddei & Garutti 1981); 8) municipality of Ribeirão Preto, state of São Paulo (Garbino 2016); 9) municipality of Curitiba, state of Paraná (Bianconi *et al.* 2009).

smaller than 7 mm in *N. laticaudatus*, 7.94 in UFMG 6940) and a longer forearm (as mentioned above). The length of the maxillary toothrow also distinguishes *N. aurispinosus* from the other species (MTL smaller than 7.5 mm in *N. femorosaccus* and longer than 8.5 mm in *N. macrotis*) (Knox-Jones & Arroyo-Cabrales 1990, Kumirai & Knox-Jones 1990, Eger 2008). Dorsal pelage of UFMG 6940 is

reddish-brown with tricolored hairs (whitish bases, pale buff middle bands, and brown tips) and the ventral pelage is slightly lighter than the dorsum. The morphometric dimensions of this specimen are similar to those observed for other Brazilian specimens of *N. aurispinosus* (Table 1). UFMG 6940 had its skull damaged due to brain tissue collection for rabies testing. However the basicranium portion

is still intact; allowing us to analyze the depth of the basisphenoid pits.

This is the second record of *N. aurispinosus* for Minas Gerais and it expands its current range in the state by approximately 430 km northwestward from the previous record for the state, in the municipality of Lavras (Tavares *et al.* 2010). Other close records of this species are in the Distrito Federal, Brasília (338 km northward) (Bredt 2003) and in the municipality of São José do Rio Preto, state of São Paulo (240 km southward) (Taddei & Garutti 1981). This is the third record of this species in the Cerrado, and the first to this habitat in the state. In the Brazillian territory,

N. aurispinosus is now known from ten localities, from which six of them are in Atlantic Forest and only one in the Caatinga habitat (Figure 1).

In the new locality reported here, *N. aurispinosus* can be found in sympatry with *N. laticaudatus* and *N. macrotis*, which are also known to occur in the municipality of Uberlândia, state of Minas Gerais (Stutz *et al.* 2004). We also examined specimens of *N. macrotis* and *N. laticaudatus* from the municipality of Uberlândia at the CCT-UFMG, reinforcing the sympatry of these species. *Nyctinomops aurispinosus* also shares the majority of its geographic distribution with these other two

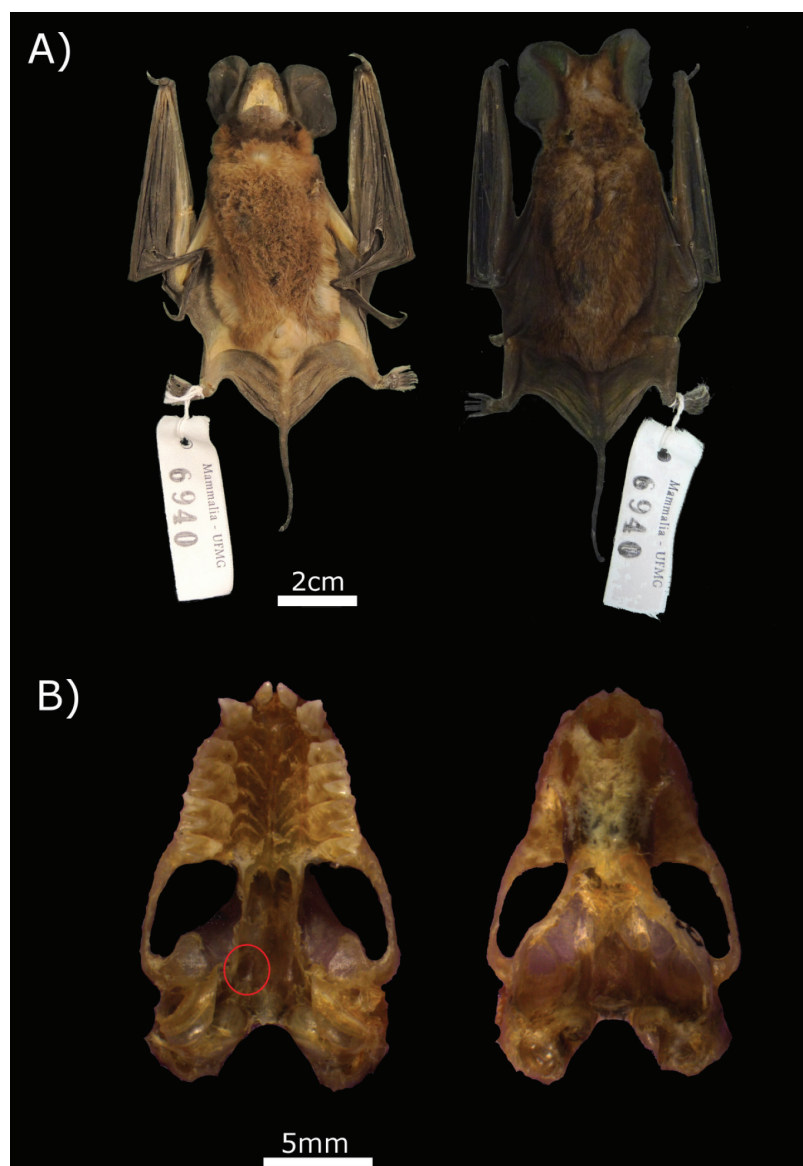


Figure 2. *Nyctinomops aurispinosus* (Chiroptera, Molossidae) (UFMG 6940) collected in the municipality of Uberlândia, state of Minas Gerais, Brazil. A) Skin in ventral (left) and dorsal view (right). B) Skull in ventral (left) and dorsal view (right). Note the shallow basisphenoid pits in the red circle.

Table 1. Comparison of morphometric measurements (mean, minimum and maximum), in millimeters, of *Nyctinomops aurispinosus* (Chiroptera, Molossidae) specimens from different localities in South America, and *N. macrotis* and *N. laticaudatus* from several localities in Brazil. Legend: HBL = head-body length, TA = tail length, FA = forearm length, LM3 = length of metacarpal III, ML3 = length of metacarpal IV, LM5 = length of metacarpal V, EL = ear length, BAM = breadth across upper molars, BAC = breadth across upper canines, MTL = maxillary toothrow length, ML = mandibular toothrow length, and MATL mandibular toothrow length.

Reference	<i>N. aurispinosus</i>					<i>N. macrotis</i>	<i>N. laticaudatus</i>		
	This study (UFMG 6940)	Bianconi et al. 2009	Taddei & Garutti 1981	Eger 2008	Shamel 1931	Carter & Davis 1961	Ibáñez & Ochoa 1989	This study	This study
Locality	Municipality of Uberlândia, state of Minas Gerais	Municipality of Curitiba, state of Paraná	Municipality of São José do Rio Preto, state of São Paulo	Municipality of Paulistana, state of Piauí	Coast of Cape St. Roque, state of Rio Grande do Norte	Colômbia Peru	Bolívia Bolívia	Several localities, Brazil	Several localities, Brazil
Sex	1 male	1 male	1 male	4 females	1 male (holotype)	1 male 1 female	4 females 4 males	Males and females	Males and females
HBL	73.97	71.2	73.0	70.6 (69.7-71.6)				75.43 (72.6 – 80.29) N = 10	57.74 (52.56 – 64.53) N = 59
TA	44.78	45.3	-	44.1 (40.7-46.6)				56.3 (54.19 – 59.71) N = 10	39.7 (30.9 – 47.12) N = 61
FA	51.67	53.4	51.5	51.2 (50.4-51.9)	50.0	49.5 51.5	49.7 51.0 (48.7-50.3) (50.3-52.8)	61.41 (59.89 - 62.81) N = 9	44.39 (41.52 – 48.13) N = 61
LM3	49.42	51.6	51.0	47.3 (46.0-48.1)	51.2	48.4		58.38 (56.89 60.8) N = 10	42.33 (39.0 – 46.83) N = 61

Table 1. Continued on next page...

Table 1. ...Continued

Reference	<i>N. aurispinosus</i>					<i>N. macrotis</i>		<i>N. laticaudatus</i>	
	This study (UFMG 6940)	Bianconi <i>et al.</i> 2009	Taddei & Garutti 1981	Eger 2008	Shamel 1931	Carter & Davis 1961	Ibáñez & Ochoa 1989	This study	This study
LM4	47.80	50.7	50.6	45.2 (43.6-46.2)		46.8		56.07 (54.13 – 58.17) N = 10	40.88 (30.06 – 45.24) N = 61
LM5	27.38	28.9	31.0	25.3 (25.1- 25.6)	29.5	26.9		27.63 (25.26 – 29.44) N = 10	24.04 (20.92 – 25.9) N = 61
EL	23.67	22.5	-	21.1 (20.2-21.5)		29.0		26.55 (23.28 – 29.22) N = 10	18.56 (16.23 – 22.03) N = 60
BAM	8.73	8.3	8.2	8.1 (7.9-8.3)		8.5	8.4 (8.3-8.6)	8.4 (8.6-8.7) N = 2	7.14 (6.66 – 7.61) N = 16
BAC	4.91	4.7	4.7	4.2 (4.2-4.4)		4.7		(4.86 – 5.11) N = 2	3.82 (3.49 – 4.11) N = 16
MTL	7.94	8.1	8.1	7.4 (7.3-7.6)		7.8	7.9 (7.8-8.0)	8.99 (8.83 – 9.19) N = 3	6.73 (6.32 – 7.09) N = 19
ML	14.12	15.5	15.0					16.06 (15.89 – 16.25) N = 3	11.82 (10.92 – 12.41) N = 18
MATL	8.65	8.6	8.7	7.7 (7.5-7.9)		8.5	8.9 (9.37 – 9.65)	9.54 (9.37 – 9.65) N = 3	7.11 (6.6 – 7.78) N = 18

species, leading them to be potentially captured together and misidentified due to their great morphological similarity (Dolman & Ammerman 2015).

Aguiar *et al.* (2012) captured a specimen of *N. aurispinosus* roosting along with individuals of *N. laticaudatus* during a colony removal from a factory in the suburbs of the municipality of Uberlândia, but it is not clear if specimens of both species were collected and where they are deposited. We choose to treat this record as doubtful because records without voucher specimens and additional information such as photographs or measures do not ensure reliability to the given identifications, especially when it comes to morphologically similar species as those from the genus *Nyctinomops* and other molossids with complex taxonomic history.

This is not the first record of *N. aurispinosus* in urban areas (*e.g.*, Taddei & Garutti 1981, Silva *et al.* 1996, Brecht 2003, Bianconi *et al.* 2009), which indicates that this elusive species may be a city dweller as well as its congeners. Although *N. aurispinosus* is found in dry and tropical forests, presumably roosting in crevices within caves (Sanborn 1951, Sampaio *et al.* 2008), the urban environment is favorable to the establishment of insectivorous bats since it provides food resources and a great variety and availability of daytime roosting sites that replaces their natural shelters (Ávila-Flores & Fenton 2005, Pacheco & Sodr e 2010, Nunes *et al.* 2017), therefore the presence of *N. aurispinosus* in these landscapes is expected. Although *N. aurispinosus* is poorly recorded, and has a sparse distribution, the conservation status of this species has been categorized as Least Concern both in Brazil and globally; however, despite being a not threatened species, *N. aurispinosus* is still poorly known (Sampaio *et al.* 2008). Thus, we highlight the importance of basic research such as biodiversity inventories, especially those that utilize other sampling methods such canopy mist netting and echolocation call monitoring, in an attempt to better clarify the geographic distribution of this species. We also strongly recommend that specimens of *Nyctinomops* in other taxonomic collections should be revised to correct potentially erroneous identifications, and also to define the species geographic distributional patterns for a better understanding of their conservation status and evolutionary and biogeographic history.

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