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Distribution extensions

In the concrete jungle: the animalivorous bat *Tonatia bidens* (Phyllostomidae) recorded in the metropolis of São Paulo, Brazil

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Resumen

La mayoría de las especies de murciélagos sinantrópicos en Brasil son insectívoros y frugívoros. El murciélago grande de orejas redondas, *Tonatia bidens*, es un animalívoro que se alimenta de insectos y pequeños vertebrados; además, percha en las cavidades de los árboles y en las grietas de las rocas. Esta especie ha sido capturada en áreas boscosas del norte de Argentina, así como este de Brasil y Paraguay. A pesar de sus hábitos relativamente generalistas y aunque *T. bidens* ha sido registrada en grandes remanentes de bosque dentro de las ciudades, reportamos aquí por primera vez un individuo encontrado dentro del garaje de una casa en un área urbana de la ciudad de São Paulo. Sugerimos que la falta de sitios de descanso adecuados, más que la falta de alimentos, es el factor limitante para la presencia de esta especie en áreas urbanas. Sin embargo, esta suposición necesita ser investigada más sólidamente.

Palabras clave: Área urbana, distribución, Murciélago de orejas redondas, Phyllostominae.

Abstract

Most of the synanthropic bat species in Brazil are insectivores and frugivores. The greater round-eared bat, *Tonatia bidens*, is an animalivore, feeding on insects and small vertebrates, and roosts in tree cavities and rock crevices. It has been captured in forested areas of northern Argentina, as well as eastern Brazil and Paraguay. Despite their relative generalist habits and although *T. bidens* has been recorded in large forest remnants inside cities, we report here for the first time an individual found inside the garage of a house in an urban area of São Paulo city. We suggest that the lack of suitable roosting sites, rather than prey, is the limiting factor for the presence of this species in urban areas. However, this assumption needs to be investigated more robustly.

Key words: Greater round-eared bat, occurrence, Phyllostominae, urban area.

Urban environments pose challenges to wildlife, and such habitats usually select species with some behavioral and dietary plasticity (Jokimäki et al. 2011; Lowry et al. 2013). Bats are ubiquitous in urban landscapes, where a few species may benefit from urbanization, while

still being affected by factors such as increased predation risk, increased competition, and conflicts with humans (Russo & Ancillotto 2014). In Brazil, most of the synanthropic bat species are insectivores or frugivores, which fared relatively well due to more abundant food and shelter (Nunes et al. 2017; Sazima & Sazima 2022).

The greater round-eared bat, *Tonatia bidens* (Spix, 1823), is a medium-sized leaf-nosed bat that occurs in northern Argentina, Paraguay, and Brazil (Solari et al. 2019). *Tonatia bidens* feeds regularly on insects and small vertebrates such as birds and smaller bats, and occasionally on fruits (Martuscelli 1995; Barquez et al. 1999; Esbérard & Bergallo 2004; Smith 2012; Felix et al. 2013; Carvalho et al. 2020). The species roosts in small groups in caves, hollow trees, abandoned buildings, and culverts, but it has never been registered in an urban area (Solari et al. 2019). We report here the occurrence of *Tonatia bidens* in São Paulo city, the largest metropolis in South America.

The metropolitan area of Sao Paulo city has a population of approximately 11 million over an area of 1.523 km^2 (IBGE 2013). Despite the intense urbanization process in São Paulo, there are still a few forest remnants inside protected areas (Mello-Théry 2011). The Divisão de Vigilância de Zoonoses (DVZ - SP) is the department in São Paulo city responsible for capturing bats that are found under atypical conditions, such as flying during the day and paralyzed. Usually, these bats are collected by the DVZ – SP as part of the São Paulo city rabies surveillance program. The collecting protocol is based on the American Veterinary Medical Association (AVMA) guidelines for the euthanasia of animals (AVMA 2020).

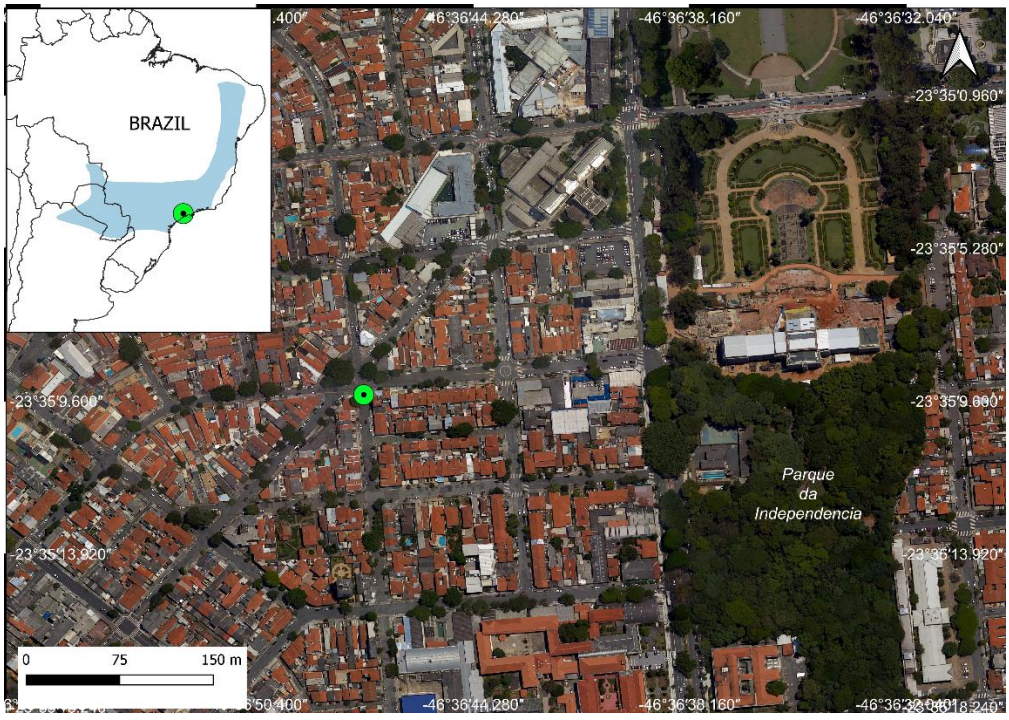

FIGURE 1. Locality where *Tonatia bidens* was recorded (green circle), in the Ipiranga neighborhood of São Paulo city, Brazil. Shaded area in the insert map is the species range map following Marsh et al. (2022).

On July 13, 2020, officers of the DVZ – SP answered a claim about a bat inside a garage of a two-floor residence in the Ipiranga neighborhood, the southeast region of Sao Paulo city (23°35'09"S, 46°36'47"W). The house lies approximately 800 m to the west of Parque da Independência (Figure 1), an urban park with a total area of 16 hectares of which

approximately 12 hectares are forested areas. The record was made during an anomalous winter in São Paulo, with unusually high temperatures and low rainfall. On the capture day, the minimum temperature was 14°C and the maximum was 26°C. Total rainfall in the month was 11.6 mm.

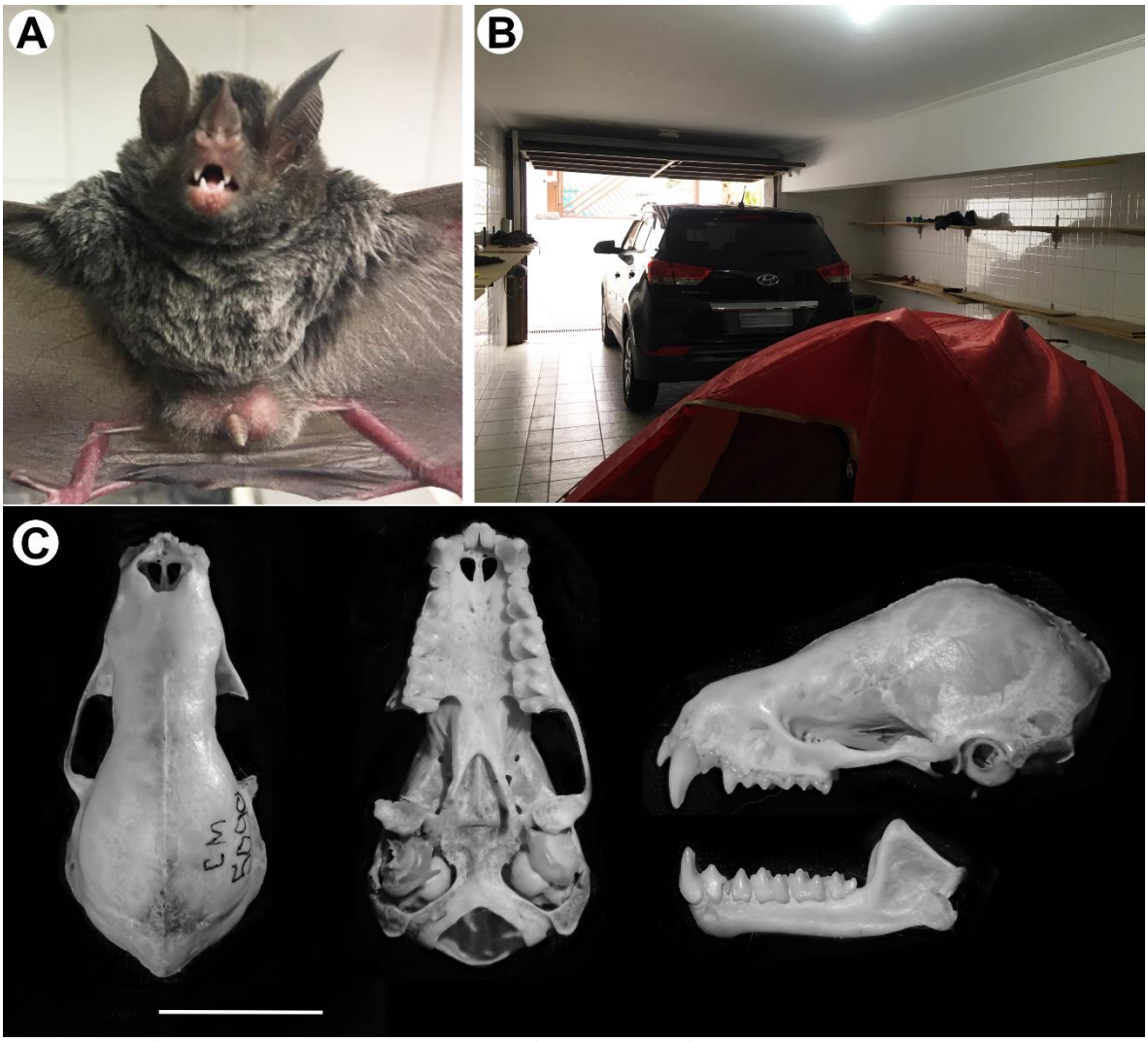

FIGURE 2. A) Adult male *Tonatia bidens* (MZUFV 5090) found inside a garage in Ipiranga neighborhood, São Paulo, Brazil. B) Garage where *T. bidens* was found. C) Skull of the *T. bidens* individual in dorsal, ventral and lateral views, and mandible in lateral view. Scale bar = 10 mm.

The specimen, an adult male with scrotal testes, is preserved in fluid with the skull separated, in the Museu de Zoologia João Moojen (MZUFV), Viçosa, under the collection number MZUFV 5090. Diagnostic characters of the genus include ears with a fringe of hair along their inner edges and a single pair of lower incisors (Figure 2). The species was determined as *T. bidens* by the absence of a longitudinal stripe on the crown and postorbital constriction larger than 5,5 mm (Williams & Genoways 2008; Basantes et al. 2020).

The *T. bidens* specimen was negative for rabies infection. It weighed 23 g and had a forearm length of 54,8 mm. Skull dimensions include (all in mm): greatest length of skull 26,9, condylobasal length 25,6, condylocanine length 24,6, postorbital breadth 5,9, braincase

breadth 10, mastoid breadth 12,4, maxillary toothrow length 9,5, breadth across molars 8,2, and length of mandible 16,5. All measurements were taken with a digital caliper (0,1 mm precision), following Basantes et al. (2020).

Our record of *T. bidens* in an urban area is noteworthy because previous records are from primary and secondary forests, forest edges, banana plantations, and areas of open vegetation (Sekiama et al. 2001; Esbérard 2003; Esbérard & Bergallo 2004; Garbino 2016; Muylaert et al. 2017). Although *T. bidens* has some day roost flexibility, being able to use caves, tree cavities, and man-made shelters (Pinto-da-Rocha 1995; Esbérard & Bergallo 2004; Biavatti et al. 2015), the species had not been reported inside occupied buildings. On Marambaia island, Rio de Janeiro state, for example, the species was found perched on a house lining but not inside the house (Esbérard & Bergallo 2004). In Parque Nacional Defensores del Chaco, Madrejón, Paraguay, *T. bidens* was observed using an abandoned building as a roost (Smith 2009). The dispersal ability of *T. bidens* is not known, but the species appears to have some roost fidelity (Martuscelli 1995; Esbérard & Bergallo 2004; Felix et al. 2013).

Considering the gleaning foraging strategy of *T. bidens*, the animal could find suitable prey in São Paulo city. The most frequent items consumed by *T. bidens* are arthropods and small birds (Felix et al. 2013; Esbérard & Bergallo 2004; Carvalho et al. 2020). Among the passerine birds recorded as prey of *T. bidens*, the bananaquit, *Coereba flaveola*, is widespread in São Paulo city (Martuscelli 1995; Felix et al. 2013; Carvalho et al. 2020). Small vespertilionid bats have also been recorded occasionally in the diet of *T. bidens* (Esbérard & Bergallo 2004). These observations suggest that, in urban areas, adequate day roosts are more limiting than food availability for the species, however, this alone would not explain the rarity of *T. bidens* in these places.

The Parque da Independência, close to the locality reported here, harbors approximately 160 species of trees such as *Aspidosperma polyneuron, Centrolobium tomentosum*, *Ceiba speciosa, Ficus elastica*, *Pseudobombax grandiflorum*, and *Hymenaea courbari* (Almeida et al. 2010). Some of these trees have hollows, which can be used as a shelter for bats, including *T. bidens*. A total of 73 species of birds and four mammals have been recorded in Parque da Independência, including opossums (*Didelphis aurita*) and introduced three-toed sloths (*Bradypus variegatus*) and marmosets (*Callithrix* spp.), but a bat inventory has not been carried out (SÃO PAULO 2021). Moreover, *T. bidens* was not recorded in the largest forest remnant in São Paulo city, the Cantareira State Park, with 7.900 hectares (SÃO PAULO 2009). We consider it likely that the individual came from nearby forested areas in the southern part of São Paulo city, where the forest connects with the large remnant of the Serra do Mar.

Our report shows that the urban bat fauna in Brazil is still insufficiently known, despite recent efforts to document it (e.g., Almeida et al. 2015; Nunes et al. 2017). Even in large cities close to research centers, new records are being made (e.g., Sodré & Uieda 2006; Sodré et al. 2008; this study). We also highlight that behavioral plasticity in bats is understudied, as our new record suggests that *T. bidens* can tolerate more disturbances than previously assumed.

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