

Records of the Phyllostomine bats *Tonatia bidens* (Spix, 1823) and *Lophostoma silvicolium* d'Orbigny, 1836 (Chiroptera, Phyllostomidae) associated with human dwellings in Paraguay

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Abstract

Noteworthy records of two species of Phyllostomine bats using human dwellings in Paraguay are presented. The use of unoccupied buildings by *Tonatia bidens* provides the first Paraguayan roosting data for this species. Roosts of this species are persistent and contained 1 to 5 individuals. An unusual record of use of a building by the harem-breeding *Lophostoma silvicolium* is also reported. The species roosts in arboreal termitaria and its temporary use of buildings is attributed to transient, non-harem individuals in areas where natural refuges are in short supply.

Keywords: roosts, Chaco, Cerrado, bachelor group

Introduction

Twenty-one species of Phyllostomidae (American Leaf-nosed Bats) occur in Paraguay, separated into five subfamilies (FAUNA Paraguay 2012). The Phyllostominae are represented by seven species in five genera, each possessing a well-defined nose leaf, a W-shaped molar cusp pattern and a well-developed interfemoral membrane (Gardner 2007). Very little is known of the biology of the Phyllostominae in Paraguay and most species are rarely recorded in the country. In this paper we provide information on noteworthy records of two little-known Phyllostomine bats, *Tonatia bidens* and *Lophostoma silvicolium*, using human dwellings.

T. bidens is a fairly small Phyllostomine bat locally distributed from northeast Brazil east of the Amazon south to eastern Bolivia, Paraguay and northern Argentina (Barquez et al. 1993, dos Reis et al. 2007, Paca et al. 2012). Though the species is a habitat generalist, almost everything that is known about its biology was documented by Martuscelli (1995) and Esbérard & Bergallo (2004) in Brazil and it apparently occurs at low density throughout its range. Myers et al. (1983) captured specimens in Paraguay over an isolated pond in thorn (Chaco) scrub (departamento Boquerón) and over a stream flowing through high tropical (Atlantic) forest (departamento Itapúa), but records from Paraguay are few (López-González 2005).

L. silvicolium is a widespread Phyllostomine occurring as four subspecies from Honduras to Paraguay. It is absent from much of northern Venezuela and the Andes, but occurs on the western Andean slope as far south as northwestern Peru and the eastern slope south to Bolivia. The nominate subspecies *L. s. silvicolium* occurs in Paraguay (Gardner 2007). López-González (2005) mentions just 8 specimens from Paraguay all from the northern Oriental region.

The roosting and breeding behaviour of *L. silvicolium* has been fairly well studied, with males forming harems and excavating a nest within arboreal termitaria (Handley 1976, Kalko et al. 1999, Aguirre et al. 2003). Though Tuttle (1970) mentions that a local man claimed to have captured specimens roosting inside a hollow tree in Peru, this information was not verifiable by the author and would seem to be atypical. Esbérard & Bergallo (2004) provided data on roost site selection for specimens of *Tonatia bidens* from Rio de Janeiro, Brazil, but the majority of older published references to the species in fact refer to what is now known as *Tonatia saurophila* Koopman & Williams, 1951 (Williams et al. 1995). *L. silvicolium* has not previously been documented as using human dwellings.

Results

T. bidens - Three male specimens of this species (TK 114879, 114880, 114886) were captured roosting inside an abandoned building at Estancia San Luis de la Sierra, departamento

Concepción (S 22°23'53" W 57°28'57") on 15-16 November 1999 (R.Owen unpubl. data). These specimens are currently in the registered collection of Dr Robert Owen in Asunción, but will eventually be deposited in the Museo Nacional de Historia Natural del Paraguay, San Lorenzo, Paraguay (MNHNP). All specimens were collected as skull and post-cranial skeletons, and specimens TK 114880 and TK 114886 were also prepared as skins. The external and cranial measurements for these specimens are provided in Table 1.

On 15 April 2011 a single individual of this species was found roosting by day in a wardrobe in an unused, but not abandoned building at the Parque Nacional Defensores del Chaco headquarters at Madrejón, departamento Alto Paraguay (S 20°37'49" W 59°52'51"). The unsexed specimen had only one pair of lower incisors (a characteristic shared in Paraguay only with Phyllostomid bats of the genera *Chrotopterus* and *Lophostoma*) and was identified as *T. bidens* on the basis of morphological characteristics (size, furred muzzle, rounded tragus, well-separated ears etc.). The record extends the known distributional range of *T. bidens* in Paraguay very slightly to the north and is the first report of the species from departamento Alto Paraguay. A voucher specimen could not be collected due to permit restrictions, but images of the specimen are available in Smith (2009) (image codes FPMAM949-952PH). Head park guard Silvino González (pers. comm.) commented that the bats had been there for some time but that the number of bats present varied.

On a second visit a few months later on 16 July 2011, five bats of the same species were found to be present in the same room, though this time roosting in a dark corner of an attached bathroom. Photographs were taken of the group which, once disturbed by the torchlight and camera flashes then departed through an open skylight in the roof. An image of four members of the group is also available in Smith (2009) (image code FPMAM996H). A group of bats of this species was also observed to be present in the same spot the following year on 5 and 6 July 2012. These observations suggest some degree of fidelity in the use of the roost site by this species and it is of note that even within the unlit room the bats sought out the darkest areas available for roosting.

L. silvicolum - A female specimen CZPLT 212 (Colección Zoológica de Para La Tierra, Laguna Blanca, San Pedro, Paraguay) was collected inside the occupied accommodation building by fieldworkers at Para La Tierra Biological Station, Reserva Natural Laguna Blanca, departamento San Pedro (S 23°48'43" W 56°17'41") on 25 January 2012. Weather data for

the evening of collection shows a temperature range of 23.63-25.17°C and absolute humidity varying between 21.3 and 23.2 g/m³ (Para La Tierra unpublished data). The bat was already present inside the house and the collector was alerted to it when it took flight. Four nights later on 29 January 2012 a male specimen CZPLT 213 was collected in another building at the same location (S 23°48'48" W 56°17'41"). Weather data for the evening of collection shows a temperature range of 25.95-31.52°C and absolute humidity varying between 16.3 and 19.3 g/m³ (Para La Tierra unpublished data).

Both specimens were prepared as a skin, skull and tissue, and ectoparasites (batflies) of specimen CZPLT 212 were also collected. The external and cranial measurements for these specimens are provided in Table 1. Images of specimen CZPLT 212 are available in Smith (2008) (image codes FPMAM1073-1074PH).

Discussion

Esbérard & Bergallo (2004) listed roosts of *T. bidens* in caves, palm trees and mines in Rio de Janeiro State, Brazil and Martuscelli (1995) mentioned the use of abandoned buildings as feeding shelters for this species in São Paulo State. The closely-related, but more northerly-distributed *T. saurophila* is known to roost in caves, hollow trees and ruins (La Val & Rodriguez 2002, Siles et al. 2003) suggesting some degree of similarity in roost site selection between the two species. Our observations are consistent with the existing data and represent the first roosting data for *T. bidens* in Paraguay.

L. silvicolum roost almost exclusively inside active arboreal termitaria and operate a harem breeding system (Dechmann et al. 2007, 2009). The implication of this breeding system and the comparative rarity of active arboreal termitaria acting as a limiting factor, is the presence of non-harem, bachelor bats in any given population (Dechmann & Kerth 2008).

The two Laguna Blanca specimens were of differing sex and though their skulls indicated they were fully adult, neither showed any signs of reproductive activity. Thus they were not dispersing juveniles, and may have been members of bachelor groups. In the ecologically similar *Phyllostomus hastatus* pre-reproductive females are often present in bachelor groups at a ratio of approximately 1:7 males, indicating that females may temporarily reside in such groups prior to joining harems (McCracken & Bradbury 1981).

Additional circumstantial evidence is consistent with these individuals being non-harem individuals. Dechmann et al. (2005) noted that males captured with a harem of females were in notably better condition than those without

females, being larger and heavier, though they were unable to confirm whether the observed differences were a product of condition related to harem membership as opposed to age. Though the sample size is small it is perhaps significant that the forearm length of both of these specimens is towards the upper end of the range provided by López-González (2005) for Paraguayan specimens, but the mass is lower than the lower range provided for both sexes in both cases.

An alternative hypothesis for the sudden appearance of these individuals inside the buildings may be the loss of their usual roost and the occupation of a temporary alternative until a new termitarium could be found. Dechmann et al. (2007) observed that 40% of the 45 termite nests that they followed to observe longevity of roosts were abandoned by the bats when the termite colony died. This could also potentially account for weight loss, the fact that both specimens were adult and that they were found under unusual circumstances in the same area within a few days of each other.

Additional potential hypotheses regarding the sudden appearance of these two bats may be discounted. There were no extreme weather conditions on the evenings of collection that may have forced the bats to seek emergency refuge within the building. In fact both the temperature and relative humidity were well within the normal range for that time of year (Para La Tierra unpublished data). Nor would a resting hypothesis be consistent with what is known about the behaviour of harem holding male Phyllostomines and their roosting behaviour. Kalko et al. (1999) state that males are particularly faithful to roost sites and return to their roosts throughout the night for reasons associated with their social behaviour.

Neither specimen was seen to forage within the building, and both were captured when perched amongst the eaves of the roof. Kalko et al. (1999) note that when leaving the roost this species flies directly to its foraging areas and is faithful to them. It is therefore relevant to note that despite two years of field work at the same site, with lights attracting a large number of insects, no bats of any kind had previously been recorded as foraging within or in association with the buildings.

In conclusion it would seem that the use of buildings for roosting by *T. bidens* is not unusual. Abandoned or unused buildings may even present a stable and secure environment that provides the conditions necessary for permanent or semi-permanent roosts provided the bats are left unmolested. The use of buildings by *L. silvicolum* would seem to be a more unusual occurrence and perhaps represents an emergency measure adopted

by transient, non-harem individuals in areas where natural refuges are in short supply.

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Table 1: External and cranial measurements of adult specimens cited in the text. Measurements taken follow López-González (2005). All measurements are in millimetres, except weight (WT) which is in grams. The following codes are used in this table: TL Total length; TA Tail; HF Hindfoot; EA Ear; FA Forearm; MCIII Third metacarpal measured from dried skins; WT Weight; GLS Greatest length of skull; CBL Condylbasal length; MAB Mastoid breadth; ZYG Zygomatic breadth; BBC Breadth of brain case; INC Interorbital constriction; BAC Breadth across canines; BAM Breadth across upper molars; LNR Length of rostrum; MAX Length of maxillary tooth row; MTR Length of mandibular tooth row; MAN Greatest length of mandible; NA Measurement not available.

Species	<i>Tonatia bidens</i>			<i>Lophostoma silvicolum</i>	
	TK114879 (sex)	TK114880 (male)	TK114886 (male)	CZPLT212 (female)	CZPLT213 (male)
TL	99	80	81	94	114
TA	21	15	25	25	19
HF	18	15	14	15	17
EA	30	25	25	32.2	30
FA	56	54	55	56	56
MCIII	NA	44	45	NA	NA
WT	31.6	26.9	31.3	27.5	26.5
GLS	28.1	26.6	28.4	26.3	27.1
CBL	24.8	23.4	24.8	22.5	23.8
MAB	13.2	12.9	13.6	12.9	13.5
ZYG	14.2	13.5	13.7	12.8	13.3
BBC	11.1	11.3	11.0	10.6	10.3
INC	5.9	5.8	5.8	4.3	4.3
BAC	5.9	6.2	6.3	5.2	5.8
BAM	8.9	8.8	9.1	8.5	8.7
LNR	10.8	10.5	11.1	9.5	10.1
MAX	9.7	9.6	9.9	8.9	9.4
MTR	10.8	10.7	11.2	9.8	10.2
MAN	18.6	17.8	18.2	16.4	17.6
Notes		Testes 3x2mm	Testes 5x3mm		