A new species of nectar-feeding bat, genus *Lonchophylla*, from the Caatinga of Brazil (Chiroptera, Phyllostomidae)

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Abstract
We describe *Lonchophylla inexpectata* sp. n. from the Caatinga of Brazil. This new species can be distinguished from all known species of *Lonchophylla* that occur in Brazil by dental traits, cranial size, and fur colour. Specimens of *L. inexpectata* have been misidentified as *L. mordax*; but *L. inexpectata* is a pale-venter species, similar in external appearance to *L. dekeyseri*. We have found *L. inexpectata* in the Caatinga of North-eastern Brazil; *L. mordax* along the eastern border of the Caatinga and in the Atlantic Forest–Caatinga ecotone in North-eastern Brazil; and *L. dekeyseri* in the Cerrado of Mid-western Brazil, in the Brazilian Cerrado–Caatinga ecotone, and as far west as the Cerrado of Bolivia.

Keywords
Atlantic Forest, Caatinga, Cerrado, *Lonchophylla inexpectata*, *Lonchophylla dekeyseri*, *Lonchophylla mordax*, North-eastern Brazil

Introduction

*Lonchophylla* Thomas, 1903 (Phyllostomidae) comprises 12 species of nectar-feeding bats restricted to the Neotropics (Griffiths and Gardner 2008, Parlos et al. 2014). Parlos et al. (2014) revised the Lonchophyllinae and established *Hsunycteris* as a new genus to include the smaller species formerly known as the *Lonchophylla thomasi* complex.
However, their revision did not include the Brazilian species *L. mordax* Thomas, 1903, *L. bokermanni* Sazima et al., 1978, *L. dekeyseri* Taddei et al., 1983, and *L. peracchii* Dias et al., 2013. During our assessment of these Brazilian species we found evidence of another new taxon based on specimens from the Brazilian Caatinga we found in museum collections. Some specimens of this previously undescribed species have been misidentified as *L. mordax* for more than a century.

*Lonchophylla mordax* was described from Lamarão, Bahia (Thomas 1903), with subsequent records ascribed to specimens from other localities in Northern ([IN] Handley 1967, Piccinini 1974, Koopman 1981), North-eastern ([NE] Vieira 1955, Sazima et al. 1978, 1983, Mares et al. 1981, Willig 1983, Astúa and Guerra 2008), Mid-western ([MW] Peracchi et al. 2011), and South-eastern Brazil ([SE] Pereira-Barreto et al. 1968, Taddei et al. 1978, Pedro and Passos 1995, Esbérard et al. 2006, Dias et al. 2002, Esbérard 2003). Handley (1966) synonymized *L. concava* Goldman, 1914 under *L. mordax*, thus enlarging its geographic distribution westward into western Colombia and Ecuador, and north-westward into Costa Rica. This arrangement was rejected by Albuja and Gardner (2005), who recognized *L. concava* as a distinct species. Based on the records available, bat biologists have assumed that *L. mordax* was restricted to eastern South America, with records from the Amazon Forest of N Brazil, eastward to xeric habitats in NE Brazil, and southward to the Atlantic Forest of SE Brazil, including transitional areas between these last two biomes (see Griffiths and Gardner 2008, Peracchi et al. 2011).

Thomas’s (1903) description of *L. mordax* is based on eight specimens from Lamarão, Bahia collected by Alphonse Robert in 1903. Lamarão is in the *agreste* sub region of NE Brazil, which is a narrow transition zone between the coastal Atlantic Forest to the east and the semi-arid Caatinga on the west (Prado 2003). According to local residents, the vegetation in Lamarão and adjacent areas during the first half of the 20th century was dominated by tall forests, which is characteristic of the transitional vegetation between the Atlantic Forest and Caatinga. Throughout the last century, land-use practices have converted the region into a semi-arid environment that resembles caatinga habitats. The type material of *L. mordax*, originally deposited in the Natural History Museum, London (BM), includes the holotype (BM 1903.9.5.34) and seven paratypes. One of the paratypes was sent to the Smithsonian’s National Museum of Natural History, Washington, DC (USNM 123392). A few years after Thomas described *L. mordax*, a series of *Lonchophylla* were collected in Barra, Bahia by Ernest Garbe and Robert H. Becker in 1908 and 1914, respectively. Barra, Bahia is in the *sertão* sub region (450 to 500 km west of Lamarão), a semi-arid environment that is characteristic of the Caatinga (Prado 2003). According to their labels, Garbe’s and Becker’s specimens from Barra were identified as *L. mordax* and either originally deposited or subsequently sent to museums in Brazil and United States of America. This material has been the basis for several subsequent published accounts on *L. mordax* (e.g., Lima 1926: 36, Vieira 1942: 321). As with the paratype of *L. mordax* (USNM 123392), one of those specimens collected by Garbe is housed in the Smithsonian’s National Museum of Natural History (USNM 238008).

After comparing skins and skulls of Garbe’s and Thomas’s USNM specimens from Barra (Caatinga, USNM 238008) and Lamarão (Atlantic Forest/Caatinga, USNM 123392),
we determined that the pale-venter *Lonchophylla* from Barra could be distinguished from *L. mordax*, and represented an undescribed species. Among distinctive traits distinguishing the Barra specimen from *L. mordax* are the paler colour of the ventral fur and the smaller skull that has a narrower and more delicate rostrum.

To test this hypothesis and further understand the geographic distribution of Brazilian species, we examined series of *Lonchophylla* from localities in the Caatinga, Cerrado, and Atlantic Forest, as well as from transitional zones between these habitats. The material used in our comparisons represents all *Lonchophylla* species known to occur in Brazil. During this process we found additional features that support our hypothesis that the pale-venter *Lonchophylla* from the Caatinga represents a new species, which we describe below.

**Methods**

The material we used in the comparisons includes series of *Lonchophylla* from the Caatinga of NE Brazil (Bahia [municipalities of Andaraí, Barra, Buíque], Ceará, Pernambuco, Piauí, Sergipe [Grotta do Angico]); Cerrado of Bolivia (Santa Cruz) and Mid-western Brazil (Distrito Federal, Goiás, Mato Grosso do Sul); Atlantic Forest of SE Brazil (Espírito Santo, Rio de Janeiro); and the Atlantic Forest–Caatinga ecotone in NE Brazil (Bahia [Lamarão], Sergipe [Itabaiana]). This material includes representatives of all currently recognized Brazilian species of *Lonchophylla*, and includes primary and secondary types of *L. bokermanni* (6 specimens from the type series), *L. dekeyseri* (holotype and one paratype), *L. mordax* (holotype and one paratype), and *L. peracchii* (holotype and two paratypes). Vouchers are preserved in the American Museum of Natural History (AMNH, New York, USA); Carnegie Museum of Natural History (CM, Pittsburgh, USA); Museu Nacional (MN, Rio de Janeiro, Brazil); Muséum d’histoire naturelle (MHNG, Geneva, Switzerland); Natural History Museum (BM, London, England); Smithsonian’s National Museum of Natural History (USNM, Washington DC, USA); Universidade Estadual Paulista Júlio de Mesquita Filho (DZSJRP, São José do Rio Preto, Brazil); Universidade Federal do Espírito Santo (UFES, Espírito Santo, Brazil); Universidade Federal Rural do Rio de Janeiro (ALP, LMD, Seropédica, Brazil). A complete list of specimens examined is in the Appendix. Most geographical coordinates follow Gardner’s (2008) gazetteer of marginal localities.

Measurements in this report are from adults, and are either in millimetres (mm) or grams ([g] body mass). The body mass was recorded from skin labels. Other dimensions include: the forearm length (FA), from the elbow to the distal end of the forearm including carpals, measured with the wing partially folded; greatest length of skull (GLS), from the posterialmost point of the occiput to the tips of the upper inner incisors; condylo-incisive length (CIL), from the line connecting the occipital condyles to the tips of the upper inner incisors; basal length (BAL), from the anterior margin of the foramen magnum to the tips of the upper inner incisors; maxillary toothrow length (MTL), from the anterior surface of the upper canine, including the cingulum, to the posterior surface of M3; molariform toothrow length (M1M3), from the crown of M1 to
the crown of M3; breadth across canines (BAC), greatest breadth across outer surface of the crowns of upper canines, including cingulae; breadth across molars (BAM), greatest breadth across outer edges of the crowns of upper molars; postorbital breadth (POB), least breadth across frontals posterior to the postorbital bulges; braincase breadth (BCB), greatest breadth of the globular part of the braincase; mastoid breadth (MAB), greatest breadth across the mastoid region; mandibular length (MAL), from the mandibular symphysis to the condyloid process; and the mandibular toothrow length (MAN), from the anterior crown of the lower canine, including cingulum, to the posterior crown of m3. Craniodental measurements were taken under binocular dissection microscopes with low magnification (usually 6×). Dimensions were taken by only one of us, using digital callipers accurate to 0.02 mm. Measurements were recorded and analysed to the nearest 0.01 mm, but values were rounded off to 0.1 mm throughout the text because this is the smallest unit that allows accurate repeatability with callipers (Voss et al. 2013). Descriptive statistics (mean and range) were calculated for all dimensions. The statistical significance of differences among samples was assessed by single analyses of variance (one-way ANOVA). This statistics was performed in PAST (Hamer et al. 2001).

Discriminant Function Analysis (DFA) was used to compare taxa. For the analysis, we selected a subset of the cranial dimensions (GLS, CIL, MAB, BCB, POB, BAC, BAM, M1M3, MTL, MAL) to represent different axes of length and width of the skull. As multivariate procedures require complete datasets, missing values (< 3% of the total dataset) were substituted by means. Measurements were transformed to natural logarithms and the covariance matrices were computed considering all variables. DFA was performed in SPSS.

Nomenclature of tooth morphology follows Phillips (1971). Capitalized colour nomenclature follows Ridgway (1912).

**Taxonomy**

*Lonchophylla inexpectata* sp. n.  
http://zoobank.org/610DFBAE-1726-4666-9B3F-BDCC063D25D2  
Figures 1, 2, 4, 5; Table 1

*Lonchophylla mordax*: Lima 1926: 76; not *Lonchophylla mordax* Thomas, 1903.  
*Lonchophylla mordax*: Vieira 1942: 321; not *Lonchophylla mordax* Thomas, 1903.  
*Lonchophylla mordax*: Taddei, Vizotto and Sazima 1983; not *Lonchophylla mordax* Thomas, 1903.  
*Lonchophylla dekeyseri*: Woodman and Timm 2006: 450; part, not *Lonchophylla dekeyseri* Taddei, Vizotto & Sazima, 1983.  
*Lonchophylla mordax*: Woodman and Timm 2006: 475; part, not *Lonchophylla mordax* Thomas, 1903.  
*Lonchophylla dekeyseri*: Woodman 2007. Part, not *Lonchophylla dekeyseri* Taddei, Vizotto & Sazima, 1983.
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Figure 2. Dorsal **A**, ventral **B**, and lateral **C** views of the cranium, and lateral **D** and dorsal **E** views of the mandible of the holotype of *L. inexpectata* (USNM 238008). Scale bar: 15 mm.

branes seem to be faded. External and craniodental measurements for the holotype and paratypes are in Table 1.

**Paratypes.** The paratype series comprises 46 vouchers. Three paratypes are from the type locality in Barra, Bahia (AMNH 235608, FMNH 21077, 21078), and were collected by R. H. Becker in 1914. One is from Serra do Catimbau, Buíque, Pernambuco (FMNH 137414; 08°37’S, 37°09’W [coordinates for Catimbau National Park]).
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and was collected by D. Guerra in 1970. Thirty-eight vouchers are from 17 km south of Exu, Pernambuco (CM 99413–99450; 07°41’S, 39°32’W), elevation ca. 480 m, and were collected by M. R. Willig in 1976. Paratypes from Barra (AMNH 235608, FMNH 21077, 21078), and Buíque (FMNH 137414) are in spirits, others are prepared as dry skin.

**Other specimen.** One additional specimen (ALP 3686) from the Caatinga of Andaraí, Bahia may represent *L. inexpectata*. The specimen is preserved in spirit, and the dentition is partially worn, preventing its unambiguous identification.

**Distribution.** *Lonchophylla inexpectata* occurs in the Caatinga of North-eastern (NE) Brazil, with confirmed records from Pernambuco (NE), and Bahia (NE) (Figure 3).

**Diagnosis.** *Lonchophylla inexpectata* can be distinguished from all South American species that occur east of the Andes by the following set of traits: presence of a lingual cusp in the P4, absence of a lingual cusp in the P3, absence of a deep longitudinal groove in the posterior face of the upper canine, proximal portion of the dorsal surface of the forearm not furred, and ventral fur pale.
Table 1. Body mass (g) and external and skull measurements (mm) of the holotype (USNM 238008) of *L. inexpectata*, and descriptive statistics for *L. inexpectata* (from Caatinga [type series]), *L. dekeyseri* (from Cerrado), and *L. mordax* (from Caatinga and Caatinga–Atlantic Forest ecotone).

|                         | *L. inexpectata* | *L. inexpectata* | *L. dekeyseri* | *L. mordax* |
|-------------------------|-------------------|-------------------|----------------|-------------|
| **Holotype**            | USNM 238008       | (Min.–Max.)       | (Min.–Max.)    | (Min.–Max.) |
| **Body mass**           | –                 | 8.2               | –              | –           |
|                         | (7.0–9.5) 15      | (7.0–9.5) 15      | (7.0–9.5) 15   | (7.0–9.5) 15|
| **FA**                  | 33.7              | 34.6              | 36.9           | 35.8        |
|                         | (32.3–36.4) 62    | (35.5–38.0) 15    | (34.5–37.4) 32 |
| **GLS**                 | 22.3              | 23.1              | 22.4***        | 23.6**      |
|                         | (22.0–23.9) 38    | (22.0–22.7) 16    | (22.6–24.5) 24 |
| **CIL**                 | 20.8              | 21.7              | 21.0***        | 22.2***     |
|                         | (20.5–22.6) 37    | (20.4–21.4) 16    | (21.3–23.2) 24 |
| **BAL**                 | 19.1              | 19.8              | 19.1***        | 20.2**      |
|                         | (18.7–20.7) 36    | (18.5–19.6) 16    | (19.6–20.8) 20 |
| **MTL**                 | 7.6               | 7.8               | 7.6**          | 8.0***      |
|                         | (7.4–8.2) 45      | (7.3–7.9) 16      | (7.6–8.4) 26   |
| **M1M3**                | –                 | 3.3               | 3.4*           | 3.5***      |
|                         | (3.1–3.6) 40      | (3.3–3.6) 14      | (3.3–3.7) 30   |
| **BAC**                 | 3.4               | 3.6               | 3.7**          | 3.7*        |
|                         | (3.3–3.8) 44      | (3.4–3.9) 16      | (3.5–4.1) 27   |
| **BAM**                 | 4.8               | 5.1               | 5.1            | 5.3*        |
|                         | (4.8–5.5) 43      | (4.9–5.3) 16      | (4.7–5.7) 26   |
| **POB**                 | 4.1               | 4.3               | 4.5***         | 4.3         |
|                         | (4.1–4.7) 46      | (4.2–4.6) 16      | (4.0–4.6) 27   |
| **BCB**                 | 7.9               | 8.3               | 8.4*           | 8.5         |
|                         | (7.9–8.6) 46      | (8.0–8.7) 16      | (8.1–8.9) 27   |
| **MAB**                 | 8.5               | 9.0               | 9.1***         | 9.3*        |
|                         | (8.5–9.6) 44      | (8.8–9.4) 16      | (8.9–9.7) 27   |
| **MAL**                 | 14.9              | 15.6              | 15.1***        | 16.1***     |
|                         | (14.1–16.3) 44    | (14.8–15.4) 16    | (15.5–17.0) 25 |
| **MAN**                 | 8.0               | 8.2               | 8.1*           | 8.4***      |
|                         | (7.8–8.5) 43      | (7.7–8.4) 16      | (7.9–8.9) 25   |

*N* = sample size (adults only, males and females combined). See “Methods” for variable abbreviations and Appendix for localities of specimens used in comparisons. One-way ANOVA for skull measurements is comparing *L. inexpectata* with *L. dekeyseri* and *L. mordax*: *p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001.

**Description and comparisons.** Like other *Lonchophylla*, the dental formula of *L. inexpectata* is 2/2, 1/1, 2/3, 3/3 = 34. *Lonchophylla inexpectata*, *L. dekeyseri* and *L. bokermanni* are the three pale-venter Brazilian species of the genus, whereas *L. mordax* and *L. peracchii* have pale-brown ventral pelage. We did not find evidence of *L. bokermanni* and *L. peracchii* in sympathy with *L. inexpectata*—*L. bokermanni* is restricted to a small area in the Serra do Espinhaço, Cerrado of Minas Gerais; and
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L. peracchii occurs in the Atlantic Forest, from Espírito Santo southward to São Paulo. Lonchophylla inexpectata can be distinguished from these two species by the presence of a well-developed lingual cusp in the P4, with lingual root in the median portion of the tooth; absence of a groove along the anterior surface of the upper canines; and proximal portion of the dorsal surface of the forearm not covered with fur.

Based on the samples we have available, L. inexpectata resembles L. dekeyseri in the pale ventral fur, and L. mordax in the dental morphology. These three species overlap partially in external and cranial size, but in general, cranial measurements for L. inexpectata average significantly larger than those for L. dekeyseri and smaller than those for L. mordax (Table 1).

Lonchophylla mordax has been reported in the literature as a pale-venter species (e.g., Lima 1926, Vieira 1942, Taddei et al. 1983, Nogueira et al. 2007), and subsequent to the description of L. dekeyseri, these taxa have been considered the two pale-venter species from NE Brazil (see Taddei et al. 1983, Nogueira et al. 2007, Dias et al. 2013). However, after examining part of the type series of L. mordax (BM 1903.9.5.34 [holotype], USNM 123392 [paratype]), along with one other specimen from the same locality of the type series (MHNG 667.13 [identified as L. mordax by Thomas]), and samples from a nearby locality having similar habitat (Itabaiana, Sergipe)—whose external and skull morphology fit with those of the type series of L. mordax (ALP 8768–8770, 8812–8819)—we concluded that L. mordax has a light-brown ventral pelage, which is consistently darker than the paler ventral pelage of the type material of L.
dekeyseri and other samples of this species. The ventral pelage of specimens from Barra, Bahia (L. inexpectata) is similar to that of L. dekeyseri. Under “historical remarks” we discuss the reasons for previous assignments of pale-venter samples from the Caatinga of NE Brazil (= L. inexpectata) to L. mordax.

Lonchophylla inexpectata averages significantly smaller than L. mordax in all cranial dimensions except in POB and BCB (Table 1, Figure 4). This is particularly notable in the length of the mandible (MAL $\bar{x} = 15.6$ mm, range [R] = 14.1–16.3 mm [inexpectata] versus $\bar{x} = 16.1$ mm, R = 15.5–17.0 mm [mordax]). L. inexpectata can also be distinguished by the ventral pelage, which varies from whitish (e.g., USNM 238008, CM 99415) to pale greyish (near Avelaneous [e.g., CM 99432, 99437]), but near Buffy Brown in L. mordax (e.g., BM 1903.9.5.34, USNM 123392). The throat and the posterior region of the belly are consistently paler, tending to whitish, in L. inexpectata (Figure 5).

Lonchophylla inexpectata resembles L. dekeyseri in the pelage colour, but these species can be distinguished by qualitative and quantitative cranial characteristics. Lonchophylla inexpectata is significantly larger than L. dekeyseri in all length measurements of skull and rostrum (GLS, CIL, BAL, MTL, M1M3, MAL, MAN), but L. dekeyseri averages slightly larger in those measurements of the width of skull and rostrum (BAC, POB, BCB, MAB), indicating a longer but narrower skull in L. inexpectata (Table 1). L. inexpectata can be distinguished from L. dekeyseri by the narrower first upper premolar (P3) in occlusal view, with lingual lobe absent or obsolete (in contrast with the usually more robust P3, which has a small or moderately developed inner lobe in dekeyseri [Figure 6]); absence of a deep longitudinal groove in the posterior surface of the canine; narrower and uninflated rostrum, with more widely projecting lacrimals (wider and more inflated rostrum, and lacrimal region almost indistinguishable in dekeyseri); upper molars (M1 and M2) with low crowns in lateral view (molars with higher crowns in dekeyseri); parastyle of M1 projecting labially over the posterior labial margin of the last upper premolar (P4); mesostyle of M1 shorter; metastyle of M1 well developed (reduced or absent in dekeyseri [Figure 6]); parastyle of M2 well developed but slender (well developed and more rounded in dekeyseri); mesostyle of M2 shorter; metastyle of M2 distinct, moderate or well developed (reduced or absent in dekeyseri).

Multivariate analysis. To test the results obtained from the morphological analyses, we performed a discriminant function analysis including samples we confidently assigned to L. dekeyseri (three groups from the Cerrado of Mid-western Brazil), L. inexpectata (two groups from the Caatinga of NE Brazil), and L. mordax (one group from the Caatinga of NE Brazil, and one group from the Atlantic Forest–Caatinga ecotone in NE Brazil). The first two discriminant functions (DF1, DF2) summarized 47% and 40% of the total variation, respectively (Table 2). All samples grouped as expected, confirming the cohesive pattern retrieved from the morphological analysis. Centroids for samples assigned to L. inexpectata were distinct from those of L. dekeyseri and L. mordax across the first two axes, and only a few scores of L. inexpectata are within the dispersal cloud of L. mordax (Figure 7). The three species overlap partially across the first axis, but L. inexpectata distinguishes from L. dekeyseri and L. mordax
Figure 5. Ventral (above) and dorsal (below) pelage colours of L. mordax A, B (USNM 123392, paratype), and L. inexpectata C, D (CM 99432) E, F (CM 99416) G, H (CM 99415) I, J (USNM 238008, holotype).
Table 2. Vector correlation coefficients (loadings) between original variables and discriminant functions (DF1, DF2) for samples of *L. dekeyseri*, *L. inexpectata* and *L. mordax*.

| Characters | DF1   | DF2   |
|------------|-------|-------|
| GLS        | 0.724 | 0.021 |
| CIL        | 0.706 | -0.130|
| MAB        | 0.240 | 0.388 |
| BCB        | 0.268 | 0.413 |
| POB        | -0.149| 0.261 |
| BAC        | 0.117 | 0.336 |
| BAM        | 0.413 | 0.193 |
| M1M3       | 0.226 | 0.477 |
| MTL        | 0.523 | 0.151 |
| MAL        | 0.645 | 0.100 |

along the second axis. Scores for *L. inexpectata* had very low positive to high negative values along the DF2, whereas those for *L. dekeyseri* and *L. mordax* have low negative to high positive values along this axis.

**Etymology.** The name “*inexpectata*” is Latin for “unexpected”, in allusion to the unexpected (at least for the authors) new taxonomic status of pale-venter populations of *Lonchophylla* from the Caatinga of North-eastern Brazil.
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**Key to the Brazil’s species of Lonchophylla**

1. Proximal portion of the dorsal surface of the forearm covered with fur; upper canines distinctly grooved along the anterior surface; P4 narrow in occlusal view, with inner lobe reduced and lingual root displaced posteriorly

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2. Proximal portion of the dorsal surface of the forearm not conspicuously furred; upper canines lacking a groove along the anterior surface; P4 robust, with inner lobe well developed and lingual root in the median portion of the tooth

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3. Smaller size; forearm length 37 mm or less; pale-brownish ventral fur; tip of the tragus rounded; parasyles, mesostyles and metastyles of M1 and M2 absent or poorly developed

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Lonchophylla peracchii

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Larger size; forearm length 39 mm or more; pale-greyish ventral fur; tip of the tragus pointed; parasyles, mesostyles and metastyles of M1 and M2 well developed

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Lonchophylla bokermanni

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**Figure 7.** Plots of multivariate individual scores in the first two discriminant functions (DF1, DF2). Samples: Lonchophylla dekeyseri (Goiás [black diamonds, N = 12]; Mato Grosso do Sul [black squares, N = 2]; Distrito Federal [black triangles, N = 2]), L. inexpectata (Barra, Bahia [crosses, N = 3]; Exu, Pernambuco [stars, N = 31]), and L. mordax (Itabaiana, Sergipe [white triangles, N = 8]; Grota do Angico, Sergipe [white inverted triangles, N = 12]). Centroid groups are marked with grey asterisks.
P3 robust in occlusal view, with lingual lobe varying from small to moderately
developed projection; presence of a conspicuous longitudinal groove along the
posterior surface of the canine; metastyle of M1 and M2 absent or reduced ...

\[\text{Lonchophylla dekeyseri}\]

\[\text{Lonchophylla mordax}\]

\[\text{Lonchophylla inexpectata}\]

\[\text{Lonchophylla mordax}\]

\[\text{Lonchophylla inexpectata}\]

\[\text{Lonchophylla mordax}\]

\[\text{Lonchophylla inexpectata}\]

\[\text{Lonchophylla mordax}\]

\[\text{Lonchophylla inexpectata}\]

Discussion

Historical remarks. Previous assignments of \textit{L. inexpectata} to \textit{L. mordax} seem to have
originated with Lima (1926: 36) who based his account of \textit{L. mordax} on the series
from Barra, which was collected by Garbe and deposited in the Museu de Zoologia da
Universidade de São Paulo. Barra is in the \textit{sertão} of Bahia (Caatinga), ca. 450–500 km
west of Lamarão, which is in the \textit{agreste} of Bahia (transition between Atlantic Forest and
Caatinga; type locality of \textit{L. mordax}). Thomas (1903: 459) described \textit{L. mordax}
as follows:

\begin{quote}
General external appearance, so far as can be judged by skins, exactly as in \textit{Glossophaga soricina}, except that the colour averages paler. The type is near “cinnamon-brown” above, the bases of the hairs whitish, and “wood-brown” below, but there is some variation in tone, and the darker specimens are quite as dark as the paler examples of \textit{Glossophaga}
obtained at the same place.
\end{quote}

Lima (1926) seems to have misinterpreted Thomas (1903) where he reported that
“darker specimens [of \textit{L. mordax}] are quite as dark as the paler examples of \textit{Glossophaga}
obtained at the same place.” Lima’s conclusion might be biased by the series he had
at hand, primarily composed by pale-venter specimens from Barra, Bahia. However,
at that time, \textit{L. mordax} was unquestionably the closest species—geographically and
morphologically. Although Lima had identified this series from Barra as \textit{L. mordax}, the
label of the USNM 238008 bears the notation “Subsp. n.?"

Vieira (1942: 321) followed Lima (1926) and based his account of \textit{L. mordax} on
the same specimens collected by Garbe. Both recognized \textit{L. mordax} as a pale-venter
species. This was followed by Taddei et al. (1983) who compared the species they were
describing (\textit{L. dekeyseri}) with “\textit{L. mordax}”—the other pale-venter species from NE
Brazil, according to those authors. However, according to Thomas (1903), the ventral
pelage of \textit{L. mordax} is “wood-brown”, but with some variation, with darker speci-
mens almost as dark as paler specimens of \textit{Glossophaga} from the same area. \textit{Glossophaga}
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*soricina* (Phyllostomidae)—the only species of the genus that occur in the region—has ventral pelage varying from “buffy to fuscous” (Alvarez et al. 1991).

**Taxonomic remarks.** Molecular and morphological analyses have recovered *Lonchophylla* (sensu Griffiths and Gardner 2008) as a paraphyletic assemblage (Dávalos and Jansa 2004, Woodman and Timm 2006, Woodman 2007). Combining evidence from nuclear and mitochondrial genes, karyotypes and skull morphology, Parlos et al. (2014) also retrieved *Lonchophylla* as paraphyletic. Based on their findings, Parlos et al. (2014) described *Hsunycteris* and moved three species into this new genus—*thomasi* J. A. Allen, 1904; *cadenai* Woodman & Timm, 2006; and *pattoni* Woodman & Timm, 2006. As a result, *Lonchophylla* comprised 12 South and Central American species (Parlos et al. 2014). However, several species were not assessed, including *L. mordax*—the type species of *Lonchophylla*. According to Parlos et al. (2014), the two genera can be distinguished by size (with species in *Lonchophylla* larger than those in *Hsunycteris*), qualitative cranial features, and karyotypes (*Lonchophylla* spp.: diploid number [2n] = 48, fundamental autosomal number [NF] = 50; *Hsunycteris* spp.: 2n = 30–36, NF = 34–50).

The samples we have available show that *L. dekeyseri* and *L. mordax* are in parapatry with *L. inexpectata*: *L. dekeyseri* occurs in the Cerrado of Brazil and possibly in the Bolivian savannah (USNM 584472, 584473) and the Cerrado–Caatinga ecotone in NE Brazil (DZSJRP 11459); and *L. mordax* occurs in the Atlantic Forest–Caatinga ecotone (agreste), and along the eastern border of the Caatinga (sertão). We are not convinced that *L. dekeyseri* occurs in the Bolivian savannah and in the Cerrado–Caatinga ecotone in NE Brazil. One of the specimens supporting these records was examined a long time ago (DZSJRP 11459), and the other two (USNM 584472, 584473) are distinct from other samples of *L. dekeyseri* as determined in a previous discriminant function analysis. These specimens are not included in this analysis because we were not able to compare them with samples from other localities. Records previously assigned to *L. mordax* from N Brazil are based primarily on Handley (1967) and Piccinini (1974), and those identifications were not confirmed in subsequent surveys. We speculate that they are misidentifications of *L. thomasi*, now *Hsunycteris thomasi*. Similarly, previous unvouched records of *L. mordax* from the Atlantic Forest of SE Brazil apparently represent *L. peracchii* based on the identity of material we have examined from nearby localities.

After Parlos et al.’s (2014) assignment of *L. thomasi* J. A. Allen, 1904 to *Hsunycteris*, *L. inexpectata* is the fifth *Lonchophylla* reported from Brazil—all pending phylogenetic positioning. There are several specimens pending verification of identity, particularly those from the Caatinga. Additional material, particularly from NE and Mid-western Brazil, will be important to a clearer understanding of the taxonomic diversity, and the geographic distribution of Brazilian species of *Lonchophylla*.

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**Appendix**

Specimens examined. Abbreviations for collections are in “Methods”.

*Lonchophylla bokermanni* (08): Brazil, Minas Gerais: Diamantina (18°23’S, 43°61’W: MN 79996, MN 79997); Serra do Cipó (19°16’S, 43°36’W: DZSJRP 10342 [paratype], 10347 [holotype], 10408 [paratype], 11410 [paratype], 11411 [paratype], 10412 [paratype; referred in the original description as ZUEC 585]).

*Lonchophylla dekeyseri* (16): Brazil, Distrito Federal: Parque Nacional de Brasília (15°41’S, 47°59’W: DZSJRP 10099 [holotype]); unknown locality (ALP 6706, 6707). Brazil, Goiás: Mambai (14°29’S, 46°06’W: LDM 283, 3008, 3065, 3066, 3104, 3169, 3170, 3184, 3185, 3201, 3215, 3270). Brazil, Mato Grosso do Sul: Corumbá (19°61’S, 57°45’W: LDM 2642).

*Lonchophylla cf. dekeyseri* (3): Bolivia, Santa Cruz: Velasco (13°54’27”S, 60°48’52.92”W: USNM 584472, 584473). Brazil, Piauí: Sete Cidades, Piracuruca (03°56’S, 41°44’W: DZSJRP 11459 [paratype of dekeyseri]).

*Lonchophylla inexpectata*: Brazil, Bahia (43): Barra (12°42’S, 41°33’W: USNM 238008 [holotype], AMNH 235608, FMNH 21077, 21078 [paratypes]). Brazil, Pernambuco: Buíque, Serra do Catimbau (08°37’S, 37°09’W: FMNH 137414 [paratype]); 17 km south of Exu (07°41’S, 39°32’W: CM 99413–99450).
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Lonchophylla cf. inexpectata (1): Brazil, Bahia: Andaraí, unknown locality (ALP 3686).
Lonchophylla mordax (35): Brazil, Bahia: Lamarão (11°45’S, 38°55’W: BM 1903.9.5.34 [holotype], USNM 123392 [paratype]). Brazil, Sergipe: Itabaiana (10°68’S, 37°42’W: ALP 6149, 8769, 8770, 8812–8819); Parque Nacional Grotta do Angico (09°65’S, 37°67’W: ALP 9747, 9752, 9755, 9757, 9759, 9761, 9762, 9768, 9769, 10075–10082, 10084–10088).
Lonchophylla peracchii (75): Brazil, Espírito Santo: Sooretama, BR-101, Km 105, Reserva Biológica de Sooretama (19°1’48.97”S, 40°1’8.976”W: UFES 2046, 2047, 2117) Brazil, Rio de Janeiro: Angra dos Reis, Ilha da Gipóia (23°02’S, 44°21’W: LDM 4200, 4423); Angra dos Reis, Ilha Grande (23°10’S, 44°12’W: DZSJRP 1515) [paratype], 15160, 15161, 15162 [holotype], 15163 [paratype], LDM 246, 2090, 3450, 3896, 3897, 4052, 4233, 4533); Cambuci (21°34’S, 41°54’W: LDM 4250, 4253, 4477); Casimiro de Abreu, Morro de São João (22°29’S, 41°58’W: LDM 2219, 2245, 4113, 4222, 4226, 4227); Itaguaí, Ilha de Itacuruçá (23°56’S, 43°53’W: LDM 5085); Mangaratiba, Vale do Rio Sahy (23°55’S, 43°59’W: LDM 5128); Nova Iguacu, Reserva Biológica do Tinguá (22°39’S, 43°34’W: ALP 6265, 6560, 6561, 6283, 6284, 6556, 6656–6659); Parati (23°19’S, 44°38’W: LDM 996, 997); Rio de Janeiro, Estrada Rio-Santos (23°55’S, 43°16’W: LDM 5008, 5010); Rio de Janeiro, Floresta da Tijuca (22°57’S, 43°24’W: LDM 1064, 1460); Rio de Janeiro, Jardim Botânico (22°58’S, 43°13’W: LDM 875); Rio de Janeiro, Parque Estadual da Pedra Branca (22°52’S, 43°23’W: ALP 5664, 5820, 5860); Rio de Janeiro, Reserva do Grajaú (22°55’S, 43°16’W: ALP 1783–1785, LDM 237, 238, 246–248, 250, 270, 280, 281, 345, 395, 531–533, 1359, 1495–1497, 1499); Rio de Janeiro, Reserva Rio das Pedras (22°59’S, 44°06’W: LDM 1781, 3700); Teresópolis, Parque Nacional da Serra dos Órgãos (22°26’S, 42°59’W: ALP 6482). Brazil, São Paulo: Ubatuba, Picinguaba (23°18’S, 44°53’W: ALP 10242).

Supplementary material I

Occurrence localities for Bolivian and Brazilian species of Lonchophylla
Authors: Ricardo Moratelli, Daniela Dias
Data type: Occurrence localities
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