

New records of the Western Rounded Ear Bat, *Lophostoma occidentale* (Davis & Carter, 1978) (Chiroptera: Phyllostomidae), from Colombia

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Abstract: We report new records of the western rounded ear bat *Lophostoma occidentale* for the Colombian territory, represented by ten specimens collected on the western portion of the country, in the departments of Cauca, Chocó, and Valle del Cauca, all in the Colombian Pacific Region. The new records of *L. occidentale* represent a substantial geographic and ecological extension in the known distribution of this species and corroborate its occurrence in Colombia. In addition, we discuss on the morphological variation of representatives of large *Lophostoma* species in Colombia.

Key words: Mammalia; morphology; Phyllostominae; southwestern Colombia; subspecies

INTRODUCTION

In Colombia, phyllostomid bats of the genus *Lophostoma* are currently represented by two small-sized species—*L. brasiliense* Peters, 1867 and *L. carrikeri* (Allen, 1910)—and two large species—*L. occidentale* (Davis & Carter, 1978) and *L. silvicolum* d'Orbigny, 1836. *Lophostoma occidentale*, however, has only recently been recognized as a valid species (Velazco and Cadenillas 2011), and Colombian records from the western versant of the Andes were all assigned as *L. s. occidentale* (Alberico 1994).

The taxonomic history of *L. occidentale* began with Davis and Carter (1978), who described this taxon as a geographic variant of *L. silvicolum* from western Peru (*L. s. occidentale*). On their part Baker *et al.* (2004) found consistent morphological and molecular differences between typical *L. silvicolum* and specimens of the genus from several localities in western Ecuador. Baker *et al.* (2004) concluded that divergent specimens from western Ecuador should be included in an undescribed species they named *L. aequatorialis* and suggested that Colombian material previously identified as *L. s. occidentale* may represent *L. aequatorialis*. Baker *et al.* (2004) advice that at the time of their work no karyotypes or tissues were available for *L. s. occidentale*, and despite the authors were allowed to extract DNA from the holotype of this taxon

(Texas Cooperative Wildlife Collection - TCWC 11704), it was not possible to obtain DNA sequences, preventing molecular analyses. Williams and Genoways (2008) restricted the distribution of *L. s. occidentale* to Peru and Ecuador influenced by Baker *et al.* (2004) suggestion that Colombian material of *L. s. occidentale* may represent *L. aequatorialis*.

Velazco and Cadenillas (2011) analyzed new museum vouchers of *L. s. occidentale*, with tissues available, and failed in identifying the evolutionary independence of typical *L. s. occidentale* from *L. aequatorialis*, suggesting the elevation of *L. s. occidentale* to the specific level. These findings open new questions about the identity of large *Lophostoma* specimens from western Colombia, and our aim here is to review the identification of those specimens, including the material assigned as *L. s. occidentale* by Alberico (1994). We also examined specimens previously identified as *L. silvicolum* from other Colombian natural regions.

MATERIALS AND METHODS

Forty seven Colombian specimens of *Lophostoma* assigned as *L. silvicolum* or *L. s. occidentale* in previous studies were contrasted against *L. occidentale* morphological diagnostic characters. These include specimens from 12 departments, and from the five Colombian regions (Amazon, Andes, Caribbean, Orinoco, and Pacific). Three appendicular (Ear, E; forearm, FA; and third metacarpal, Mt3) and 16 craniodental measurements (greatest skull length, GSL; condylobasal length, CBL; zygomatic width, ZW; mastoid width, MW; braincase width, BW; braincase height, BH; palatal length, PL; postpalatal length, PPL; postorbital constriction width, PO; interorbital width, IW; distance across upper molars, M-M; distances across canines, including cingula, C-C; maxilar tooth-row length, TR; mandibular tooth-row length, MTR; coronoid process length, CR; and mandibular length, ML) were taken of each specimen reviewed. A total of 30 specimens with complete measurements (marked with an asterisk in Appendix 1), were analysed through a principal component analysis (PCA), in order to explore whether there is a morphological gap or intraspecific geographic structure separating *L. occidentale*

and *L. silvicolum* from Colombia. This analysis was performed using the software PAST (Hammer et al. 2001) and included only skull measurements (log-transformed) of adult specimens (identified by closed epiphyses). Males and females were analysed together because both species lack sexual dimorphism (Velazco and Cadenillas 2011). Examined material is deposited at the following institutions in Colombia: Instituto Alexander von Humboldt (IAvH); Instituto de Ciencias Naturales, Universidad Nacional de Colombia (ICN); Museo de Historia Natural Universidad de la Amazonia (UAM); Museo de Historia Natural Universidad de La Salle (MLS); Museo de Historia Natural Universidad del Cauca (MHNUC); and Universidad del Valle (UV).

RESULTS

As product of our taxonomic assessment, ten specimens were identified as *L. occidentale*, all obtained in localities west of the Andean system (Figure 1 and 2, Appendix 1), in the Chocó-Magdalena biogeographic province, as defined by Hernández-Camacho et al. (1992). These specimens match the following characters in *L. occidentale* re-description (Velazco and Cadenillas 2011): mastoid process developed; clinoid processes laterally curved; cingula absent on upper canines; distal accessory cusp on P3 and P4 present; labial cingula on P4 absent; mesostylar crest on M1 and M2 present, and lingual cingula on M1 and M2 present (Figure 3).

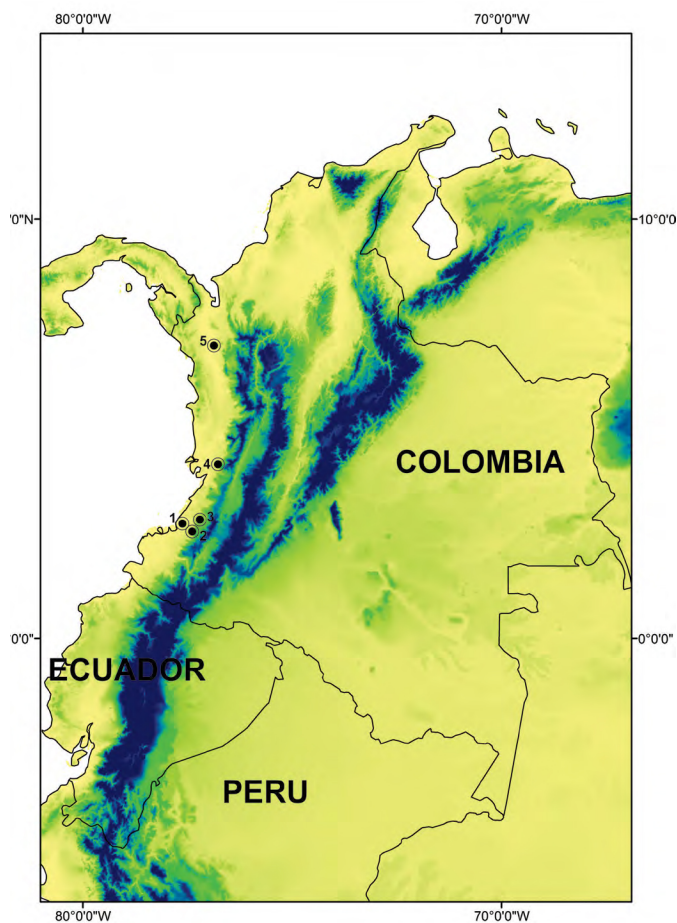


Figure 1. Locality records of *Lophostoma occidentale* in Colombia: 1) La Fragua, Cauca; 2) Calle Santa Rosa, Cauca; 3) Buenaventura, Valle del Cauca; 4) Cuartel B.V. 83, concesión Bajo Calima, Valle del Cauca; 5) Riosucio, PNN Los Katíos, Chocó.

The average of the measurements of external and craniodental characters tend to be larger in *L. silvicolum* than in *L. occidentale* (Table 1). However, all variables overlap in their range. Morphometric variation of Colombian *L. silvicolum* and *L. occidentale* specimens analyzed in our PCA based on skull measurements show no interspecific segregation, or intraspecific geographic structure in *L. silvicolum*. In the PCA, the first two components accounted for most of the observed variation (PC1=55.5; PC2=9.3), with higher loadings on PC1 associated with GSL, CBL, MW, and ML, whereas GSL, MW, and BH had the highest loadings on PC2 (Figure 4).

DISCUSSION

The herein presented records of *L. occidentale* for Colombia represent a significant geographic and ecological extension in the distribution of this taxon. Additionally, we confirmed that the three specimens assigned as *L. s. occidentale* from Department of Valle del Cauca by Alberico (1994), all deposited at UV collections (UV 5673 ♂, UV 5674 ♂, UV 5675 ♀), conform with the diagnosis provided by Velazco and Cadenillas (2011) for *L. occidentale*.



Figure 2. Ventral view of a Colombian *Lophostoma occidentale* (MHNUC 1935 ♀) from the Chocó region, Calle Santa Rosa, Río Saija, Timbiquí, Cauca.



Figure 3. Lateral and ventral views of the skull and mandible of the Colombian *Lophostoma occidentale* ICN 5928 ♀, from Buenaventura, Valle del Cauca (GSL: 28.17 mm).

Prior Velazco and Cadenillas (2011), it was difficult to define the northern limits of *L. s. occidentale* and this is probably the reason for which the taxon was not reported for the western portion of the country in recent checklists (Alberico et al. 2000; Mantilla-Meluk and Jiménez-Ortega 2006; Mantilla-Meluk et al. 2009). As mentioned above, Colombian *L. occidentale* match all cranial characters in Velazco and Cadenillas (2011) re-description of the species. However, Colombian specimens share a paler dorsal coat color, grayish brown rather than chocolate brown, as in typical *L. silvicolum*. These Colombian specimens also proved to be variable for the following external diagnostic characters: whitish venter, as described by Davis and Carter (1978); paler throat and naked forearm, as described by Velazco and Cadenillas (2011); and white distinctive postauricular patches, as presented in both descriptions. These variations were found in specimens from the Department of Chocó. The adult male IAvH 4490 has less distinctive postauricular patches, paler throat, and whitish venter, while the adult female ICN 5928 presents distinctive postauricular patches and a frosted throat of same color as the venter. Interestingly, all herein presented Colombian specimens of *L. occidentale* have a dorsal frosted coat color pattern, contrasting the non-frosted *L. silvicolum* dorsal pelage of Colombian specimens also analyzed in this work. In addition, although Davis and Carter (1978) used the size of the middle lower premolar as a diagnostic character of *L. s. occidentale* — not discussed by Velazco and Cadenillas (2011) — we found size and placement of this dental piece variable among Colombian analyzed samples.

Finally, despite specimens from the five Colombian natural regions were included in our PCA, there was no evidence of a morphological gap among *L. occidentale* and *L. silvicolum*. These results are in agreement with findings of Velazco and Cadenillas (2011).

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Table 1. Average, standard deviation, and range of measurements (mm) of external and craniodental characters of Colombian *Lophostoma silvicolum* ($n=25$) and *L. occidentale* ($n=4$) (see Material and Methods for abbreviations).

Variables	<i>L. silvicolum</i>	<i>L. occidentale</i>
E	32.93 ± 2.96 (26.50–42.40)	31.48 ± 1.94 (29.00–33.50)
FA	53.09 ± 1.36 (49.85–55.42)	52.91 ± 3.00 (51.25–57.40)
Mt3	43.68 ± 1.76 (40.50–47.78)	42.96 ± 2.66 (40.70–46.45)
GSL	27.78 ± 0.68 (26.35–29.00)	27.72 ± 0.95 (26.35–28.50)
CBL	22.99 ± 0.64 (22.00–23.95)	22.65 ± 0.61 (22.00–23.35)
ZW	13.26 ± 0.35 (12.80–14.09)	13.02 ± 0.19 (12.80–13.20)
W	13.48 ± 0.53 (12.50–14.22)	13.27 ± 0.54 (12.50–13.75)
BW	10.64 ± 0.3 (10.15–11.28)	10.40 ± 0.14 (10.30–10.60)
BH	10.20 ± 0.33 (9.50–10.79)	10.20 ± 0.42 (9.75–10.73)
PL	11.37 ± 0.44 (10.15–12.28)	11.34 ± 0.44 (10.85–11.80)
PPL	8.41 ± 0.25 (7.95–9.00)	8.19 ± 0.50 (7.64–8.80)
PO	4.07 ± 0.21 (3.55–4.54)	3.93 ± 0.19 (3.70–4.13)
IW	6.28 ± 0.3 (5.85–6.90)	5.87 ± 0.26 (5.50–6.08)
M–M	8.84 ± 0.27 (8.30–9.39)	8.69 ± 0.13 (8.55–8.85)
C–C	5.78 ± 0.34 (5.10–6.44)	5.52 ± 0.23 (5.35–5.85)
TR	9.63 ± 0.28 (9.05–10.09)	9.43 ± 0.19 (9.15–9.57)
MTR	11.09 ± 0.37 (10.05–11.57)	10.80 ± 0.50 (10.05–11.08)
CR	5.45 ± 0.27 (4.98–6.14)	5.48 ± 0.28 (5.10–5.70)
ML	17.56 ± 0.45 (16.8–18.30)	17.32 ± 0.42 (16.80–17.80)

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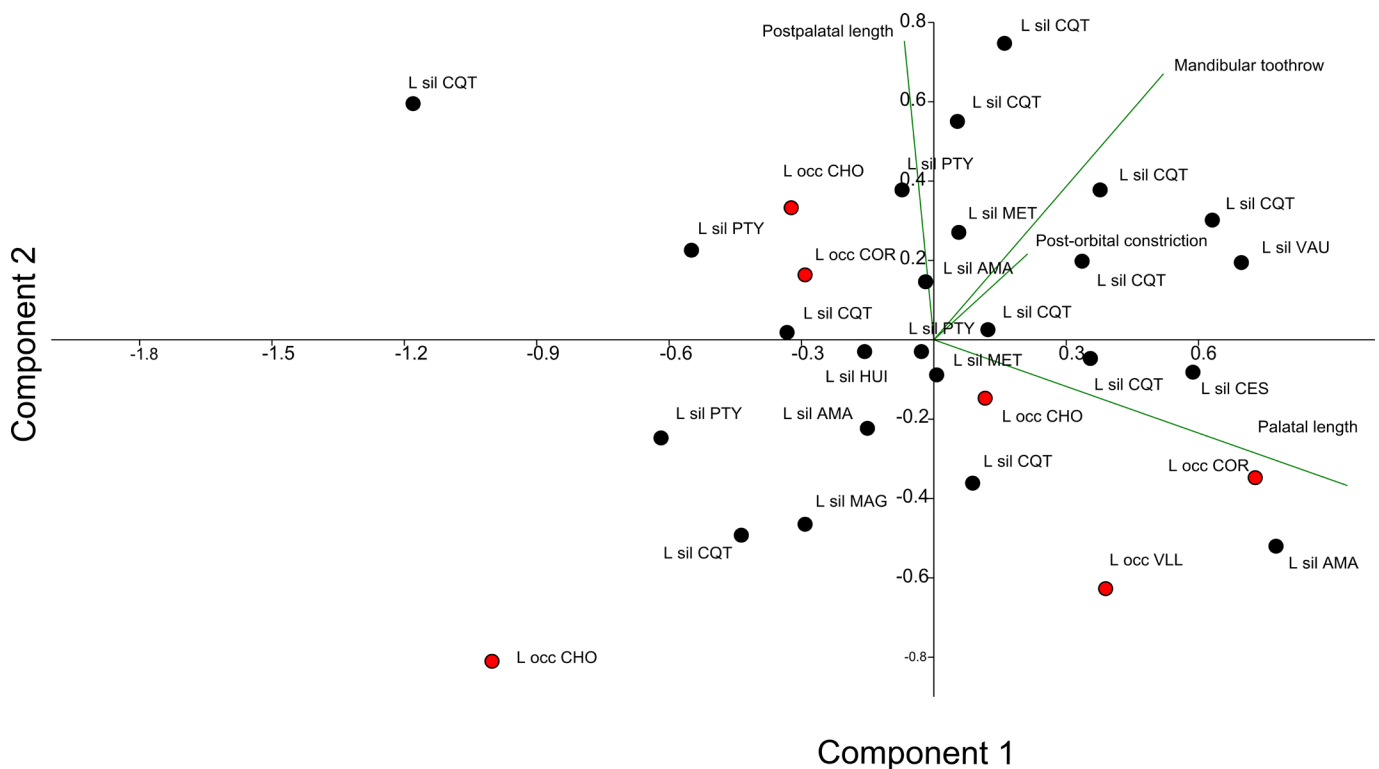


Figure 4. Principal components analysis, performed on skull measurements of 30 adult *Lophostoma* specimens from Colombia: *L. occidentale*: L. occ (red circles); and *L. silvicolum*: L. sil (black circles). The geographic regions are Amazon (including the localities of Amazonas - AMA, Caquetá - CQT, Putumayo - PTY, and Vaupés - VAU), Andes (including Cesar - CES, and Huila - HUI), Caribbean (Córdoba - COR), Orinoco (Meta - MET), and Pacific (Chocó - CHO, and Valle del Cauca - VLL).

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APPENDIX 1. List of specimens examined and their associated localities. Specimens used in our principal components analysis are marked with an asterisk (*).

L. occidentale (n=10): COLOMBIA: Chocó, Riosucio, PNN Los Katios, IAvH 3166 ♀*, IAvH 4490 ♂*, IAvH 4492 ♀*. Valle del Cauca, Buenaventura, 75m, ICN 5928 ♀*; Cuartel B.V. 83, concesión Bajo Calima, UV 5675 ♀, UV 5673 ♂, UV 5674 ♂. Cauca, La Fragua 54 m, MHNUC 2002 ♀; Calle Santa Rosa 18 m, MHNUC 1935 ♀, MHNUC 1936 ♀.

L. silvicolum (n=30): Colombia: Amazonas, La Pedrera 96 m, ICN 21167 ♂*, ICN 21166 ♀*, ICN 17876 ♀*, Rio Amacayacu, Puerto Mogue,

IAVH 1854 ♂. Caquetá, Belén de los Andaquies, 300 m, UAM 506 ♂, (AMV272); Cartagena del Chaira, 270 m, UAM 513 ♂; Chiribiquete, 340 m, ICN 14720 ♂*, ICN 14621 ♀*, ICN 14622 ♂*, ICN 14624 ♀*, ICN 14689 ♀*, ICN 14690 ♂*, ICN 14691 ♂*, IAvH 7140 ♂*, IAvH 7148 ♂*; Florencia, MLS 2039 ♂*, MLS 2064 ♂*, MLS 2065 ♀; Cesar, Serranía del Perijá, 500 m, ICN 19408 *sex undetermined; Córdoba, Montería, 100 m, ICN 17250 ♂*; Pueblo Nuevo, 30 m, ICN 17251 ♀*; Huila, Barayá, 750 m, ICN 13626 ♀*. Magdalena, PNN Tayrona, IAvH 4193 ♀*. Meta, Meseta de San Isidro, 420 m, ICN 11534 ♀*; PNN La Macarena, IAvH 1991 ♀*; Putumayo, Puerto Leguizamo, 140 m, ICN 13777 ♀*, ICN 13778 ♂*, ICN 13779 ♂*, ICN 13780 sex undetermined; Vaupés, Taraira, Caparú, 200 m, ICN 17934 ♂*.