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Glossophaga longirostris.

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Glossophaga longirostris Miller, 1898

Miller's Long-tongued Bat

Glossophaga longirostris Miller, 1898:330. Type locality "Santa Marta Mountains (near Santa Marta), Colombia."
G. elongata Miller, 1900*a*:124. Type locality "Willemstad, Curaçao."
G. rostrata Miller, 1913*a*:32. Type locality "Westerhall Estate, Grenada."
G. major Goodwin, 1958:5. Type locality "Ariapita Avenue, Woodbrook, Port of Spain, Trinidad."

CONTEXT AND CONTENT. Order Chiroptera, Suborder Microchiroptera, Family Phyllostomidae, Subfamily Glossophaginae (Koopman, 1993). Five species of *Glossophaga* are recognized (Webster, 1993; Webster and Jones, 1980); a key to the species is in Webster and Jones (1984). Six subspecies of *Glossophaga longirostris* currently are recognized (Webster and Handley, 1986):

G. l. campestris Webster and Handley, 1986:6. Type locality "Hato San José, 20 km. W Paragua (=146 km. S, 7 km. E Ciudad Bolívar), Bolívar, Venezuela, 300 m."
G. l. elongata Miller, 1900*a*, see above.
G. l. longirostris Miller, 1898, see above.
G. l. major Goodwin, 1958, see above.
G. l. reclusa Webster and Handley, 1986:6. Type locality "4 km. E Villavieja, Huila, Colombia, 1400 ft."
G. l. rostrata Miller, 1913*a*, see above.

DIAGNOSIS. *Glossophaga longirostris* (Fig. 1) is the largest member of the genus in most external and cranial dimensions; however, it can be distinguished from its congeners only by a set of cranial and dental characters (Webster, 1993; Webster and Handley, 1986). The diagnostic characters are as follows: premaxillae elongate anteriorly; pterygoid alae absent; presphenoid ridge usually high and complete throughout; mandibular symphyseal ridge absent, chin of mandible receding at a 45° angle; upper incisors noticeably and equally procumbent, I2 equal to I1 in bulk in occlusal view; P4 with reduced lingual cingular shelf; M1 narrow; parastyle of M1 usually absent or, if present, minute and directed posterolabially from paracone; mesostyle of M1 reduced, continuous with labial outline of tooth; fourth commissure of M1 long, well developed, and always longer than the third; M2 similar in shape to M1 except parastyle better developed, directed labially; lower incisors large and usually in contact, subtriangular in occlusal view, equal in bulk; p4 narrow, similar to p2 and p3 in bulk (Fig. 2).

GENERAL CHARACTERS. *Glossophaga longirostris* is similar to other glossophagine bats in external appearance (Fig. 1). The rostrum is slightly elongate, the lower jaw is delicate, and the tongue is extremely protrusible and covered anteriorly and labially

FIG. 1. Photograph of live *Glossophaga l. longirostris* from Lagunillas, Mérida, Venezuela.

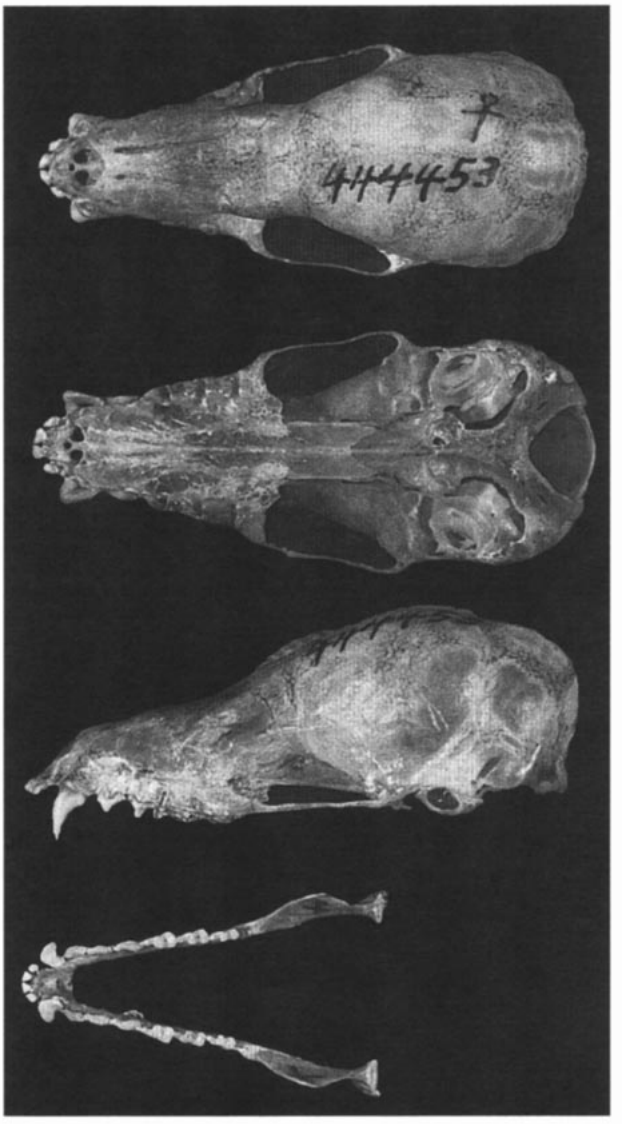

FIG. 2. Dorsal, ventral, and lateral views of cranium and dorsal view of lower jaw of *Glossophaga l. longirostris* (female, USNM 444453, from La Isla, near Cojoro, 37 km NNE Paraguipoa, Guajira, Colombia, 15 m). Greatest length of skull, including incisors, is 24.3 mm.

by numerous feather-like papillae. The noseleaf averages 6.1 mm in length (range, 5.7–6.4) in specimens referrable to *G. l. campestris* (Webster and Handley, 1986). The pelage is bicolored, with the tips of individual hairs darker than the paler bases. The coloration (capitalized terms from Ridgway, 1912) of the dorsal pelage ranges from Wood Brown to Fuscous, whereas the ventral pelage ranges from Avellaneous to Clove Brown (Webster and Handley, 1986). Occasional individuals from throughout the range of the species have randomly placed dot-like patches of white fur interspersed throughout otherwise normally-colored pelage (Webster, 1993), and one individual from Cantaura, Venezuela, was albinistic (Setzer, 1950).

Females are significantly larger than males in measurements of cranial length and the forearm (Webster, 1993). Adult males have significantly greater body mass, averaging 13.3 g (range, 10.3–16.0) as opposed to 12.8 g (9.8–14.3) for adult nonparous females (Webster and Handley, 1986). Measurements (in mm) recorded from specimen labels for 57 males and 66 females, respectively, from throughout the range of the species (Webster, 1993) are as follows: total length, 52–75, 58–80; length of tail, 4–12, 4–18; length of hind foot, 9–15, 8.5–14; length of ear from notch, 11–18, 11–20. Males also have significantly longer canines (Handley and Webster, 1987), averaging 2.32 mm (n = 14) as opposed to 2.18 mm in females (n = 9).

The six subspecies differ in external and cranial dimensions (Webster and Handley, 1986). *G. l. campestris* of the llanos of Venezuela and grasslands surrounding the Kanuku Mountains in Guyana and adjacent Brazil is relatively small in external and cranial measurements, but it has moderately large postorbital swellings. *G. l. elongata* of the Netherlands Antilles has small wing measurements and a moderately long, narrow cranium. *G. l. longirostris* of northern Colombia and northwestern Venezuela has moderately large external and cranial measurements, reduced postorbital swellings, and a slightly dished facial profile. *G. l. major* of Trinidad, coastal Venezuela, and the high llanos of Colombia has a short, high braincase, dished facial profile, and inflated postorbital swellings. *G. l. reclusa* of the upper Magdalena River Valley of Colombia is massive in external and cranial dimensions, and it has well-developed postpalatal processes. *G. l. rostrata* of Tobago and the Windward Islands from Grenada northward to St. Vincent has a narrow rostrum, moderately reduced postorbital swellings, a low and narrow braincase, and zygomata that converge anteriorly.

Average forearm and cranial measurements (in mm, range in parenthesis) for males and females of *G. l. campestris* (n = 67 and 65), *G. l. elongata* (n = 12 and 8), *G. l. longirostris* (n = 36 and 28), *G. l. major* (n = 26 and 37), *G. l. reclusa* (n = 9 and 10), and *G. l. rostrata* (n = 9 and 17), respectively (Webster and Handley, 1986), are as follows: length of forearm, 36.9 (35.5–38.1), 37.3 (35.9–38.7); 37.3 (36.1–38.3), 37.7 (36.5–39.0); 38.1 (35.9–39.7), 38.7 (37.0–40.3); 37.2 (35.0–38.9), 38.2 (36.1–40.0); 39.4 (38.7–40.5), 40.4 (39.5–41.4); 37.8 (36.6–38.9), 38.4 (36.5–40.2); greatest length of skull, 21.9 (21.0–23.0), 22.0 (21.2–22.7); 23.2 (22.7–23.6), 23.5 (23.0–24.2); 23.4 (22.4–23.8), 23.6 (23.0–24.2); 22.4 (21.4–23.2), 22.6 (21.8–23.5); 23.6 (23.2–24.3), 23.8 (23.0–24.4); 22.4 (22.2–22.7), 23.0 (22.6–23.6); zygomatic breadth, 9.7 (9.3–10.2), 9.6 (9.0–10.3); 9.4 (8.7–9.8), 9.5 (9.3–9.8); 10.2 (9.4–10.6), 10.2 (10.0–10.6); 9.9 (9.6–10.3), 9.9 (9.3–10.2); 10.4 (10.1–10.7), 10.2 (9.6–10.6); 9.9 (9.7–10.1), 9.8 (9.3–10.2); breadth of braincase, 8.8 (8.4–9.1), 8.7 (8.4–9.1); 8.5 (8.3–8.8), 8.6 (8.5–8.8); 9.1 (8.7–9.7), 9.1 (8.8–9.4); 8.9 (8.5–9.3), 8.9 (8.6–9.2); 9.0 (8.8–9.3), 9.0 (8.7–9.3); 8.6 (8.4–8.8), 8.9 (8.7–9.1); postorbital breadth, 4.6 (4.2–4.9), 4.6 (4.3–4.9); 4.5 (4.2–4.7), 4.6 (4.5–4.7); 4.8 (4.5–5.0), 4.8 (4.5–5.1); 4.6 (4.5–4.9), 4.6 (4.4–4.9); 4.9 (4.7–5.0), 4.8 (4.6–5.0); 4.6 (4.5–4.8), 4.7 (4.5–4.8); breadth across canines, 3.9 (3.6–4.3), 3.9 (3.5–4.1); 4.1 (3.9–4.3), 4.0 (3.9–4.1); 4.3 (4.1–4.5), 4.1 (3.8–4.4); 4.0 (3.7–4.3), 4.0 (3.8–4.2); 4.5 (4.3–4.6), 4.3(4.2–4.5); 4.1 (3.8–4.3), 4.0 (3.7–4.3); length of maxillary toothrow, 7.5 (7.1–8.0), 7.6 (7.4–7.9); 8.0 (7.7–8.1), 8.1 (7.8–8.4); 8.0 (7.7–8.5), 8.2 (7.8–8.5); 7.7 (7.4–8.3), 7.9 (7.5–8.2); 8.3 (7.9–8.6), 8.4 (8.2–8.5); 7.8 (7.6–7.9), 7.9 (7.7–8.2).

DISTRIBUTION. Miller's long-tongued bat is known from northern South America and several islands relatively near the mainland (Fig. 3). It is distributed continuously from northern Colombia eastward throughout coastal Venezuela and southward throughout the llanos of Venezuela and Colombia. Isolated inland populations are known from the upper Magdalena River Valley of

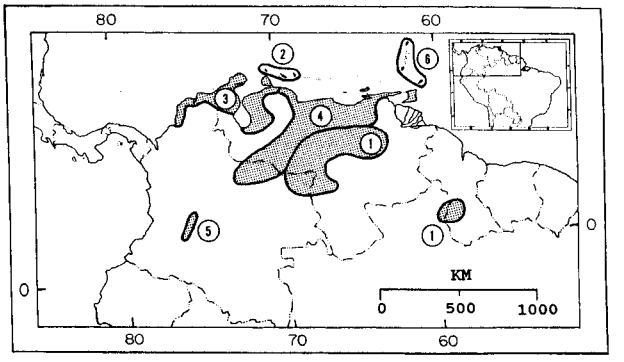

FIG. 3. Geographic distribution of *Glossophaga longirostris* after Webster and Handley (1986) and Soriano et al. (1991): 1, *G. l. campestris;* 2, *G. l. elongata;* 3, *G. l. longirostris;* 4, *G. l. major;* 5, *G. l. reclusa;* 6, *G. l. rostrata.*

Colombia (Tamsitt and Valdivieso, 1963; Valdivieso, 1964; Webster and Handley, 1986), the Kanuku Mountains of Guyana and adjacent Brazil (Webster and Handley, 1986), and several xeric rainshadow valleys in the Venezuelan Andes (Soriano et al., 1991). Insular populations have been reported from the Netherlands Antilles, Isla Margarita, Isla de Conejo, Trinidad, Tobago, the Grenadines, Grenada, and St. Vincent (Webster and Handley, 1986), but not from Dominica (Handley and Webster, 1987). The elevational range of the species is from sea level to ca. 650 m. Most records, however, are from <500 m in elevation.

Glossophaga longirostris also has been reported from localities in coastal Ecuador (Albuja, 1983), Colombia (Morales-Alarcón et al., 1968; Valdivieso and Tamsitt, 1962), and Venezuela (Pirlot, 1965) that are not shown in Fig. 3. Cranial photographs and measurements indicate that the Ecuadorian specimens are referrable to *Glossophaga soricina valens* (Webster, 1993). Colombian records from Mesitas del Colegio in Cundinimarca, Mariquita in Tolima, and Villavicencio in Meta (Valdivieso and Tamsitt, 1962) were disregarded (Webster and Handley, 1986) because they were not referred to in subsequent publications by the same authors (Tamsitt and Valdivieso, 1963; Valdivieso, 1964). The Colombian record from Santander (Morales-Alarcón et al., 1968) was omitted because the subspecific identity of bats from this region is not known (Webster and Handley, 1986). The record from Guayo, T. F. Delta Amacuro, Venezuela (Pirlot, 1965), was rebuffed (Webster and Handley, 1986) because the xeric environments preferred by *G. longirostris* are not found in Delta Amacuro.

FOSSIL RECORD. *Glossophaga longirostris* (identified as *G. soricina*) is known from sub-Recent deposits at Cueva de Quebrada Honda, Aragua, Venezuela (Linares, 1968).

FORM AND FUNCTION. Adult *G. longirostris* molt annually between June and November; however, molt is not synchronous among individuals from the same locality at any given time (Webster and Handley, 1986). Worn fur is shed in irregular patches when the underlying new hair has grown to half its normal length. Hair on the head and shoulders generally is the first to be replaced, but in some specimens the hair on the back is replaced first. Although molt is generally restricted to reproductively inactive females, Webster and Handley (1986) reported a pregnant female that was molting.

In *G. longirostris,* each subscapular hair has smooth, imbricate, and petal-shaped scales, two of which surround the shaft at any given height. The scales flare distally from the shaft at the base and tip of each hair but cling to the shaft in the middle region (Webster, 1993).

The dental formula for *G. longirostris* is i 2/2, c 1/1, p 2/3, m 3/3, total 34; however, four of 194 specimens (2.1%) examined by Webster (1993) exhibited hyperdontia. One female had an extra upper incisor and three females each had an extra lower incisor. Another specimen, an adult male, lacked metacristae and metastyles on both M2s, but the remainder of the dental arcade was normal. An individual that lacked both M3s has been reported (Miller, 1900*a*).

Compared with other phyllostomids, *G. longirostris* has a rel-

atively short forearm but a relatively long third metacarpal and second phalanx of the fifth digit. This results in a wing with a relatively high tip index and aspect ratio (Smith and Starrett, 1979).

Fresh body mass and percentage ash (dry mass) do not vary throughout the year in adult *G. longirostris*. However, percentages of water and dry caloric content, respectively, are significantly greater during the rainy season (71.5%, 5.5 Kcal g^{-1}), when fruit is more commonly consumed, than during the dry season (68.3%, 4.0 Kcal g^{-1}), when pollen is favored (Cabello and Soriano, 1993).

For short periods of time (1.5–3.0 h), Miller's long-tongued bat is able to maintain a relatively high and constant body temperature (37.4°C) over a broad range of ambient temperatures (10–30°C—Arends et al., 1995). Its lower critical temperature is 31.5°C and its upper critical temperature is ca. 37°C. Within its thermoneutral zone, the basal metabolic rate is 120% greater and thermal conductance is 112% greater than would be predicted from its body mass (Arends et al., 1995).

REPRODUCTION. The reproductive strategy of *Glossophaga longirostris* is one of uniparous bimodal polyestry. One period of pregnancy extends from December to April and another extends from June to October for 383 specimens collected throughout the range of the species. Lactating females have been collected in all months except February (Webster and Handley, 1986). On Curaçao volant young, subadults, and adults were collected in August, indicating the end of a recent reproductive cycle (Genoways and Williams, 1979).

One population of *G. longirostris* isolated in a rain-shadow island of xeric vegetation in the Venezuelan Andes had two annual reproductive peaks correlated with the flowering and fruiting of Cactaceae and Moraceae that dominated the habitat (Sosa and Soriano, 1996). Pregnant females were common from the end of the long dry season to the height of the first rainy season (January to May) and throughout the second rainy season (July to November). Duration of gestation was estimated to be three months, during which time female body mass increased by as much as 25%. Late-term embryos weighed up to 4.5 g. Juveniles were present in every month except April, with peaks in numbers in June and October.

ECOLOGY. Miller's long-tongued bat inhabits arid thorn forests, deciduous and evergreen forests, and savannas (Webster and Handley, 1986). In Venezuela, the distribution of 837 specimens was characterized by the following ecological parameters: habitat type—thorn forest (49%), savannas and other open areas (43%), and moist forests (8%); site moisture—dry areas (65%) or near streams and other moist areas (35%); vegetative life zone—tropical dry forest (43%), tropical thorn forest (35%), tropical very dry forest (17%), other dry zones (1%), and moist zones (4%—Handley, 1976).

Individuals have been collected from daytime roosts such as caves, tunnels, culverts, crevices in rocks, hollow trees, and houses and other edifices, or taken in mist nets set over water near farm buildings, in gallery forest, in peach and mango orchards, or in the habitats listed above (G. M. Allen, 1902, 1911; J. A. Allen, 1900, 1911; Genoways and Williams, 1979; Goodwin and Greenhall, 1961; Handley, 1976; Husson, 1954; Jones, 1951; Miller, 1898, 1900*b*, 1913*a*; Pirlot, 1963, 1964; Pirlot and León, 1965; Robinson and Lyon, 1901; Smith and Genoways, 1974; Tamsitt and Valdivieso, 1963; Valdivieso, 1964; Webster and Handley, 1986). In semiarid thorn forest in northern Venezuela, *G. longirostris* roosts in small numbers (<20 individuals) near the entrances of caves, which are relatively cool (26.7–28.7°C) and well ventilated, rather than in the interiors of caves, which are warmer (33–36°C) and poorly ventilated (Arends et al., 1995; Bonaccorso et al., 1992). Other bats known to share daytime roosts with Miller's long-tongued bat include *Peropteryx macrotis, Mormoops megalophylla, Pteronotus davyi, P. personatus, Micronycteris megalotis, Phyllostomus hastatus, Glossophaga soricina, Leptonycteris curasoae,* and *Carollia perspicillata* (Arends et al., 1995; Bonaccorso et al., 1992; Goodwin and Greenhall, 1961; Robinson and Lyon, 1901). There is, however, pronounced spatial separation of species roosting in caves in northern Venezuela, with mormoopids and maternity colonies of *Leptonycteris* selecting roost sites in warmer cave interiors rather than at cooler cave entrances (Arends et al., 1995; Bonaccorso et al., 1992).

Glossophaga longirostris is thought to feed on fruit, pollen, and nectar, with some insects taken incidentally (Gardner, 1977). Fecal analyses indicate that nectar, pollen, and fruit of columnar cacti (*Stenocereus griseus, Subpilocereus repanus, Pilocereus tillianus*) and the fruit of "palo de mora" (Moraceae: *Chlorophora tinctoria*) comprise the bulk of its mixed diet in the semiarid shrub habitat in Mérida, Venezuela (Soriano et al., 1991; Sosa and Soriano, 1993, 1996). Flowering and fruiting cycles vary among plant species so that both pollen and fruit are available to the bats throughout the year; however, fruit is more commonly consumed during rainy seasons and pollen is more important during dry seasons. Fruit and pollen comprise 55% and 44% of the total annual diet, respectively, with incidental insects contributing 1%. *G. longirostris* appears to be important in the pollination and seed dispersal of these columnar cacti (Soriana et al., 1991; Sosa and Soriano, 1996). In Colombia, Miller's long-tongued bat consumes pollen of several species of cacti and *Helicteris baruensis*, fruit of several cacti species and *Muntingia calabura*, and few insects (Espinoza et al., 1995).

Ectoparasites of *G. longirostris* include labidocarpid mites (*Alabidocarpus furmani, Parakosa maxima,* and *P. tadarida*), spinturnicid mites (*Periglischrus caligus, P. iherinqi,* and *P. ojastii*), and trombiculid mites (*Eutrombicula qoeldii, Hooperella vesperuginis, Loomisia desmodus, L. yunkeri, Perissopalla precaria,* and *Whartonia nudosetosa*), argasid ticks (*Ornithodoros azteci, O. hasei,* and *O. rossi*) and ixodid ticks (*Amblyomma*), and streblid batflies (*Megistopoda aranea, Nycterophila coxata, Paraeuctenodes longipes, Strebla curvata, S. wiedemanni, Trichobioides perspicillatus, Tricobius dugesii, T. parasiticus, T. sphaeronotus, T. uniformis*) (Brennan and Reed, 1975; Herrin and Tipton, 1975; Reed and Brennan, 1975; Webb and Loomis, 1977; Wenzel, 1976). *G. longirostris* from Colombia was rabies negative (Morales-Alarcón et al., 1968).

BEHAVIOR. In islands of xeric vegetation in the Venezuelan Andes, seasonal asynchrony among food plants and scarcity of flowers or fruit per plant may force *G. longirostris* to employ a solitary foraging strategy (Sosa and Soriano, 1996). There is no evidence, however, that *G. longirostris* forages in groups when food resources are abundant.

GENETICS. The standard karyotype of *G. longirostris* consists of 2n = 32 chromosomes with FN = 60 (Baker, 1979). Autosomes range in size from large to small and in morphology from metacentric to subtelocentric. The X chromosome is a medium-sized metacentric and the Y is a minute acrocentric.

According to an electrophoretic study of five species of *Glossophaga* based on 17 loci, *G. longirostris* most closely resembles *G. morenoi*, then, in descending order, *G. leachii, G. commissarisi,* and *G. soricina*. However, no fixed alleles separates *G. longirostris* from its congeners. Heterozygosity was 0.0000 in 10 specimens of *G. l. rostrata* from Carriacou Island (Grenadines) and one individual of *G. l. major* from Guarico, Venezuela, 0.0353 in 10 specimens of *G. l. rostrata* from Union Island (Grenadines), and 0.0117 in 10 specimens of *G. l. rostrata* from Grenada. The percentage of polymorphic loci for these samples was 0.00, 0.00, 11.76, and 11.76, respectively (Webster, 1993).

REMARKS. Handley and Webster (1987) argued that the holotype of *Glossophaga rostrata* Miller is a composite, consisting of a male skin with a female skull. Because the characters most useful in taxonomic studies of *Glossophaga* are cranial, they restricted the holotype designation to the female skull, thereby relegating the male skin to the status of a paratype. A series of bats from Boquerón de San Francisco, Colombia, originally described by J. A. Allen (1916) as *Glossophaga apolinari* and listed by Cabrera (1958) as *Glossophaga longirostris apolinari*, represent *Anoura geoffroyi* according to Sanborn (1933) and Webster and Handley (1986).

The generic name *Glossophaga* combines the Greek roots *glossa,* tongue, and *phage,* to eat. The specific name combines the Latin roots *longi,* long, and *rostrum,* beak or snout.

There is much disagreement regarding the phylogenetic relationships among the 16 genera of long-tongued bats in the Family Phyllostomidae (Baker et al., 1989). Koopman (1993), without comment but in agreement with Griffiths (1982), separated these genera into four subfamilies, with *Glossophaga* and nine other genera comprising the Subfamily Glossophaginae. An alternative taxonomic arrangement proposed by Baker et al. (1989) places the 16 genera

of long-tongued bats, including *Glossophaga,* in the Subfamily Phyllostominae, Tribe Glossophagini.

LITERATURE CITED

ALBUJA, L. 1983. Murciélagos del Ecuador. Escuela Politécnica Nacional, Quito, Ecuador, 285 pp.

ALLEN, G. M. 1902. The mammals of Margarita Island, Venezuela. Proceedings of the Biological Society of Washington, 15:91–97.

———. 1911. Mammals of the West Indies. Bulletin of the Museum of Comparative Zoology, 52:25–63.

ALLEN, J. A. 1900. List of bats collected by Mr. H. H. Smith in the Santa Marta region of Colombia, with descriptions of new species. Bulletin of the American Museum of Natural History, 13:87–94.

———. 1911. Mammals from Venezuela collected by Mr. M. A. Carriker, Jr., 1909–1911. Bulletin of the American Museum of Natural History, 30:239–273.

———. 1916. New South American mammals. Bulletin of the American Museum of Natural History, 35:83–87.

ARENDS, A., F. J. BONACCORSO, AND M. GENOUD. 1995. Basal rates of metabolism of nectivorous bats (Phyllostomidae) from a semiarid thorn forest in Venezuela. Journal of Mammalogy, 76:947–956.

BAKER, R. J. 1979. Karyology. Pp. 107–155, *in* Biology of bats of the New World family Phyllostomatidae. Part III (R. J. Baker, J. K. Jones, Jr., and D. C. Carter, eds.). Special Publications, The Museum, Texas Tech University, 16:1–441.

BAKER, R. J., C. S. HOOD, AND R. L. HONEYCUTT. 1989. Phylogenetic relationships and classification of the higher categories of the New World bat family Phyllostomidae. Systematic Zoology, 38:228–238.

BONACCORSO, F. J., A. ARENDS, M. GENOUD, D. CANTONI, AND T. MORTON. 1992. Thermal ecology of moustached and ghost-faced bats (Mormoopidae) in Venezuela. Journal of Mammalogy, 73:365–378.

BRENNAN, J. M., AND J. T. REED. 1975. A list of Venezuelan chiggers, particularly of small mammalian hosts (Acarina: Trombiculidae). Brigham Young University Science Bulletin, Biological Series, 20(1):45–75.

CABELLO, D. R., AND P. J. SORIANO. 1993. Calorimetria de los murcielagos *Glossophaga longirostris* y *Desmodus rotundus* de una zone arida de los Andes venezolanos. Revista Brasileira de Biologia, 53:601–609.

CABRERA, A. 1958. Catálogo de los mamíferos de América del Sur. Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Ciencias Zoológicas, 4:1–308.

ESPINOZA, A. R., M. SANTOS, P. SORIANO, J. CAVELIER, AND A. CADENA. 1995. Ecological relationships between *Glossophaga longirostris* (Phyllostomidae) and columnar cacti in a tropical dry forest-thorn shrubland of Colombia. Bat Research News, 36:63.

GARDNER, A. L. 1977. Feeding habits. Pp. 293–350, *in* Biology of bats of the New World family Phyllostomatidae. Part II (R. J. Baker, J. K. Jones, Jr., and D. C. Carter, eds.). Special Publications, The Museum, Texas Tech University, 13:1–364.

GENOWAYS, H. H., AND S. L. WILLIAMS. 1979. Notes on bats (Mammalia: Chiroptera) from Bonaire and Curaçao, Dutch West Indies. Annals of the Carnegie Museum, 48:311–321.

GOODWIN, G. G. 1958. Three new bats from Trinidad. American Museum Novitates, 1877:1–6.

GOODWIN, G. G., AND A. M. GREENHALL. 1961. A review of the bats of Trinidad and Tobago. Bulletin of the American Museum of Natural History, 122:187–301.

GRIFFITHS, T. A. 1982. Systematics of the New World nectar-feeding bats (Mammalia, Phyllostomidae), based on features of the morphology of the hyoid and lingual regions. American Museum Novitates, 2742:1–45.

HANDLEY, C. O., Jr. 1976. Mammals of the Smithsonian Venezuelan Project. Brigham Young University Science Bulletin, Biological Series, 20(5):1–89.

HANDLEY, C. O., JR., AND W. D. WEBSTER. 1987. The supposed occurrence of Glossophaga longirostris Miller on Dominica and problems with the type series of Glossophaga rostrata Miller. Occasional Papers, The Museum, Texas Tech University, 108:1–10.

HERRIN, C. S., AND V. J. TIPTON. 1975. Spinturnicid mites of Venezuela (Acarina: Spinturnicidae). Brigham Young University Science Bulletin, Biological Series, 20(2):1–72.

HUSSON, A. M. 1954. On Vampyrodes caracciolae (Thomas) and some other bats from the island of Tobago (British West Indies). Zoologische Mededelingen, Leiden, 33:63–67.

IBAÑEZ U., C. J. 1984. Biología y ecología de los murciélagos del Hato "El Frío" Apure, Venezuela. Doñana Acta Vertebrata, 8(4):1–271.

JONES, T. S. 1951. Bat records from the islands of Grenada and Tobago, British West Indies. Journal of Mammalogy, 32:223–224.

KOOPMAN, K. F. 1993. Order Chiroptera. Pp. 137–241, *in* Mammal species of the world: a taxonomic and geographic reference. Second ed. (D. E. Wilson and D. M. Reeder, eds.). Smithsonian Institution Press, Washington, District of Columbia, 1206 pp.

LINARES, O. J. 1968. Quirópteros subfósiles encontrados en las cuevas venezolanas. Boletín de la Sociedad Venezolana de Espeleología, 1:119–145.

MILLER, G. S., JR. 1898. Descriptions of five new phyllostome bats. Proceedings of the Academy of Natural Sciences of Philadelphia, 50:326–337.

———. 1900*a*. Three new bats from the island of Curaçao. Proceedings of the Biological Society of Washington, 13:123–127.

———. 1900*b*. A second collection of bats from the island of Curaçao. Proceedings of the Biological Society of Washington, 13:159–162.

———. 1913*a*. Five new mammals from tropical America. Proceedings of the Biological Society of Washington, 26:31–33.

———. 1913*b*. Revision of bats of the genus Glossophaga. Proceedings of the United States National Museum, 46:413–429.

MORALES-ALARCÓN, A., E. OSORNO-MESA, C. BERNAL CUBIDES, AND A. LLERAS PIZZARO. 1968. Aislamiento de virus rábico de murciélagos en Colombia, S. A. Caldasia, 10:167–172.

PIRLOT, P. 1963. Algunas consideraciónes sobre la ecología de los mamíferos del oest de Venezuela. Revista de la Universidad del Zulia, Kasmera, 1:169–214.

———. 1964. Nota sobre la ecología de ciertos quirópteros de la región del Río Palmar (Venezuela). Revista de la Universidad del Zulia, Kasmera, 1:289–307.

———. 1965. Chiroptères de l'est de Venezuela. II: Delta de l'Orénoque. Mammalia, 29:375–389.

PIRLOT, P., AND J. R. LEÓN. 1965. Chiroptères de l'est de Venezuela. I: Région de Cumana et Ile de Margarita. Mammalia, 29:367–374.

REED, J. T., AND J. M. BRENNAN. 1975. The subfamily Leeuwenhoekinae in the neotropics (Acarina: Trombiculide). Brigham Young University Science Bulletin, Biological Series, 20(1):1–42.

RIDGWAY, R. 1912. Color standards and color nomenclature. R. Ridgway, Washington, District of Columbia, 340 pp.

ROBINSON, W., AND M. W. LYON, JR. 1901. An annotated list of the mammals collected in the vicinity of La Guaira, Venezuela. Proceedings of the United States National Museum, 24:135–162.

SANBORN, C. C. 1933. Bats of the genera *Anoura* and *Lonchoglossa.* Field Museum of Natural History, Zoology Series, 20: 23–27.

SETZER, H. W. 1950. Albinism in bats. Journal of Mammalogy, 31:350.

SMITH, J. D., AND H. H. GENOWAYS. 1974. Bats of Margarita Island, Venezuela, with zoogeographic comments. Bulletin of the Southern California Academy of Sciences, 73:64–79.

SMITH, J. D., AND A. STARRETT. 1979. Morphometric analysis of chiropteran wings. Pp. 229–316, *in* Biology of bats of the New World family Phyllostomatidae. Part III (R. J. Baker, J. K. Jones, Jr., and D. C. Carter, eds.). Special Publications, The Museum, Texas Tech University, 16:1–441.

SORIANO, P. J., M. SOSA, AND O. ROSSELL. 1991. Hábitos alimentarios de *Glossophaga longirostris* Miller (Chiroptera: Phyllostomidae) en una zona árida de los Andes venezolanos. Revista de Biología Tropical, 39:263–268.

SOSA, M., AND P. J. SORIANO. 1993. Solapamiento de dieta entre *Lentonycteris curasoae* y *Glossophaga longirostris* (Mammalia: Chiroptera). Revista de Biología Tropical, 41:529–532.

———. 1996. Resource availability, diet and reproduction in *Glossophaga longirostris* (Mammalia: Chiroptera) in an arid

zone of the Venezuelan Andes. Journal of Tropical Ecology, 12:805–818.

TAMSITT, J. R., AND D. VALDIVIESO. 1963. Records and observations on Colombian bats. Journal of Mammalogy, 44:168–180.

VALDIVIESO, D. 1964. La fauna quiróptera del Departamento de Cundinimarca, Colombia. Revista de Biología Tropical, 12:19–45.

VALDIVIESO, D., AND J. R. TAMSITT. 1962. First records of the pale spear-nosed bat in Colombia. Journal of Mammalogy, 43: 422–423.

WEBB, J. P., JR., AND R. B. LOOMIS. 1977. Ectoparasites. Pp. 57–119, *in* Biology of bats of the New World family Phyllostomatidae. Part II (R. J. Baker, J. K. Jones, Jr., and D. C. Carter, eds.). Special Publications, The Museum, Texas Tech University, 13:1–364.

WEBSTER, W. D. 1993. Systematics and evolution of bats of the genus Glossophaga. Special Publications, The Museum, Texas Tech University, 36:1–184.

WEBSTER, W. D., AND C. O. HANDLEY, JR. 1986. Systematics of Miller's long-tongued bat, Glossophaga longirostris, with description of two new subspecies. Occasional Papers, The Museum, Texas Tech University, 100:1–22.

WEBSTER, W. D., AND J. K. JONES, JR. 1980. Taxonomic and nomenclatorial notes of bats of the genus Glossophaga in North America, with description of a new species. Occasional Papers, The Museum, Texas Tech University, 71:1–12.

———. 1984. Glossophaga leachii. Mammalian Species, 226:1–3.

WENZEL, R. L. 1976. The streblid batflies of Venezuela (Diptera: Streblidae). Brigham Young University Science Bulletin, Biological Series, 20(4):1–177.

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