**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, 1900a:124. Type locality “Willemstad, Curaçao.”

*G. rostrata* Miller, 1913a: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, 1966:6. 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, 1900a, 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, 1913a, 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; prephenoid ridge usually high and complete throughout; mandibular symphysal ridge absent, chin of mandible receding at a 45° angle; upper incisors noticeably and equally procumbent, 12 equal to 11 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.

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**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 Cojóro, 37 km NNE Paraguapoa, Guajira, Colombia, 15 m). Greatest length of skull, including incisors, is 24.3 mm.
by numerous feather-like papillae. The rosette averages 6.1 mm in length (range, 5.7–6.4) in specimens referable to G. l. campesi (Webster and Handley, 1986). The pelage is bicolor, 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 Clowen Brown (Webster and Handley, 1986).

Occasional individuals from throughout the range of the species have rarely placed white dot-like patches of white fur interspersed throughout otherwise normally-colored pelage (Webster, 1993), and one individual from Cantauna, Venezuela, was albino (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 37 males and 66 females, respectively, from throughout the range of the species (Webster, 1993) are as follows: total length, 52–75, 38–80; 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, 1967), 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. campesi 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 northeastern Venezuela has moderately large external and cranial measurements, reduced postorbital swellings, and a slightly dish-faced profile. G. l. major of Trinidad, coastal Venezuela, and the high llanos of Colombia has a short, high braincase, dish-faced 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. campesi (n = 16 and 65), G. l. elongata (n = 12 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, 38.9 (35.5–38.9); 37.3 (35.0–37.5); 37.7 (35.0–38.9); 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); 23.0 (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 (21.8–23.3); 23.6 (23.2–24.3); 23.8 (23.0–24.4); 22.4 (22.2–22.7); 23.0 (22.6–23.6); 23.0 (22.6–23.6); 23.0 (22.6–23.6); 23.0 (22.6–23.6); 23.0 (22.6–23.6); 23.0 (22.6–23.6); 23.0 (22.6–23.6); 23.0 (22.6–23.6). 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 rain-shadow valleys in the Venezuelan Andes (Soriano et al., 1991).

Isolated populations have been reported from the Netherlands Antilles, Isla Margarita, Isla de Coneyo, 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 <500 m in elevation.

Glossophaga longirostris also has been reported from localities in coastal Ecuador (Albija, 1983), Colombia (Morales-Alarcon 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 referable to Glossophaga soricina valencia (Webster, 1993). Colombian records from Mesitas del Colegio in Cundinamarca, 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-Alarcon et al., 1968) was omitted because the subspecific identity of bats from this region is not known (Webster and Handley, 1986). The record from Guaya, T. F. Delta Amacuro, Venezuela (Pirlot, 1965), was disregarded (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, Araquà, 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 reproductive inactive females, Webster and Handley (1986) reported a pregnant female that was molting.

In G. longirostris, each subcaudal 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, 1959).

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 meta- cristae on both M2s, but the remainder of the dental arcade was normal. An individual that lacked both M3s has been reported (Miller, 1900a).

Compared with other phyllostomids, G. longirostris has a rel-
attively short forearm but a relatively long third metacarpal and second phalanges 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 of dry mass vary during the rainy season (71.5%, 5.5 Kcal g⁻¹), when fruit is more commonly consumed, than during the dry season (68.6%, 4.0 Kcal g⁻¹), when pollen is favored (Cabello and Soriano, 1990).

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 thermoneutral zone, the basal metabolic rate is 120% greater and thermal conductance is 112% greater than what would be predicted from its body mass (Arends et al., 1995).

**REPRODUCTION.** The reproductive strategy of Glossophaga longirostris is one of uniparous bimodal polysty. One period of pregnancy extends from December to April and another extends from June to October for 333 specimens collected throughout the range of the species. Lactating females have been collected in all months except February (Webster and Handle, 1986). On Curacao 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 and thorn forests, deciduous and evergreen forests, and savannas (Webster and Handle, 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 forest (35%), tropical very dry forest (17%), other dry zones (1%), and moist zones (4%)—Handle, 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 paddy fields, 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 Greenhull, 1961; Handle, 1976; Husson, 1954; Jones, 1951; Miller, 1898, 1900b, 1913a; Pirlot, 1963, 1964; Pirlot and Leont, 1965; Robinson and Lyon, 1901; Smith and Genoways, 1974; Tannard and Valdivieso, 1963; Valdivieso, 1964; Webster and Handle, 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 Peropygys macrata, Mmoomops megalophylla, Pororatus dasy, P. personatus, Micronycteris megalogus, Phyllostomus hastatus, Glossophaga soricina, Glossophaga curassone, and Carollia perspicillata (Arends et al., 1995; Bonaccorso et al., 1992; Goodwin and Greenhull, 1961; Robinson and Lyon, 1901).

There is, however, pronounced spatial separation of species roosting in caves in northern Venezuela, with mormoops 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, Subpillocereus repansus, Pilocereus tillyanus) and the fruit of "palo de mona" (Moraceae: Chlorophora tinctoria) comprise the bulk of its 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 the 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 Helicteres baranosus, fruit of several cacti species and Muntingia calabura, and a few insects (Espinoza et al., 1995).

**Ectoparasites of G. longirostris** include lalidicidum mites (Albidoscutus farmani, Parakusa maxima, and P. tayrae), spinturnicid mites (Periliguchis caligus, P. hirani, and P. ojasii), and trombiculid mites (Eutrombicula ocellata, Hooperella vesperugins, Loomisia desmodus, L. yunkeri, Perissopla precoria, and Whartonia nudoidea), argasid ticks (Ornithodoros astroei, O. haesi, and O. rostii) and ixodid ticks (Amblyomma), and stridulating beetles (Megistopoda aranea, Nycteolophota coxata, Paracteneodes longipes, Strebla curvata, S. wiedemanni, Tritoboides perspicillatus, Triobius dugesii, T. parasiticus, T. sphaerotonus, T. uniformis) (Brennan and Reed, 1975; Herrin and Tipton, 1975; Herrin and Brennan, 1975; Webb and Loomis, 1977; Wenzel, 1976). G. longirostris from Colombia was rhabies 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 mediumsized 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. leachi, G. commissariai, and G. soricina. However, few alleles separate G. longirostris from its congeners. Heterozygosity was 0.0000 in 10 species of G. l. rostrata from Carrao Island (Grenadines) and one individual of G. l. major from Guaro Island, 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.** Handle 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 relgating the male skin to the status of a paratype. A series of bats from Boquería 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 Handle (1986).

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

There is much disregard regarding the phylogenetic relationships among the 16 genera of long-tongued bats in the Family Phyllostomidae (Baker et al., 1989). Koopman (1989), without comment but in agreement with Griffin (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 Phylllostominae, Tribe Glossophagini.

LITERATURE CITED


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