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Choeronycteris mexicana.

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Choeronycteris Tschudi, 1844

Choeronycteris Tschudi, 1844:70. Type species *Choeronycteris mexicana* Tschudi.

CONTEXT AND CONTENT. Order Chiroptera, Suborder Microchiroptera, Superfamily Phyllostomoidea, Family Phyllostomidae, Subfamily Glossophaginae. *Choeronycteris* is treated herein as a monotypic genus distinct from the later-named *Musonycteris* Schaldach and McLaughlin, 1960, but there is controversy on this point. The two were regarded as congeneric by Handley (1966), Hall (1981), and Koopman (1984). *Musonycteris* was recognized as a valid genus by Phillips (1971), Jones and Carter (1976), Honacki et al. (1982), and Webster et al. (1982).

Choeronycteris mexicana Tschudi, 1844

Mexican Long-tongued Bat

Choeronycteris mexicana Tschudi, 1844:72. Type locality México.

CONTEXT AND CONTENT. Context as in the generic account above. No subspecies are recognized.

DIAGNOSIS. *Choeronycteris mexicana* is a medium-sized phyllostomid with generally grayish to brownish pelage and an elongate muzzle (Fig. 1). The tail is relatively short, about a third the length of the naked uropatagium and about half the length of the femur. Diagnostic cranial and dental characteristics (Fig. 2) include: rostrum elongate, accounting for 40 to 50% of length of cranium; zygomata incomplete; pterygoid processes long, concave on inner surfaces, hamulae expanded and in contact (or nearly so) with auditory bullae and mandibular fossae; teeth, except canines, much reduced in size; evident gaps between cheekteeth; lower incisors absent in adults (Hall, 1981; Miller, 1907; Phillips, 1971).

From *Musonycteris*, its nearest relative, *Choeronycteris* differs principally as follows: rostrum shorter and relatively broader, lacking evident dome; cheekteeth, although reduced, relatively larger and with shorter gaps between them; basisphenoidal ridge much less well developed; braincase larger; M3 reduced and lacking a distinct metastyle; second upper incisor only slightly larger than first (as opposed to noticeably larger in *Musonycteris*); pterygoid processes concave inwardly rather than evenly rounded; posterior palatine emargination broadly V-shaped rather than broadly U-shaped; fundamental number of chromosomes 24 instead of 22 (Schaldach and McLaughlin, 1960; Webster et al., 1982).

GENERAL CHARACTERS. Ranges in external and cranial measurements (in mm) in a series (three males, 10 females) of adults from Coahuila (Baker, 1956) are as follows: total length, 81 to 103; length of tail, 6 to 10; length of hind foot, 10 to 13; length of ear, 15 to 18; length of forearm 43.2 to 47.8; greatest length of skull, 29.2 to 30.4; condylobasal length, 28.2 to 29.3; postorbital constriction, 3.6 to 4.1; palatal length, 17.6 to 18.8; mastoid breadth, 9.9 to 10.5; breadth of braincase, 9.4 to 10.1; depth of braincase, 7.3 to 7.9; length of maxillary toothrow, 8.6 to 9.3. Weight ranges from about 10 to 20 g, up to 25 g in pregnant females.

The dorsal pelage varies from buffy brown to relatively dark grayish brown, palest on shoulders; the venter is paler than the dorsum; the ears are pale brownish gray but the membranes are darker, a dark shade of grayish brown (paler at the wing tips); the uropatagium is essentially hairless. Middorsally, the pelage is about 7 mm long in specimens we have examined. As in other glossophagines, the tongue is long and extensible. The noseleaf is broad at the base, pointed at the tip, and about 5 mm high.

The dental formula of *C. mexicana* is i 2/0, c 1/1, p 2/3, m 3/3, total 30. Upper incisors are small and do not fill the space betwen the canines; there is a gap between those of the inner pair. There are no permanent lower incisors, but one to four deciduous teeth may persist in adults. Upper canines are stout, with a narrow anterolingual cingulum and small posterior cingular style. Lower canines are slender and simple. Upper premolars are long and narrow, nearly the same size, and differ only in that the second has a posterolingual cingular shelf. Lower premolars also are long and narrow and all three are of approximately the same size except that the second and third are narrower than the first; the first lacks anterior and posterior cingular styles present in the other two. All three upper molars are roughly oval in occlusal outline and are so reduced that a W-shaped ectoloph is lacking; the third differs from the others in being slightly smaller and lacking a distinct metastyle; in all the labial edge consists of a raised lip with an anterior parastyle and posterior metacone. The three lower molars are long and narrow, and of approximately the same size except the third is slightly smaller. Phillips (1971) and Phillips et al. (1977) provided a more detailed description of teeth and dental variation.

DISTRIBUTION. The distribution of this long-tongued species (Fig. 3) extends from southern California, southern Arizona, and southwestern New Mexico southward through much of northern and central México (including Baja California and the Tres Marías Islands) to El Salvador and Honduras (Hall, 1981). There is a sight record, complete with photographs (LaVal and Shifflett, 1971), of an individual, possibly a straggler, from the lower Rio Grande Valley of Texas. The usual altitudinal range is from about 300 to 2,400 m. We know of no reported fossils of *Choeronycteris.*

FORM AND FUNCTION. McDaniel (1976) described the anatomy of the brain, characterized by relatively elongate, vertically shallow cerebral hemispheres; a cerebellum with only primary foliations; large olfactory bulbs; a shallow but definite cingulate sulcus; and a dense layer of cells along the margin of the interhemispheric sulcus above the superior colliculi.

According to Phillips (1971), the deciduous dental formula is i 2/2, c 1/1, p 3/2, total 22. Six deciduous teeth (all four lower incisors and the first upper premolars) are not replaced by permanent counterparts. Conversely, the first lower permanant premolars have no known deciduous precursors. The deciduous upper incisors are

FIG. 1. Adult *Choeronycteris mexicana* from the San Carlos Mountains, Tamaulipas. Photograph by R. R. Hollander.

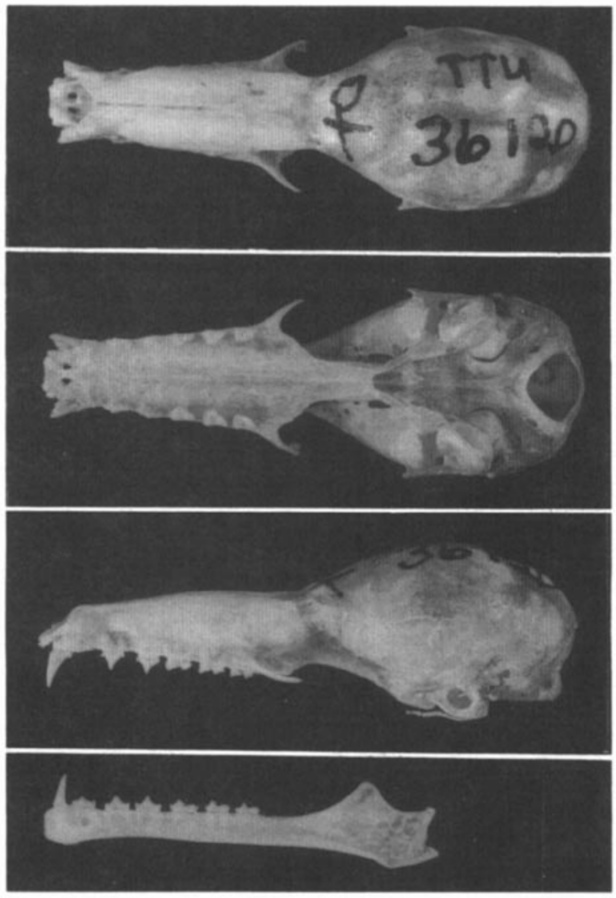

FIG. 2. Dorsal, ventral, and lateral views of skull, and lateral view of lower jaw of *Choeronycteris mexicana* (female, TTU 36120, from 8 mi S Alamos, Sonora). Greatest length of skull is 30.0 mm. Photographs by N. L. Olson.

located directly anterior to the developing permanent teeth; those of the outer pair are simple, recurved pegs that are larger than the inner teeth. The deciduous upper canines are large and hooked. The deciduous first premolar, not replaced by a permanent tooth, is the smallest of the upper milk teeth; the second is simple and slightly recurved; the third is relatively large and premolariform, narrow and bladelike. The lower deciduous incisors are small, slightly recurved spicules with rounded crowns. The lower deciduous canines are slender and hooked. The first deciduous lower premolar is a small spicule, slightly recurved; the second is relatively long and bladelike. The order of replacement of milk teeth (Phillips, 1971; Stains and Baker, 1954) is the same in both upper and lower jaws, proceeding from back to front. The initial process of eruption of permanent teeth is a fairly rapid process in phyllostomids generally (Phillips et al., 1977), and directly affects the shedding of deciduous teeth.

Phillips et al. (1977) studied the dental histology of *C. mexicana* and other phyllostomids and found the coronal part of the dentin characterized by distinct tubules that follow a general S-shaped path from the pulpal chamber to the dentino-enamel junction, a thin cementoid layer, and that the pulp in glossophagines "frequently is pathologic."

Phillips et al. (1977:177) also described the tongues of this and other nectar feeders as highly specialized, being "narrow, extemely elongate, highly extensible, and often have a pointed apex." The tongue of *Choeronycteris* has a dorsal trough, which widens posteriorly; lacks lateral grooves, fungiform papillae, and vallate papillae (present on the posterodorsal surface in many microchiropterans); and has rows of long, hairlike vertical papillae along the dorsolateral edge of the anterior third, and a cluster of horny papillae middorsally about a third back from the tip. The remainder of the tongue is covered by small, hairlike papillae.

Griffiths (1982) studied the lingual and hyoid regions of glossophagines and included *Choeronycteris* in a group with the following characteristics: stylohyoideus muscle absent; sphincter colli protundus muscle quite reduced; medial circumvallate papille absent; complex pattern of horny papillae present; and geniohyoideus muscle laterally expanded. Additionally, Wille (1954) found the genioglossus of *C. mexicana* to be highly developed and leaflike, contributing to the great protrusibility of the tongue, and that the posterior part of the geniohyoideus muscle envelops the sterohyoideus.

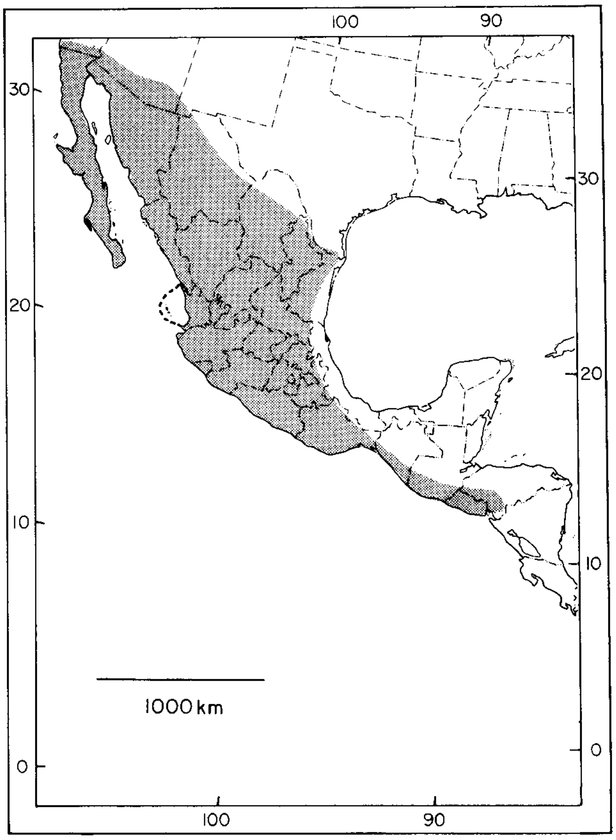

FIG. 3. Geographic distribution of *Choeronycteris mexicana*.

According to Forman et al. (1979), the stomach of *Choeronycteris* is large and saccular, and the fundic caecum is dilated, bulbar, and can be distinguished from the rest of the stomach by a distinctive furrow or sulcus on the dorsal surface; the pyloric stomach is elongated and curved, and the pyloric sphincter consists of thin valves. Park and Hall (1951) found the intestine to be 11.5 cm long (288% head and body length) and 2 mm in diameter throughout its length. The spermatozoa have a large, rounded head and a long midpiece, and are distinguished easily from those of other glossophagines by their larger size (Forman and Genoways, 1979).

Benedict (1957) characterized the dorsal hairs as 9 mm in length and 28.9 μm in diameter. The scale pattern of individual hairs is annular, alternating between entire coronal and alternate coronal; medulla absent; melanin granules generally dispersed but most abundant in distal quarter of filament. Howell and Hodgkin (1976) published a scanning electron micrograph of interscapular hair.

Smith and Starrett (1979) included *Choeronycteris* in their morphometric analysis of chiropteran wings, and Walton and Walton (1968) used skeletons, without specific description, in their study of pectoral and pelvic girdles of phyllostomids. Strickler (1978) described the anatomy of the shoulder region in some detail.

In a study of acoustic behavior in *C. mexicana*, Howell (1974) found this species to be intermediate in terms of obstacle detection in comparison with *Glossophaga soricina*, *Anoura geoffroyi*, and *Leptonycteris sanborni*. *Choeronycteris* emits short pulses, "frequency modulated to some degree but showing no set rise or fall, with second and third harmonics" (p. 297). Experiments on avoiding wire obstacles indicated that Mexican long-tongued bats emitted approximately 2.5 dynes/cm^2 when avoiding the largest wires (1.04 mm diameter), but with a decrease in wire diameter they increased pulse amplitude to 4 dynes/cm^2. At the beginning of a particular flight through an array of wires, when the bat presumably was searching or scanning, pulses were repeated at the rate of 5 to 10/s but increased to 30/s upon detection of the wire. Scanning pulses ranged from 0.5 ms to 2 ms in duration.

In studies of cochlear potential, Howell (1974) found that *C. mexicana* has a hearing curve much like that of *Carollia perspicillata* in that both are extremely sensitive to high frequencies, particularly in the range of 65 to 80 KHz. Both species also were sensitive to sound at 5 KHz (a sound pressure of minus 20 db re 1 dyne/cm^2), the lowest frequency measured. Howell (1974) noted that structure and function of the ear in the four glossophagines she studied might support polyphyletic origin of bats in that subfamily.

ONTOGENY AND REPRODUCTION. Wilson (1979: 337) reviewed the literature on reproduction, reporting that females "are pregnant in the early spring in México . . . and those that migrate to Arizona and New Mexico give birth in June." Births in early July also have been recorded. Wilson (1979:371) characterized the reproductive pattern as "monestry," but also noted (p. 337) the possibility of a second period of parturition as supported by the record of a pregnant female from Jalisco in September (Watkins et al., 1972).

Few data are available on ontogeny of *C. mexicana.* Mumford and Zimmerman (1962) collected six females in New Mexico on 19 June; four carried attached young and two were gravid. The pregnant females weighed 19.9 and 22.1 g, and their fetuses weighed 4.5 and 4.3 g, respectively; the latter measured 29 mm in crown-rump length. The fetuses were covered dorsally with dense, dark hair that was 2 mm long; the venter was scantily furred with silvery hair. There is but a single offspring per pregnancy, although Goodwin (1946) reported a female with two young from Guatemala.

Barbour and Davis (1969) watched a female give birth in Arizona. Parturition lasted about 15 min as the female hung head down from a vertical surface. They reported neonates to be in a remarkably advanced stated of development and surprisingly well furred.

ECOLOGY AND BEHAVIOR. *Choeronycteris* has been taken in a wide variety of vegetative habitats ranging from arid thorn scrub (Axtell, 1962; Baker and Greer, 1962; Baker and Womochel, 1966; Matson et al., 1978) to tropical deciduous forest (Davis and Russell, 1954) and mixed oak-conifer forest (Matson and Patten, 1975). By way of example, a specimen from New Mexico was captured in a canyon containing a dry wash and vegetated on the sides with evergreen oak (*Quercus* sp.), alligator juniper (*Juniperus pachyphloea*), manzanita (*Arctostaphylos* sp.), and other shrubs (Findley, 1957); slopes above harbored *Yucca*, *Agave*, and ocatillo (*Fouquieria splendens*). In Oaxaca, Baker and Womochel (1966: 306) netted a *Choeronycteris* at a place where vegetation was "transitional between the higher pine-oak montane forests and the lower tropical broadleaf vegetation of the narrow, well watered canyons." These bats evidently migrate seasonally to avail themselves of suitable sources of food.

Caves and abandoned mine tunnels evidently are favored as daytime retreats; roosting sites usually are in dimly lit areas near the entrances, so that even small caves are occupied. *Myotis velifer*, *Eptesicus fuscus*, *Plecotus townsendii*, and *Tadarida brasiliensis* frequently share diurnal quarters in the northern part of the range, *Glossophaga* in the south, although according to Goodwin (1946: 313), *C. mexicana* is "less gregarious than most bats and seems to be disinclined to mingle with other species." Davis and Russell (1954) reported a group of *C. mexicana* hanging from the exposed roots of a tree on the side of a ravine in Morelos. Man-made structures such as buildings and culverts occasionally are occupied. In Jalisco, Watkins et al. (1972:14) reported "a night roost in an abandoned adobe bulding in pine-oak forest."

In roosts, these bats do not cluster but hang 2 to 5 cm apart, usually by only one foot so that they can rotate 360° to watch any intruder. They are extremely wary, thus easily disturbed, and readily leave the roost, seemingly preferring to fly out into open light rather than to retreat deeper into large shelters (Barbour and Davis, 1969). Baker (1956:173) reported that many individuals flushed from a cave in Coahuila flew out and "hid nearby in small holes in rocky ledges." Females have been observed carrying young, but in such instances probably only to move them from one shelter to another. In flight, the wings make a "swishing sound similar to that produced by *Leptonycteris*" (Barbour and Davis, 1969:33).

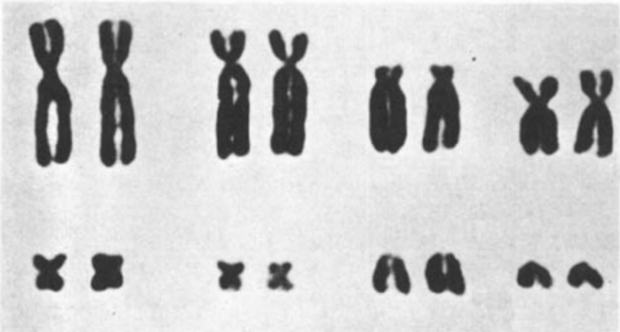

FIG. 4. Karyotype of female *Choeronycteris mexicana* (after Baker, 1967); sex chromosomes at lower left.

The food of *Choeronycteris* was described as fruits, pollen, nectar, and probably insects by Gardner (1977*a*). Alvarez and González Q. (1970) reported all stomachs they examined from central México to contain pollen grains, the greatest percentages from pitahaya (*Lemaireocereus*), cazahuate (*Ipomoea*), *Ceiba*, *Agave*, and garambulla (*Myrtillocactus*); they regarded *C. mexicana* as an obligate pollen feeder. Villa-R. (1967), however, reported the mouths of specimens taken in Sonora to contain remains of the fruit of pitahayas or garambullas. Monés (1968) reported finding remains of *Choeronycteris* in owl pellets, probably those of a barn owl, in a cave in Oaxaca.

Webb and Loomis (1977) listed two streblids, *Paratrichobius americanus* and *Trichobius longipes*, and a trombiculid mite, *Whartonia glenni californicus*, as ectoparasites. Mumford and Zimmerman (1962) reported a female and her young as parasitized by larval ticks, *Ornithodoros* sp. We are unaware of any internal parasites recorded from *C. mexicana.*

Olson (1947) and Huey (1954) reported that long-tongued bats captured in California bit viciously and repeatedly, but Barbour and Davis (1969) found those they handled in Arizona to be docile; none attempted to bite. Olson (1947) reported a severe illness that possibly resulted from the bites of this bat.

GENETICS. *Choeronycteris mexicana* has a diploid chromosome number of 16 (Fig. 4) and a fundamental number of 24 (Baker, 1967, 1973); the X and Y chromosomes are submetacentric. Baker (1973) reported that *Hylonycteris underwoodi* and *C. mexicana* have basically identical karyotypes and suggested a common ancestor for the two genera, but Gardner (1977*b*) argued that the similarity resulted from parallelism or convergence; Baker (1979) and Webster et al. (1982) disputed Gardner's view. The latter authors first reported the karyotype of *Musonycteris harrisoni*, which differs from *C. mexicana* in having a fundamental number of 22.

Webster et al. (1982) described and compared the karyotypes of *Choeronycteris*, *Hylonycteris*, and *Musonycteris*; they found them to be remarkably similar and suggested common ancestry for all three genera. We know of no electrophoretic studies involving *C. mexicana.*

REMARKS. The generic name *Choeronycteris* is a combination of two Greek words, *choiros* (pig) and *nykteris* (bat). The specific name denotes the general type locality and, fortuitously, the major distribution of the Mexican long-tongued bat.

There has been controversy in recent years concerning the origin, relationships, and proper classification of the 13 genera of New World leaf-nosed bats that share morphological adaptations for nectivory. Traditionally, these taxa were grouped together in the phyllostomid subfamily Glossophaginae, but recent study of different data sets—chromosomes (Baker, 1967, 1970, 1979; Gardner, 1977*b*; Haiduk and Baker, 1982; Webster et al., 1982), immunology (Gerber and Leone, 1971), and morphology (Griffiths, 1982; Phillips, 1971)—has led some authors to regard glossophagines as polyphyletic. However, Forman and Genoways (1979) found that structure of spermatoza does not support polyphyly in this group.

As noted, we regard *C. mexicana* as monotypic. However, Pirlot (1967) described a subspecies (*ponsi*) from northwestern Venezuela, far distant from the otherwise known distribution of the species. Jones and Carter (1976:18) were "unconvinced by Pirlot's brief description that his two specimens are referable to the genus *Choeronycteris.*"

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