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Microtus umbrosus.

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Microtus umbrosus Merriam, 1898

Zempoaltepec Vole

Microtus umbrosus Merriam, 1898:107. Type locality "Mt. Zempoaltepec, [Mixes District] Oaxaca [Mexico] (alt. 8200 ft.)."

CONTEXT AND CONTENT. Order Rodentia, Suborder Sciurognathi, Family Muridae, Subfamily Arvicolinae, Genus *Microtus* (Musser and Carleton, 1993), Subgenus *Phaiomys* (Martin, 1987). Originally *M. umbrosus* was designated type species of the monotypic Subgenus *Orthriomys* (Merriam, 1898). *Orthriomys* has subsequently been variously regarded as a genus (Ellerman, 1941; Hinton, 1926), subgenus (Hall and Cockrum, 1953; Hall and Kelson, 1959; Musser and Carleton, 1993), or not recognized (Hall, 1981). *M. umbrosus* is monotypic.

DIAGNOSIS. The presence of two inguinal pairs of mammary glands and the absence of pectoral pairs is diagnostic of *M. umbrosus*. The presence, on the last lower molar, of two rather than three transverse loops and at least one closed median triangle rather than none separate *M. umbrosus* from other extant North American *Microtus* except *M. oaxacensis* and *M. (Herpetomys) guatemalensis* (Hall, 1981). *M. umbrosus* can be distinguished from these species by two triangles on the last upper molar rather than five in *M. oaxacensis* or three in *M. guatemalensis*. The first lower molar has an anterior cap confluent with two open triangles, three closed triangles, and a posterior lobe. *M. umbrosus* can be distinguished from other voles occurring in Mexico by its large size (total length, >163 mm), much longer tail (a third of total length and >48 mm) and large hind feet (length of hind foot, >21 mm). Only *M. oaxacensis*, which has hind feet as long as 22.5 mm, has hind feet that overlap the size range of *M. umbrosus*.

GENERAL CHARACTERS. *Microtus umbrosus* is a large vole. The pelage is long and soft with upper parts uniformly dusky with brown-tipped hairs and underparts dark plumbeous thinly washed with fulvous (Bailey, 1900; Goodwin, 1969; Hall, 1981; Hall and Cockrum, 1953). The tail is dark brown, scantily haired, and relatively long, approximately 33% of total length (length of head and body is 1.8–2.3 times length of tail, and length of tail is 2.1–2.8 times length of hind foot). In America, only *M. longicaudus*, *M. californicus*, *M. pennsylvanicus*, and *M. townsendi* have tails of similar proportion (Hall, 1981). The feet are dark brown and large, with five planter tubercles and a rudimentary sixth tubercle. The ears have been described as short, almost concealed by fur (Goodwin, 1969) or large and almost naked (Bailey, 1900; Hall, 1981; Hall and Cockrum, 1953); the ears are relatively large and naked in comparison with other North American *Microtus*. Posterolateral glands are absent (Quay, 1968). There are two pairs of inguinal mammary glands. Means and ranges (in parentheses) of external measurements (in mm) of six specimens (Goodwin, 1969) are: total length, 176.7 (164–188); length of tail, 58.3 (49–65); and length of hind foot, 23.08 (22.0–24.0). No ear measurements have been published. Of nine specimens in the University of Kansas Museum of Natural History from "NW slope Cerro Zempoaltepetl, 3,000 m Oaxaca" (124803–124808, 124810–124812), the mean length of ear is 15.0 mm (range, 14–16 mm).

The skull is relatively long and narrow with a long braincase (Fig. 1). The skull is flat and outlines are smooth. The interorbital region is broad; zygomatic arches are slender and not widely spreading; incisive foramina are relatively short and widest in the middle; bullae are very small; palate is low with slender or incomplete lateral bridges, shallow lateral pits, and posterior median ridge sloping and grooved; the interpterygoid fossa is wide and quadrate (Bailey, 1900; Goodwin, 1969; Hall, 1981; Hall and Cockrum, 1953). Means and ranges (in parentheses) of cranial measurements (in mm—Goodwin, 1969) are: greatest length of skull, 27.4 (26.1–28.0, n = 6); condylobasal length, 26.9 (25.5–27.7, n = 4); nasal length, 7.7 (7.3–8.1, n = 6); zygomatic width, 15.5 (15.1–16.0, n = 6); interorbital width, 4.1 (3.9–4.4, n = 5); braincase width, 10.9 (10.3–11.2, n = 5); palatal width across molars, 5.4 (5.3–5.6, n = 5); and length of maxillary tooth row, 6.8 (6.4–7.0, n = 6).

The dental formula is i 1/1, c 0/0, p 0/0, m 3/3, total 16.

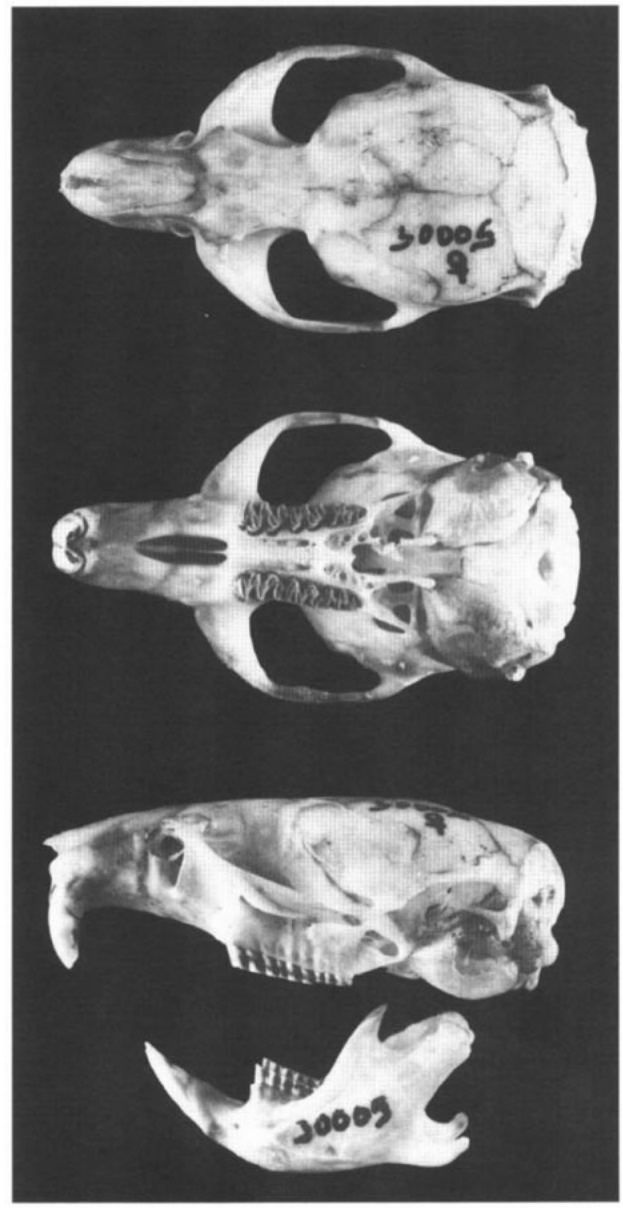

FIG. 1. Dorsal, ventral, and lateral views of the skull, and lateral view of the mandible of *Microtus umbrosus* (adult female, Instituto de Biología, Universidad Nacional Autónoma de Mexico, 30005) from 5 km N Santa Maria Yacochi, Municipio Tlahuitoltepec, Oaxaca, Mexico, 2,450 m. Greatest length of skull is 28.1 mm.

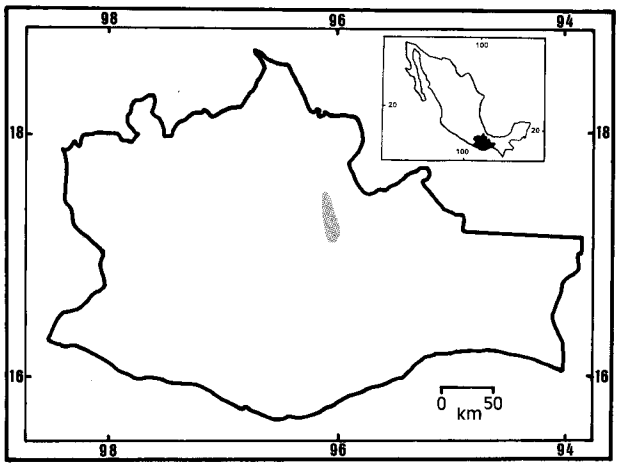

FIG. 2. Distribution of the Zempoaltepec vole, *Microtus umbrosus*, in Oaxaca, Mexico (modified from Goodwin, 1969).

Incisors are abruptly decurved and molars are large and broad (Bailey, 1900; Goodwin, 1969). Lingual triangles tend to be rounded rather than acute. The enamel pattern of the lower molars shows negative differentiation; i.e., the enamel on the posterior edge of the triangles is thicker than on the anterior edge (Martin, 1987). Dental terminology is that of van der Meulen (1973) and Martin (1987): M1 has an anterior lobe and four closed triangles (five closed sections total), two buccal and two lingual reentrant angles; M2 has an anterior lobe and three closed triangles, two buccal and one lingual reentrant angles (four closed sections total); M3 has an anterior lobe, two closed triangles (may be open and confluent), and a third open triangle confluent with a posterior cap, two buccal and two lingual reentrant angles (four closed sections total); m1 has an anterior cap confluent with two open triangles, three closed triangles, and a posterior lobe, three buccal and three lingual reentrant angles (five closed sections total); m2 has two confluent anterior open triangles, two posterior closed triangles and a posterior lobe, two buccal and two lingual reentrant angles (four closed sections total; four closed triangles making a total of five closed sections is a common variant—Carleton, 1985); and m3 has two anterior confluent open triangles of which the buccal triangle may be reduced, two closed triangles, and a posterior lobe, two buccal and two lingual reentrant angles (four closed sections total).

DISTRIBUTION. *Microtus umbrosus* is a relict species (Hoffmann and Koeppl, 1985; Martin, 1987) with a distribution limited to a relatively small (ca. 80 km^2), semi-isolated mountain range situated southeast of the Rio Cajones in Mixes District, Oaxaca, Mexico (Fig. 2). Localities of record for the species range in elevation: 1,829 m at the town of Totontepec (Goodwin, 1969); 2,450 m, 5 km north of Santa Maria Yacochi (Cervantes et al., 1994); 2,499 m on Mount Zempoaltepec at the southern end of the range (Goodwin, 1969); and 3,000 m on Cerro Zempoaltepetl (reported herein; = Mount Zempoaltepec). No fossils for this species are known.

ECOLOGY. The habitat of *M. umbrosus* has been described as humid Upper Austral Zone, dense oak forest, montane pine-oak forest, evergreen cloud-forest, and evergreen broadleaf rainforest (Bailey, 1900; Getz, 1985; Hoffmann and Koeppl, 1985). However, Goldman (1951) reported *M. umbrosus* from the humid Upper Tropical Subzone. The habitat at Totontepec is humid, with dense oak forests and cleared pastures (Goodwin, 1969). *M. umbrosus* is associated with mesic, well-drained soil (Getz, 1985). It lives in burrows and in long subterranean tunnels (Bailey, 1900).

GENETICS. The diploid chromosome number of *M. umbrosus* is 56 and the fundamental number is 60. The karyotype is comprised of three pairs of small or medium-sized metacentric chromosomes and 24 pairs of small, medium or large telocentric chromosomes. The X chromosome is a large metacentric, whereas the Y chromosome is a small telocentric (Cervantes et al., 1994). The karyotype of this vole has features similar to the hypothesized primitive pattern (Modi, 1987) for the genus *Microtus* and is consistent with the view that this species is older than *M. mexicanus* (Cervantes et al., 1994).

REMARKS. The name *Microtus* is derived from the Greek *mikros* meaning small and *otus* meaning ear. No reason was provided for *umbrosus* as the specific epithet (Merriam, 1898). Presumably, it is derived from the Latin *umbros* meaning shady and possibly refers to shady habitats occupied by this vole or to the dusky or dark pelage. The subgenus *Orthriomys* means early-mouse, referring to its primitive characteristics and is derived from the Greek *orthrio* meaning early and Greek *mys* meaning mouse. The type specimen is housed in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM 68480; Wilson, 1991). *M. umbrosus* is not closely related to any extant North American *Microtus* (Martin, 1987). *M. umbrosus* has been considered a relict North American survivor of the subgenus *Phaiomys* from an early microtine invasion from Asia (Martin, 1987), but it may be included in the otherwise extinct genus *Neodon* (Martin, 1974). However, Musser and Carleton (1993) supported the recognition of *Orthriomys* as a subgenus of *Microtus*. At present, *M. umbrosus* is considered a fragile species according to the model of conservation classification developed by Ceballos and Navarro (1991), because of its very restricted geographic range and evidence of habitat modification in Oaxaca.

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