MAMMALIAN SPECIES No. 717, pp. 1–3, 3 figs.

Pappogeomys bulleri.

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Published 30 July 2003 by the American Society of Mammalogists

Pappogeomys Merriam, 1895

Geomys Thomas, 1892:196. Type species *Geomys bulleri* Thomas.
Pappogeomys Merriam, 1895:145. Redesignation of *Geomys bulleri* Thomas.

CONTEXT AND CONTENT. Order Rodentia, suborder Myomorpha, family Geomyidae, subfamily Geomyinae, tribe Geomyini. The genus *Pappogeomys* is monotypic (Patton, in press).

Pappogeomys bulleri Thomas, 1892

Buller's Pocket Gopher

Geomys bulleri Thomas, 1892:196. Type locality "Talpa, Mascota, Jalisco, 8500 feet," Mexico.
Geomys nelsoni Merriam, 1892:164. Type locality "north slope of the Sierra Nevada de Colima, Jalisco, Mexico (altitude 6,500 feet)."
Pappogeomys bulleri Merriam, 1895:146. First use of current name combination.
Pappogeomys albinasus Merriam, 1895:149. Type locality "Atemajac, suburb of Guadalajara," Jalisco, Mexico.
Pappogeomys alcorni Russell, 1957:359. Type locality "4 mi. W Mazamitla, 6000 ft., Jalisco."

CONTEXT AND CONTENT. Order Rodentia, suborder Sciurognathi, family Geomyidae, tribe Geomyini, genus *Pappogeomys* (McKenna and Bell 1997; Patton, in press; Russell 1968a). Nine subspecies are currently recognized (Demastes et al. 2003; Russell 1968a).

P. b. albinasus Merriam, 1895:149, see above.
P. b. alcorni Russell, 1957:359, see above.
P. b. amecensis Goldman, 1939:97. Type locality "mountains near Ameca, Jalisco, Mexico (altitude 6,500 feet)."
P. b. bulleri (Thomas, 1892:196), see above (*flammeus* Goldman, *lagunensis* Goldman, and *nelsoni* Merriam are synonyms).
P. b. burti Goldman, 1939:97. Type locality "Tenacatita Bay, southwest coast of Jalisco, and Colima, Mexico."
P. b. infuscus Russell, 1968a:610. Type locality "Cerro Tequila, 10,000 feet, 7 mi. S and 2 mi. W Tequila, Jalisco, Mexico."
P. b. lutulentus Russell, 1968a:612. Type locality "Sierra de Cuale, 7,300 feet, 9 km. N El Tenosite (= Desmoronado), Jalisco, Mexico."
P. b. melanurus Genoways and Jones, 1969:748. Type locality "7½ mi. SE Tecomate, 1,500 feet, Jalisco, Mexico."
P. b. nayaritensis Goldman, 1939:94. Type locality "Jalisco, about 10 miles S of Tepic, Nayarit, Mexico (altitude 5,000 feet)."

DIAGNOSIS. *Pappogeomys bulleri* is smaller than species of *Cratogeomys*. *P. bulleri* differs from *Cratogeomys* in that enamel plates on posterior surface of M1 and M2 (sometimes absent on M1) usually extend across entire posterior wall and sometimes are reduced but rarely are absent (Hall 1981). Posterior enamel plate of M1 and M2 is absent in *Cratogeomys*. Sagittal crest is lacking in *P. bulleri*, and parietal impressions are developed only partway across parietal bones in adults. Anterior angles of zygomata are without lateral platelike expansions. Claws on forefeet of *P. bulleri* are larger in relation to size of animal than in *Cratogeomys*, and *P. bulleri* has a nasal patch (Hall 1981; Nowak 1999; Russell 1968a).

GENERAL CHARACTERS. Nasal patch in *P. bulleri* (Fig. 1) is white or pale buffy but is often absent; pelage of dorsum is bicolored: basally pale gray to dark gray and apically black to ochraceous-tawny or cinnamon, depending on subspecies (Hall 1981; Nowak 1999; Russell 1968a). Males are slightly larger than females, but sexual dimorphism is not as pronounced as in *Cratogeomys* (Russell 1968a). Subspecies of *Pappogeomys* vary considerably in size. *P. b. albinasus* is the largest subspecies (Russell 1968a). Subspecies from the northern part of the range (*albinasus*, *burti*, *infuscus*, and *nayaritensis*) have darker and duller pelage and are larger than other subspecies. Fur is soft, long (ca. 10 mm), and fine; body is well covered in all forms except *P. b. burti* from the Pacific coast, in which pelage is half the length and more dense (Hall 1981; Nowak 1999). Tail of *P. bulleri* is naked, white, and less than half the length of head and body (Hall 1981; Nowak 1999; Russell 1968a). Total length of adult males is 214–237 mm (n = 4) and of adult females is 192–247 mm (n = 5—Goldman 1939); external average measurements (in mm) are: length of head and body, 130–175; length of tail, 50–85 (sample size not given—Nowak 1999); length of ear, 6.5–8.0 (n = 23 females and 9 males—Genoways and Jones 1969); length of hind foot, 28–35 (sample size not given—Hall 1981). Ranges of cranial measurements (in mm) are: occipitonasal length, 36.2–44.0; zygomatic breadth, 21.4–27.8; width across squamosals (over mastoids), 20.3–27.2; breadth of interorbital constriction, 6.5–8.0; length of nasals, 11.8–16.2; length of maxillary toothrow (alveoli), 7.5–10.2; width of upper incisors (cutting edge), 3.8–4.9 (n = 4 adult males and 5 adult females—Goldman 1939); length of rostrum, 16.6–21.4 (n = 23 adult females and 9 adult males—Genoways and Jones 1969). Skull of *P. bulleri* (Fig. 2) is small (range of condylobasal length: females, 33.1–42.2 mm; males, 36.4–45.5 mm) and narrow (range of squamosal breadth: females, 19.8–25.4 mm; males, 20.6–27.7; sample size not given—Russell 1968a, 1968b). Each incisor has a single, centrally placed sulcus down the entire labial surface (Nowak 1999). *P. bulleri* has a thin enamel plate (thickness varying with subspecies) on posterior surface of M1 that usually extends across the entire posterior wall and rarely is absent in specimens from the Pacific coast range (*P. b. amecensis*, *P. b. bulleri*, and *P. b. nayaritensis*—Hall 1981; Russell 1968a). Incisive foramina are long and slitlike (Russell 1968a). Nasals are emarginate posteriorly with a V-shaped notch between posterior tips. Basioccipital is strongly wedge-shaped with sides converging anteriorly; it rarely is hourglass-shaped, with breadth across middle shorter than at either end. M3 is subtriangular or suborbicular in cross section, with posterior heel weakly developed (Russell 1968a).

DISTRIBUTION. *Pappogeomys bulleri* is endemic to west-central Mexico (Fig. 3) and occurs in Nayarit, Jalisco, Colima, and Michoacan, ranging from the Pacific coast east to the Río Grande de Santiago in Jalisco (Russell 1968a). In Jalisco, *P. bulleri* occurred in the following locations: Milpillas, 5 mi SW of San Sebastian (altitude 1,158 m); La Laguna, Sierra de Juanacatlán, northwestern Jalisco (altitude 1,981 m); near Talpa, Sierra de Mascota; Sierra Nevada de Colima in Jalisco (altitude 1,981 m); Atemajac; from mountains near Ameca and the upper part of the valley of the Río Ameca; and from Tenacatita Bay, along the southwestern coast

FIG. 1. *Pappogeomys bulleri* from Cloud Forest, El Jabalí, Colima, Mexico. Photograph by G. Ceballos.

FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of an adult female *Pappogeomys bulleri burti* from Jalisco, Mexico (Instituto de Biología, Universidad Nacional Autónoma de México 12353). Greatest length of skull is 42 mm.

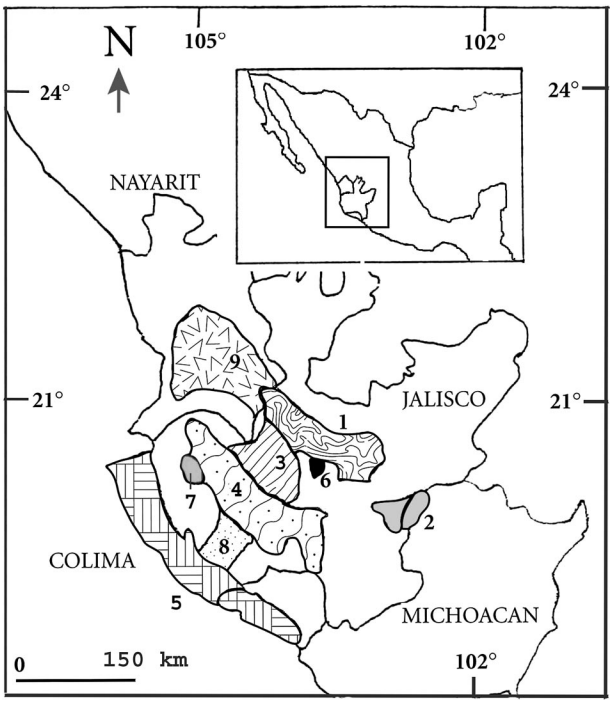

FIG. 3. Geographic distribution of *Pappogeomys bulleri* in Mexico. Subspecies are 1, *P. b. albinasus*; 2, *P. b. alcorni*; 3, *P. b. amacensis*; 4, *P. b. bulleri*; 5, *P. b. burti*; 6, *P. b. infuscus*; 7, *P. b. lutulentus*; 8, *P. b. melanurus*; and 9, *P. b. nayaritensis*.

of Jalisco and Colima. Geographic range of the subspecies is as follows (Russell 1968a): *P. b. albinasus* is restricted to central Jalisco at elevations of ca. 1,500 m. The distribution of *P. b. alcorni* is disjunct, occurring around Mazamitla in La Sierra del Tigre, Jalisco, and near Jiquilpan in Michoacan. *P. b. amecensis* occurs in mountains bordering Valle de Ameca in northwestern Jalisco at altitudes above 1,550 m on the Sierra de Quila and up to 1,980 m on Sierra de Ameca. *P. b. bulleri* occurs in the mountains of west-central Jalisco from northwestern slopes of the Coastal Range south of Río de Ameca, southward including Sierra de Juanacatlán, Sierra de Mascota, Sierra de Parnosa, and Sierra de Autlán to Sierra Nevada de Colima in south-central Jalisco. *P. b. burti* ranges down the coast to ca. 54 km SE of Manzanillo, Colima, in open fields in forest (Goldman 1939) and to Tenacatita Bay on the southwestern coast of Jalisco and Colima (Hall 1981). *P. b. infuscus* is found between 2,750 and 3,050 m at Cerro Tequila. *P. b. lutulentus* occurs in northwestern Jalisco, probably restricted to type locality at Sierra de Cuale. *P. b. melanurus* is found south of Purificación, Jalisco, and probably also occurs along the Pacific coast of Sierra de Perote and other coastal mountains in southwestern Jalisco. *P. b. nayaritensis* is restricted to the Sierra Tequila, ca. 16 km S of Tepic, Nayarit (altitude 1,524 m), and on the mountain ridge between the valleys of Compostela and Tepic, Nayarit.

FOSSIL RECORD. *Pappogeomys* 1st appeared in the late Pliocene (early Blancan) in Arizona with the extinct species *Pappogeomys bensoni*. The genus could have been derived from the morphotype *P. bensoni* (Russell 1968a). Most speciation took place in the Pleistocene. *P. bulleri* most closely resembles the ancestral morphotype. Restricted range of *P. bulleri* suggests that it is a relict species, possibly a late survivor of the ancestral stock of the genus (Russell 1968a).

FORM AND FUNCTION. The 6 mammae of *P. bulleri* consist of a pectoral pair and 2 inguinal pairs (Goldman 1939). Reproduction occurs year-round. Litter size is from 2 to 11 (Ceballos and Miranda 2000). Thinness of pelage and development of melanism are responses to the arid tropical environment in which *P. b. burti* lives (Russell 1968a).

ECOLOGY. *Pappogeomys bulleri* occurs from sea level on the Pacific coast to above 3,000 m (Hall 1981; Nowak 1999). Buller's pocket gopher is predominantly a montane species, occurring in soils mostly of volcanic origin in the pine–oak–madroño zone in western Jalisco and Nayarit, and is most abundant at higher elevations in meadows supporting grasses and forbs. Burrows sometimes extended into adjacent forest (Russell 1968a). Buller's pocket gopher occurs near corn and open fields where the soil is sufficiently deep (Ingles 1959). *P. bulleri* occurs in semitropical environments in larger canyons dissecting the western slope of the coastal range where it is associated with tropical shrubs, especially in cultivated areas. *P. b. albinasus* occurs in desert grassland on the western edge of the Central Plateau in north-central Jalisco, west of the Rio Santiago. *P. b. burti* occurs in arid tropical shrub associations on the Pacific coastal plains and open fields near Manzanillo (Goldman 1939; Russell 1968a). Roots of xerophytic shrubs, grasses, and forbs (species not given) are eaten by *P. bulleri* (Russell 1968a).

GENETICS. *Pappogeomys bulleri* has a 2n = 58 (Honeycutt and Williams 1982). Mitochondrial DNA cytochrome-*b* sequences indicate that *Pappogeomys* is a monophyletic lineage and that time since divergence from *Cratogeomys* was ca. 4.3 million years ago (DeWalt et al. 1993).

REMARKS. A recent phylogenetic analysis using DNA concluded that *P. alcorni* was a geographically disjunct subspecies of *P. bulleri* rather than a monotypic species (Demastes et al. 2003).

We thank A. Gardner for his help with synonymies and for providing general comments and J. Demastes and J. Patton for constructive comments on the manuscript.

LITERATURE CITED

Ceballos, G., and A. Miranda. 2000. Guía de campo de los mamíferos de la Costa de Jalisco, México. Fundación Ecológica de Cuixmala, A. C. Universidad Nacional Autónoma de México, Mexico City.

Demastes, J. W., A. L. Butt, M. S. Hafner, and J. E. Light. 2003. Systematics of a rare species of pocket gopher, *Pappogeomys alcorni*. Journal of Mammalogy 84:753–761.

DeWalt, T. S., P. D. Sudman, M. S. Hafner, and S. K. Davis. 1993. Phylogenetic relationships of pocket gopher (*Cratogeomys* and *Pappogeomys*) based on mitochondrial DNA cytochrome b sequences. Molecular Phylogenetics and Evolution 2:193–204.

Genoways, H. H., and J. K. Jones, Jr. 1969. Notes on pocket gophers from Jalisco, Mexico, with descriptions of two subspecies. Journal of Mammalogy 50:748–755.

Goldman, E. A. 1939. The pocket gophers of the genus *Pappogeomys*. Journal of Mammalogy 20:93–98.

Hall, E. R. 1981. The mammals of North America. Second edition. John Wiley & Sons, New York 1:1–600 + *90*.

Honeycutt, R. L., and S. L. Williams. 1982. Genic differentiation in pocket gophers of the genus *Pappogeomys*, with comments on intergeneric relationships in the subfamily Geomyinae. Journal of Mammalogy 63:208–217.

Ingles, L. G. 1959. Notas acerca de los mamíferos mexicanos. Anales del Instituto de Biología Universidad Nacional Autónoma de México 29:379–408.

McKenna, M. C., and S. K. Bell. 1997. Classification of mammals above the species level. Columbia University Press, New York.

Merriam, C. H. 1892. Descriptions of nine new mammals collected by E. W. Nelson in the states of Colima and Jalisco, Mexico. Proceedings of the Biological Society of Washington 7:164–174.

Merriam, C. H. 1895. Monographic revision of the pocket gophers, family Geomyidae (exclusive of the species of *Thomomys*). North American Fauna 8:1–258.

Nowak, R. M. 1999. Walker's mammals of the world. Johns Hopkins University Press, Baltimore, Maryland 2:837–1936.

Patton, J. L. In press. Family Geomyidae. In Mammal species of the world. Third edition (D. E. Wilson and D. M. Reeder, eds.).

Russell, R. J. 1957. A new species of pocket gopher (genus *Pappogeomys*) from Jalisco, México. University of Kansas Publications, Museum of Natural History 9:359–361.

Russell, R. J. 1968a. Revision of pocket gophers of the genus *Pappogeomys*. University of Kansas Publications, Museum of Natural History 16:581–776.

Russell, R. J. 1968b. Evolution and classification of the pocket gophers of the subfamily Geomyinae. University of Kansas Publications, Museum of Natural History 16:473–579.

Thomas, O. 1892. Diagnosis of a new Mexican *Geomys*. Annals and Magazine of Natural History, series 6, 10:196–197.

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