J. Mamm., 63(3):536–538, 1982

STRUCTURE OF SURFACE MOUNDS OF *ZYGOGEOMYS* (RODENTIA: GEOMYIDAE)

Pocket gophers of the genus *Zygogeomys*, once known from the Pliocene of Kansas and the Plio-Pleistocene of Arizona (Russell, 1968), are now restricted to the Neovolcanic range of north-central Michoacán, Mexico (Hall and Villa-R., 1949). The single living species, *Zygogeomys trichopus*, inhabits both undisturbed and cultivated regions on pine forest slopes above 2,000 m and is replaced at lower elevations by larger pocket gophers of the widespread genus, *Pappogeomys*. The limited geographic range and taxonomic monotypy of *Zygogeomys* are unusual among geomyids; the four other extant genera are both geographically widespread and taxonomically diverse.

Aside from anecdotal comments by Merriam (1895), little is known of the life history of *Zygogeomys*. During the summer of 1977, spring of 1978, and winter of 1981, we captured and observed *Z. trichopus* on the northwestern slopes of Volcán Tancítaro in Michoacán. Several features of its life history, including the structure of surface mounds, appear to be unique to this genus of pocket gopher and collectively suggest habits very different from those of other geomyids.

Merriam (1895) noted that *Z. trichopus* exhibits a unique combination of cranial characteristics and concluded, "*Zygogeomys* thus occupies an anomalous position in the family." In addition to diagnostic cranial and dental features, *Zygogeomys* is readily distinguished by several trenchant external features, including: 1) a naked, pad-like region on the rostrum posterior to the rhinarium (most conspicuous in the living animal); 2) very small, deep-set eyes; 3) a hairless tail; and 4) short, dense pelage with an almost metallic, smoke-black luster reminiscent of mole (Talpidae) fur (Fig. 1A). Whereas most other field-caught geomyids are very pugnacious, *Z. trichopus* was docile and did not posture aggressively or attempt to bite.

Surface mounds produced by *Z. trichopus* are volcano-shaped, similar to the earthen eruptions made by moles, and differ from those of other geomyids (Fig. 1B). Because differences in size and shape of pocket gopher mounds might reflect differences in burrowing and/or foraging behavior, we quantified the structure or surface mounds produced by *Zygogeomys* in order to compare mound morphology across genera. Surface mounds were measured for *Zygogeomys*, *Thomomys*, *Pappogeomys*, and *Orthogeomys*, all of which occur in the state of Michoacán. Four mound characters, including three dimensional variables (taken in mm and read to the nearest 5 mm) and one ratio variable, were recorded: 1) mound height; 2) greatest mound diameter; 3) tunnel diameter at surface; and 4) mound height:greatest mound diameter. Measurements of fresh mounds were taken only at actual collecting sites to insure correct identity of the owner. Each mound was presumed to represent the workings of a different individual because only one mound per burrow system was measured. Exact localities in Michoacán are available on request.

The characteristics of surface mounds produced by the four genera are presented in Table 1. The genera are listed in order of increasing body size, which is reflected in tunnel diameter. The ratio of mound height: greatest mound diameter serves as an index of gross mound shape; a low value indicates a mound that is relatively short and broad-based, whereas a high ratio describes a tall, narrow mound. Surface mounds belonging to *Thomomys*, *Pappogeomys*, and *Orthogeomys* differ significantly in absolute size, but not in gross shape (Mann-Whitney U-test; Sokal and Rohlf, 1973). All mounds produced by *Thomomys*, *Pappo-*

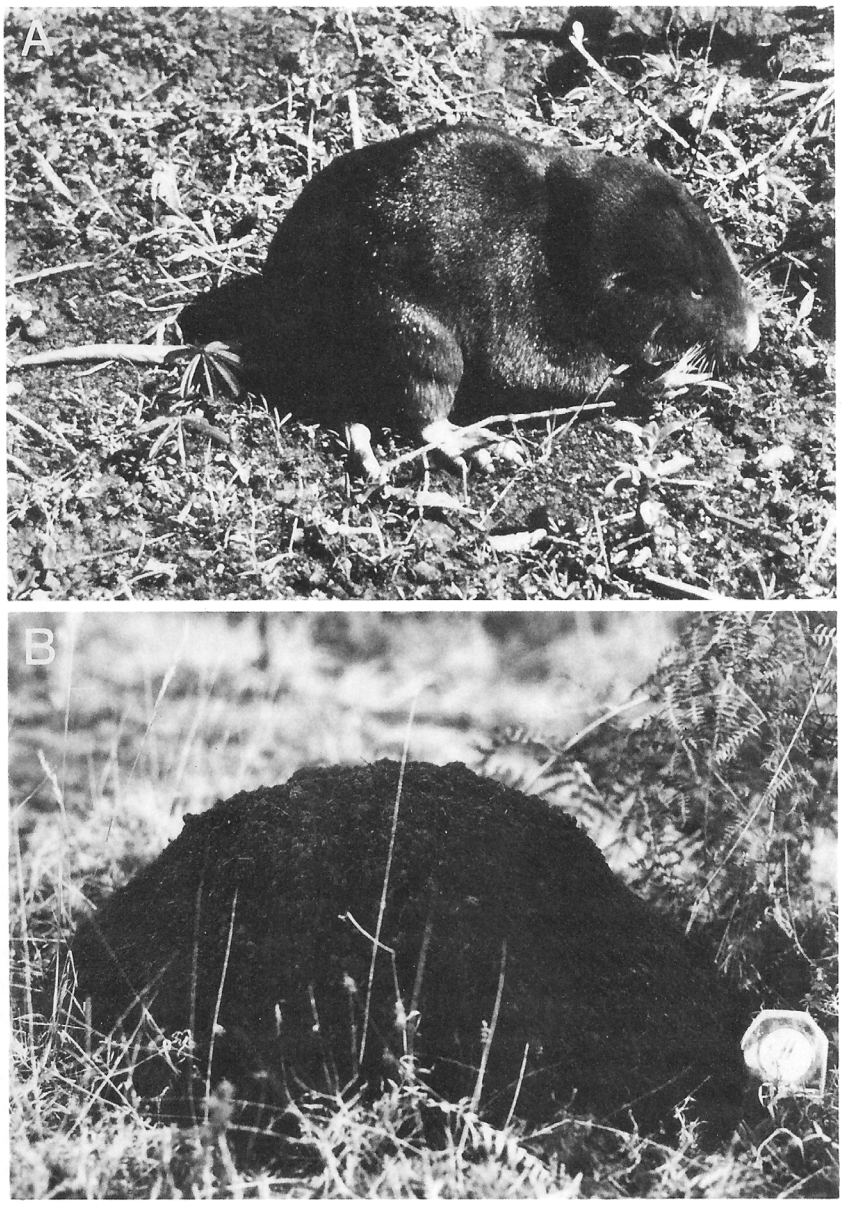

FIG. 1.—A. Adult male *Zygogeomys trichopus* collected 6 km N, 2 km W Tancítaro, 2,000 m, Michoacán, Mexico. Total length = 283 mm. B. Typical surface mound produced by Z. *trichopus*. Note the conspicuous absence of a terminal opening or plug. Tape measure is 5.5 cm at widest point.

geomys, and *Orthogeomys* have either the characteristic ring-like entrenchment indicative of a terminal plug, or simply a terminal opening (unplugged entrance).

Surface mounds produced by *Zygogeomys* are significantly taller ($P < 0.05$; Mann-Whitney U-test) and more conical in shape (significantly larger mound height:greatest mound diameter ratio; $P < 0.05$) than are those of the other three genera (Fig. 1B). Moreover, *Zygogeomys* mounds lack a terminal opening or plug.

Surface mounds of *Zygogeomys* differ in gross shape from mounds of other geomyids (including those of *Geomys*, which are not quantified herein) because *Zygogeomys* do not emerge through the apex of the mound to push soil away from the burrow entrance. Such "bull-dozing" behavior in other geomyids tends to spread and flatten the mound. Although it is easy to account for the general shape of the mounds of *Zygogeomys*, it is more difficult to relate burrow shape to the burrowing and/or foraging habits of this genus. *Zygogeomys* do not emerge onto the surface to forage, for we found no open holes and no evidence of surface foraging activity. All other geomyid genera exhibit surface foraging activity, especially near the surface mound (Grinnell, 1923; Aldous, 1951; Howard and Childs, 1959; Hall and Dalquest, 1963; pers. observ.). Mounds of *Zygogeomys* appear to serve only as dump-sites for excavated soil.

Our preliminary observations suggest that Z. *trichopus*, unlike other living geomyids, may be totally

TABLE 1.—*Characteristics of surface mounds constructed by four genera of pocket gophers in Michoacán, Mexico. Values within a column for the four mound descriptors ($\bar{X} \pm 2$ SE) are significantly different ($P < 0.05$) except where indicated.*

Genus N (mounds per genus)	Mound height	Greatest mound diameter	Tunnel diameter at surface	Mound height: greatest mound diameter
Thomomys (10)	94 ± 11	298 ± 42	75 ± 3	0.32
Zygogeomys (20)	226 ± 17	487 ± 36	92 ± 3	0.46
	ns	ns ns		ns ns
Pappogeomys (10)	137 ± 16	509 ± 59	105 ± 4	0.27
	ns		ns	ns
Orthogeomys (10)	119 ± 21	353 ± 25	118 ± 11	0.34

subterranean in foraging habits. Such habits would lead to fewer encounters with predators, particularly avian predators, and might have placed a lower selective premium on pugnacious behavior. If Z. *trichopus* is totally subterranean in its foraging behavior, it is unique among geomyids and provides an unusual opportunity to investigate different kinds and degrees of fossoriality within a family of mammals.

This work was supported in part by a grant from the University of California Center for Latin American Studies and National Science Foundation Grant DEB 81-07039 to M.S.H. and by National Science Foundation grant DEB78-12029 to James L. Patton, University of California, Berkeley. Field assistance from Patti M. Hafner is gratefully acknowledged.

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