A REVIEW OF THE GEOMYDOECUS MINOR COMPLEX (MALLOPHAGA: TRICHODECTIDAE) FROM THOMOMYS (RODENTIA: GEOMYIDAE)¹

By Roger D. Price² and Ronald A. Hellenthal³

Abstract. Nine species of the Geomydectes (Thomomydectes) minor complex are described and illustrated: G. (T.) minor from 43 subspecies of Thomomys bottae and 3 of T. umbrinus (type-host: T. b. bottae); G. (T.) horseyi, n. sp. from 2 subspecies of T. bottae and 3 of T. umbrinus (type-host: T. u. sanctus); G. (T.) zaatecae, n. sp. from 11 subspecies of T. umbrinus and 5 of T. bottae (type-host: T. u. zaateca); G. (T.) tumi, n. sp. from 27 subspecies of T. bottae (type-host: T. b. nigricans); G. (T.) dierrenii from 2 subspecies of T. umbrinus (type-host: T. u. tabac), G. (T.) marshalli, n. sp. from T. u. umbrinus; G. (T.) williamsi, n. sp. from T. umbrinus subsp. from Haxaca, Mexico; G. (T.) arizaba, n. sp. from 2 subspecies of T. umbrinus (type-host: T. u. arizaba); and G. (T.) pholusii, n. sp. from T. u. valdorensis. A key is given for the identification of the males of the complex.

Following the revision of Geomydectes Ewing by Price & Emerson (1971), the new subgenus Thomomydectes was erected by Price & Emerson (1972) to include 6 species of pocket gopher lice. Of these, 5 are restricted in their host distribution to subspecies of Thomomys bottae (Eydoux & Gervais) and T. umbrinus (Richardson). Extensive collecting of lice since then from these host groups has revealed that members of Thomomydectes occur much more widely than previously thought and that they include a number of undescribed taxa. The Thomomydectes from the bottae-umbrinus complex of hosts can be separated into the new species complex containing species whose males have tergites II-III with long clustered setae and the minor complex whose males have tergites II-III with short, widely spaced setae. We treat the taxonomy of the latter complex here. This consists of the redescription of the 2 species now recognized in the minor complex, the description of 7 new species, and the presentation of a key for the identification of the males of these species.

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We have restricted the scope of this paper to the presentation of louse descriptions and associated distributional host and locality data. No attempt is made to discuss the significance of these distributions, as we feel that can best be done after the taxa of all louse complexes on T. bottae and T. umbrinus have been delineated.

Quantitative data for lice of the minor complex combined with their host and locality information are included as part of a computerized pocket gopher louse data base maintained at the University of Minnesota. The retrieval and analysis of these data were performed with an integrated group of computer programs that we developed and called the BUG system. A description and explanation of our data handling and analysis procedures may be found in Price & Hellenthal (1979).

In the following descriptions, counted or measured characters are followed by the minimum and maximum observed values, then the sample size, mean, and standard deviation in parentheses. Measurements are in millimetres. Illustrations are for specimens from the type-host. In evaluating character usefulness for specific discrimination, critical values for each character were calculated at the point where the likelihood of single character misidentification of the 2 compared taxa was equal, given normality and equal variance, and ignoring probability of collection. For characters offering moderately good discriminating ability, these critical values and the corresponding probabilities of misidentification are given. Comparative descriptions for closely related species are abbreviated, with quantitative data given only for those characters whose means differ at a significance level of $P \leq 0.01$. In the “Specimens examined” section, a number in parentheses following a locality represents the total number of gophers from which lice were taken. Original locality data expressed in miles are followed parenthetically by the metric equivalent to 0.1 km; the English figure, rather than the metric, expresses the precision of the location estimate. Full locality information including latitude, longitude and in many cases elevation for
any host collection is available from the authors. Although most paratypes will be retained in the collection of the University of Minnesota, representatives will be deposited in the U.S. National Museum of Natural History, British Museum (Natural History), and occasionally other major collections.

The discriminant functions given in this paper were calculated using the U.C.L.A. Biomedical Computer Program BMD04M (Discriminant Analysis for Two Groups), as described in Dixon (1975). The principal components analysis used a computer program adapted from program PCFLOR in Goldstein & Grigel (1972).

The species within the minor complex may be separated into 2 groups based largely on the shape of the male genitalia; these are called the minor group and the dickerman group. The following 4 species form the minor group based on the male genitalia having relatively straight parameral arch (Fig. 6–8,B) and endomeral plate (Fig. 6–8,C) elements. For males, the best quantitative characters between the minor and dickerman groups and their critical values for discrimination and probabilities of misidentification were the width of the genital endomeral plate 0.029 (0.059), the length of the antennal scape 0.096 (0.162), and the number of setae on tergite II 10.29 (0.184). There are no known quantitative or qualitative features for distinguishing between the females of the 2 groups.

Genycoedus (Thomomycoedus) minor Wernneck

Fig. 1–6, 9


As in Fig. 1. Temple width (IW) 0.315–0.370 (475: 0.338 ± 0.010); head length (HL) 0.220–0.290 (476: 0.265 ± 0.009); submargin and inner marginal temple setae (S1S, MTN: Fig. 2) 0.015–0.035 (446: 0.025 ± 0.003) and 0.025–0.050 (427: 0.037 ± 0.005) long, respectively, with S1S lateral to inner MTN. Antenna (Fig. 3) with scape length (SL) 0.085–0.120 (453: 0.108 ± 0.015), scape width (SW) 0.060–0.080 (456: 0.070 ± 0.004). Prothorax width (PW) 0.215–0.280 (482: 0.247 ± 0.010). Tergal setae. I: 2, II: 7–12 (477: 9.0 ± 0.55). III: 11–20 (474: 14.1 ± 1.50). IV: 9–20 (480: 14.1 ± 1.56). V: 8–16 (475: 12.4 ± 1.33). VI: 6–13 (478: 9.5 ± 1.33). Female and pleural setae on V: 10–13 (479: 11.8 ± 0.76). Dorsal terminalia as in Fig. 9, with broad terminal setose portion preceded anteriorly by paired long lateral setae on each side, pair of sensillum (SN) more or less posterior to these setae, then short and medium seta anterior to these. Sternal setae. II: 3–12 (478: 8.2 ± 1.10); III: 8–16 (479: 11.6 ± 1.28); IV: 9–19 (481: 14.3 ± 1.50); V: 9–17 (476: 11.9 ± 1.29); VI: 8–15 (482: 11.0 ± 0.97). Total length (TL) 0.970–1.270 (452: 1.145 ± 0.052).

Remarks. The best qualitative feature for recognizing the males of G. minor from those of the other 3 species in the group is the deep medioanterior indentation of the genitalic endomeral plate and the asymmetry of the adjacent lateroanterior projections; we know of no qualitative or quantitative characteristics that will separate the females. For males, the best quantitative characters separating them from other taxa in the group and their critical values for discrimination and probabilities of misidentification were the length of the antennal scape 0.102 (0.162) and the length of the endomeral plate 0.073 (0.194).

Specimens examined. USA: 5♂, 5♀, T. b. tularoae, New Mexico: Otero Co.: 0.5 mi. (0.8 km) W of Tularosa (3), Alamogordo (1). 100♂, 101♀, T. b. actuatus Kelson, New Mexico: Bernallillo Co.: La Madera Ski Run (1); Lincoln Co.: 0.3 mi. (0.5 km) E (1), 2.7 mi. (4.3 km) N, 6.5 mi. (10.5 km) W (1), 7.2 mi. (11.6 km) N, 6.8 mi. (10.9 km) E (3), 1.2 mi. (1.9 km) S, 7 mi. (11.3 km) E (1), 4 mi. (6.4 km) S, 11 mi. (17.7 km) E (1), 5.5 mi. (8.8 km) S, 4.5 mi. (7.2 km) E (1) of Capitan, 5 mi. (8.0 km) S, 5 mi. (8.0 km) W of Glencoe (1), 1.4 mi. (2.3 km) S, 1.3 mi. (2.1 km) E (3), 2 mi. (3.2 km) S (1) of Nogal, 2 mi. (3.2 km) S of Rough Mt (4), 5.7 mi. (9.2 km) N, 15 mi. (24.1 km) E (1), 2.4 mi. (3.9 km) N, 9 mi. (14.5 km) E (1) of Ruidoso; San Miguel Co.: 3.0 mi. (4.8 km) N of Pecos (5); Sierra Co.: 32
Fig. 1–5. Geomyophora minor: (1) ♂ (TW, temple width; PW, prothorax width; HL, head length; TL, total length); (2) ♂ temple margin (MTS, marginal temple seta; STS, submarginal temple seta); (3) ♂ ventral antenna (SL, scape length; SW, scape width); (4) ♀ terminalia (LS, lateral setae of fast tergite; SGP, subgenital plate); (5) ♀.
mi. (51.5 km) W, 10 mi. (16.1 km) N of Tularosa (1); Torrance Co.: 7 mi. (11.3 km) NW of Taquile (4). 22°23'.25", T. b. alexandrae Goldman, Arizona: Coconino Co.: 5 mi. (8.0 km) S of Summit, Navajo Mts (4), 2 mi. (3.2 km) SE of Endische Spring (1), Rainbow Lodge (2). 46°46', T. b. alienus Goldman, Arizona: Cochise Co.: 1 mi. (1.6 km) N (1), at (1) St. David, 5 mi. (8.0 km) SE of Casabel (1), Fairbank (5); Graham Co.: Safford (2), 0.8 mi. (1.3 km) E of Solomon (1); Pima Co.: Redington (6); Pinal Co.: Mammoth (1), 71°46'.9", T. b. apache V. Bailey, Colorado: La Plata Co.: 7 mi. (11.3 km) N (1), at (3) Florida; New Mexico: Rio Arriba Co.: 1 mi. (1.6 km) S of Lake Jara (2). 129°23', T. b. aurea J. A. Allen, Arizona: Navajo Co.: Polacca (1); Colorado: La Plata Co.: Bayfield (3); Montezuma Co.: 15 mi. (24.1 km) W (1), 4.5 mi. (7.2 km) S (1) of Cortez, 1 mi. (1.6 km) E of Cahone (3), Park Point, Mesa Verde National Park (1); San Miguel Co.: 19 mi. (30.6 km) N of Dooe Creek (1); New Mexico: Rio Arriba Co.: 1 mi. (1.6 km) N, 1 mi. (1.6 km) W of Llaves (2); San Juan Co.: Aztec (1); Utah: San Juan Co.: Bluff (4), Monticello (1). 1°26', T. b. bailey Merriam, Texas: Hudspeth Co.: Sierra Blanca (2). 65°22', T. u. burtii Huey, Arizona: Pima Co.: Santa Rita Mts (1). 19°18', T. b. catalinae Goldman, Arizona: Pima Co.: Summerhaver (3), Soldier Camp, Spencer Mt (3), Santa Catalina Mts (4). 26°23', T. b. collinus Goldman, Arizona: Cochise Co.: Rustlers Park (7), Turkey Creek Canyon (3), Upper Pinery Canyon (1). 26°23', T. b. confinis Goldman, Texas: Sutton Co.: 7 mi. (11.3 km) E of Sonora (4); Crockett Co.: 4 mi. (6.4 km) N of Ozona (1). 57°56', T. b. connectens Hall, New Mexico: Bernalillo Co.: 5 mi. (8.0 km) N (2), 4.5 mi. (7.2 km) S (1), at (2) Albuquerque, Pajarito (1); Sandia Co.: Sandia (2); Socorro Co.: 1 mi. (1.6 km) S (1), 1.2 mi. (1.9 km) E (1) of Bernardo. 1°4', T. b. contractus Durante, Utah: Beaver Co.: Beaver (2), 2 mi. (3.2 km) E of Adamsville (1). 1°28', T. b. callidus Kelso, New Mexico: Colfax Co.: Cimarroncito (1); Union Co.: 5.9 mi. (9.5 km) SE of Des Moines (7). 2°6', T. u. emorius Goldman, New Mexico: Hidalgo Co.: Guadalupe Canyon (1), 5 mi. (8.0 km) E of Cloversdale (1), Animas Peak (1). 17°18', T. b. extensus Goldman, Arizona: Cochise Co.: El Coronado Ranch (3), 2.7 mi. (4.3 km) W of State Highway 181 and Turkey Creek Road (1), Wilcox (2); Graham Co.: Bonita (4), 4092', 3232', T. b. fulvus (Woodhouse), Arizona: Apache Co.: W Fork of Black River (4), N Fork of White River (2), 2 mi. (3.2 km) N (1), at (1) Phelps Botanical Area, 30 mi. (48.3 km) SSW (1), at (2) Springerville, 7 mi. (11.3 km) N of Big Lake (2); Coconino Co.: 3 mi. (4.8 km) S. 4 mi. (6.4 km) E of Clints Well (4), Little Spring (5), 2 mi. (3.2 km) W (3), at (1) Bismarck Lake, 3 mi. (4.8 km) E of Morman Lake (2), Fern Mt (3), Whistler Lehake (1), Pivot Rock Spring (1), San Francisco Mt (1); Gila Co.: 7.4 mi. (11.9 km) S of Colorod Lookout (1); Greenlee Co.: 2 mi. (3.2 km) N of Blue (1), Hannagan Creek (1), 8.2 mi. (13.2 km) N of Hannagan Meadows (2), Rose Peak (4); Navajo Co.: 7.3 mi. (11.7 km) W (1), 4 mi. (6.4 km) W of Show Low (2), 2.8 mi. (4.5 km) SW of Heber (2); Yavapai Co.: 5 mi. (8.0 km) SW of Jerome (3), Prescott (2), 0.5 mi. (0.8 km) E of Ponderosa Park (2); New Mexico: Catron Co.: 4.5 mi. (7.2 km) E. 2 mi. (3.2 km) S of Madre Mt (1), 15.8 mi. (25.4 km) N of Apache Creek (2), Davenport Spring (2), 6.7 mi. (10.8 km) S of Luna (2), 9 mi. (14.5 km) E of State Line and Highway 60 (1), Willow Creek (3), 2.5 mi. (4.0 km) N of Glenwood (1); Grant Co.: Rocky Canyon (3), 1 mi. (1.6 km) S of Cliff (1), Trout Creek (1), 7 mi. (11.3 km) E of Silver City (1), Iron Creek (3); McKinley Co.: Sawmill Canyon (3); Socorro Co.: Bear Trap (2). 48°23', T. b. graminis Woodward, Arizona: Graham Co.: Hospital Flat (7), Arcadia Campground (2), Turkey Flat (2), Marjilda Canyon (1). 17°26', T. b. guadalupensis Goldman, New Mexico: Eddy Co.: 1 mi. (1.6 km) N. 23.3 mi. (37.5 km) W of White City (5); Texas: Culberson Co.: McKittrick Canyon (1), Guadalupe Mts (1). 35°32', T. b. hualapensis Goldman, Arizona: Mohave Co.: Hualapai Peak (2), Democrat Mine (2). 19°26', T. b. hueyi Goldman, Arizona: Cochise Co.: Miller Canyon (2), Huachucha Mts (1); Pima Co.: Rincon Mts (3). 38°22', T. u. intermedius Means, Arizona: Cochise Co.: Ramsey Canyon (2); Santa Cruz Co.: Sycamore Canyon (1). 31°26', T. b. intermedius Goldman, Colorado: Coster Co.: 2.5 mi. (4.0 km) S of Wetmore (1); Fremont Co.: 1 mi. (1.6 km) E of Coaldale (1); Huerfano Co.: Gardner (1), 4 mi. (6.5 km) W of Walsenburg (4). 17°25', T. b. latirostris Merriam, Arizona: Navajo Co.: Keams Canyon (1), Zuni Well (2), Winslow (1), 11 mi. (17.7 km) NW of Kayenta (1). 38°22', T. b. limitatus Goldman, Texas: Brewster Co.: Mt Emory (1), 21°27', T. b. limpinse Blair, Texas: Jeff Davis Co.: 1 mi. (1.6 km) N (3), 11.6 mi. (18.7 km) NNW (1), 8.2 mi. (13.2 km) N, 6.5 mi. (10.5 km) E (4) of Fort Davis, 23°19', T. b. mearnsi V. Bailey, New Mexico: Hidalgo Co.: Gray's Ranch, Animas Valley (5), 4 mi. (6.4 km) NW of San Luis Pass (1). 48°27', T. b. medicus
Goldman, Arizona: Pima Co.: 10 mi. (16.1 km) E, 6 mi. (9.7 km) N (1), at (5) Tucson; Santa Cruz Co.: 5 mi. (8.0 km) NE (1), 4 mi. (6.4 km) N (1) of Nogales, 0.5 mi. (0.8 km) E of Amado (1), 1 mi. (1.6 km) SW (1), 7 mi. (11.3 km) N (3) of Patagonia, 2 mi. (3.2 km) W of Lochiel (1), Tubac (1). 35°3.33′, T. b. mutabilis Goldman, Arizona: Gila Co.: South Fork of Workman Creek (1), Peterson Ranch (1), Rose Creek (2); Yavapai Co.: Camp Verde (4), Oak Creek at Cornville (2). 65°4.4′, T. b. operans Hatfield, Arizona: Yavapai Co.: Kirkland Jet (1), 6 mi. (9.7 km) N of Yarnell (1). 28°5.26′, T. b. opulentis Goldman, New Mexico: Dona Ana Co.: 0.8 mi. (1.3 km) S of Ruidoso Springs (6); Socorro Co.: San Marcial (2), Socorro (1). 19°3.16′, T. b. parvulus Goldman, Arizona: Cochise Co.: 30 mi. (48.3 km) E of Tucson (1); Pima Co.: 14 mi. (22.5 km) E of Tucson (5). 46°4.46′, T. b. parvulus Merriam, Colorado: Conejos Co.: 5 mi. (8.0 km) W of Antonito (1), 3.1 mi. (5.0 km) W of Las Mesitas (2); New Mexico: Rio Arriba Co.: Alcalde (2), 4.5 mi. (7.2 km) N of El Rito (1), 2 mi. (3.2 km) N of Española (1); Santa Fe Co.: Santa Fe (1); Taos Co.: 5 mi. (8.0 km) NE of Questa (1). 33°1.1′, T. b. pervarius Goldman, Texas: Presidio Co.: 35 mi. (56.3 km) S of Marfa (1). 45°3.3′, T. b. praximus Burt & Campbell, Arizona: Pima Co.: 1 mi. (1.6 km) N of Greatererville (2). 5°5.11′, T. b. rubidus Youngman, Colorado: Fremont Co.: 3 mi. (4.8 km) E of Canon City (2). 10°5.6′, T. b. rufulus Hoffmeister, New Mexico: McKinley Co.: Gallup (2), 51°3.54′, T. b. ruidosae Hall, New Mexico: Lincoln Co.: 14 mi. (22.5 km) N (3), 1 mi. (1.6 km) S (1), at (3) Ruidoso, 2.8 mi. (4.5 km) S, 2.0 mi. (3.2 km) W of Nogal (1), 4 mi. (6.4 km) W of Alto (2); Otero Co.: Jct Willie White & Penasco Canyons (2), 4 mi. (6.4 km) E, 3.25 mi. (5.2 km) N of Mescalero (3). 47°14′, T. b. scotoophilus Davis, Texas: Hudspeth Co.: Diablo Mts (3). 43°2.2′, T. b. texensis V. Bailey, Texas: Jeff Davis Co.: 5 mi. (8.0 km) E of Mt Livermore (2), Davis Mts (1). 27°4.7′, T. b. tollocos J. A. Allen, New Mexico: Grant Co.: Fort Webster (1); Hidalgo Co.: Upper Corner Monument 40 (1). MEXICO: 27°2.2′, T. b. angustidens Baker, Coahuila: 5 mi. (8.0 km) S, 3 mi. (4.8 km) W (1), 6 mi. (9.7 km) N, 6 mi. (9.7 km) W (1) of Acebuches. 1°4.4′, T. b. basilicata Benso & Tillotson, Sonora: 2 mi. (3.2 km) W of Magdalena (2). 27°, T. b. divergens Nelson & Goldman, Sonora: 13.25 mi. (21.3 km) S of Esqueda (1). 16°3.3′, T. b. modicus, Sonora: 2 mi. (3.2 km) S of La Casita (1), 40 km S of Nogales (1), Santa Cruz (1). 7°5.6′, T. b. retractus Baker, Coahuila: 1 mi. (1.6 km) N (1), at (1) Las Margaritas. 65°5.1′, T. b. sturgisi Goldman, Coahuila: Piedra Blanca, Sierra del Carman (1), 38 mi. (61.1 km) S, 23 mi. (37.0 km) E of Boquillas del Carman (1). 1°4.7′, T. b. tollocos, Chihuahua: Casas Grandes Viejo (2).

**Geomydoecus (Thomomydoecus) birneyi** Price & Hellenthal, new species

- **Type-host**: Thomomys unrimus sonorensis Nelson & Goldman.
- **Distribution**: Much as for *G. minor*, except as follows: Temple width 0.325–0.365 (56: 0.343 ± 0.0086); head length 0.250–0.265 (56: 0.249 ± 0.0078); Antenna with scape length 0.075–0.095 (54: 0.088 ± 0.0040), scape width 0.055–0.065 (54: 0.063 ± 0.0029); Prothorax width 0.225–0.270 (56: 0.242 ± 0.0085); Tergal setae. IV, 9–17 (54: 13.1 ± 1.11); V, 8–16 (55: 11.5 ± 1.30). Dorsal terminalia as in Fig. 10, with paired sensilla on line with anterior to lateral paired setae. Sternal setae. III, 8–13 (56: 10.9 ± 1.24); IV, 7–17 (56: 13.7 ± 1.89); V, 9–15 (54: 11.4 ± 1.26); VI, 8–12 (55: 10.5 ± 0.90); VIII, 4–7 (55: 5.6 ± 0.80). Total length 1.030–1.165 (54: 1.092 ± 0.0338). Genitalia. As in Fig. 7A: parameral arch as in Fig. 7B, width 0.045–0.055 (56: 0.051 ± 0.0027); endosomal plate shaped as in Fig. 7C, without deep medioanterior indentation and with symmetrical lateroanterior corners, width 0.015–0.025 (53: 0.020 ± 0.0020). Length 0.060–0.075 (52: 0.069 ± 0.0039).

- **Type-locality**: Much as for *G. minor*, except as follows: Temple width 0.350–0.410 (75: 0.384 ± 0.0133); head length 0.245–0.290 (75: 0.265 ± 0.0092); inner marginal temple setae 0.035–0.050 (69: 0.040 ± 0.0039); long. Tergal and pleural setae on VII, 22–35 (74: 27.9 ± 2.62); medial setae on tergite VIII, 2–6 (138: 3.6 ± 0.91) (Fig. 12). Last tergite with outer seta 0.090–0.120 (60: 0.104 ± 0.0077), middle seta 0.070–0.110 (62: 0.092 ± 0.0091), inner seta 0.050–0.105 (70: 0.065 ± 0.0080); long. Sternal setae. II, 8–16 (74: 11.8 ± 1.43); VI, 12–20 (74: 17.1 ± 1.59); VII, 11–17 (75: 13.4 ± 1.37). Total length 1.020–1.285 (74: 1.153 ± 0.0685).

**Remarks.** Qualitatively, the male of *G. birneyi* is easily separated from that of *G. minor* by the symmetry of the anterior portion of the endosomal plate and the absence of a deep medioanterior indentation. There are no known qualitative features for separating the females of these taxa. For males, the best quantitative characters separating *G. birneyi* from *G. minor* and their critical values for discrimination and probabilities of misidentification were the length of the antennal scape 0.098 (0.021), the width of the parameral arch 0.054 (0.186), and the length of the endosomal plate 0.074 (0.190). For females, the larger number of median tergal setae on VIII will separate most individuals; *G. minor* had 2 setae in this position whereas *G. birneyi* had 87% of the specimens with 3 or more setae.

This species is named for Dr Elmer C. Birney, Bell Museum of Natural History, University of
Minnesota, in recognition of his interest and support of mammal-ectoparasite studies.

Holotype ♂, T. u. sonoriensis (University of California Museum of Vertebrate Zoology-148909), MEXICO: Sonora: 1 mi. (1.8 km) N of Sahuaraipa, 19.VII.1975, J. L. Patton; in collection of University of Minnesota. Paratypes: 5♂♂, 7♀♀, T. u. sonoriensis, MEXICO: Sonora: 3 km NE (2), 1 mi. (1.6
km) S (3), at (3) Moctezuma, Mina San Eufracio, 10 mi. (16.1 km) NE of Chinapán (3).

Other specimens examined. USA: δ, 87, T. u. burtii Huey, Arizona: Pima Co.: Madera Canon (2), Santa Rita Mts (2), 29δ, 41♀, T. u. intermedius, Arizona: Cochise Co.: 2 mi. (3.2 km) N (2), at (2) Sunnyside; Santa Cruz Co.: Sycamore Canyon (8), Italian Canyon (1). δ, 15♀, T. b. modicus, Arizona: Pima Co.: 55 mi. (56.3 km) S of Tucson (3); Santa Cruz Co.: Sycamore Canyon (4). MÉXICO: 1δ, 3♀, T. b. divergens Nelson & Goldman, Sonora: 1 mi. (1.6 km) N of Hoachinera (1). 6δ, 13♀, T. umbrinus subsp., Sonora: 1 mi. (1.6 km) W of Yecora (2).

**Geomyodescus (Thomomyodescus) zacatecae** Price & Hellenthal, new species

*Type-host.* Thomomys umbrinus Nelson & Goldman.

δ. Much as for G. minor, except as follows. Temporal width 0.390-0.430 (169; 0.349 ± 0.015); head length 0.225-0.275 (166; 0.242 ± 0.0116); subarcual and inner marginal temporal setae 0.015-0.035 (137; 0.024 ± 0.0080) and 0.025-0.045 (135; 0.034 ± 0.0057) long, respectively. Antenna with scape length 0.080-0.115 (163; 0.099 ± 0.0059), scape width 0.055-0.075 (161; 0.066 ± 0.0044). Prothorax width 0.210-0.265 (174; 0.239 ± 0.0105). Tergal setae: II, 6-11 (172; 8.7 ± 0.57); III, 10-18 (172; 13.3 ± 1.34); IV, 9-16 (169; 12.4 ± 1.48); V, 7-14 (167; 10.9 ± 1.47); VI, 6-12 (169; 8.4 ± 1.25); tergal and pleural setae on VII, 9-14 (169; 11.5 ± 0.91). Dorsal terminalia as for G. birneyi (Fig. 10), but with sensilla often posterior to lateral setae. Sternal setae: II, 6-12 (172; 7.9 ± 1.02); III, 8-14 (168; 10.5 ± 1.05); IV, 9-17 (171; 12.8 ± 1.41); V, 8-13 (168; 10.8 ± 1.28); VI, 8-13 (171; 10.2 ± 0.91); VII, 6-11 (170; 9.1 ± 1.03); VIII, 3-8 (169: 5.2 ± 0.86). Total length 0.935-1.259 (158: 1.104 ± 0.0578). Geomyodescus. Close to G. birneyi (Figs. 7), parameral arch width 0.055-0.060 (165: 0.052 ± 0.0047); endomeral plate width 0.015-0.025 (167: 0.021 ± 0.0025); length 0.060-0.080 (162: 0.072 ± 0.0042).

♀. Much as for G. minor, except as follows. Temporal width 0.355-0.430 (167; 0.384 ± 0.0147); head length 0.240-0.295 (168; 0.265 ± 0.0110); subarcual and inner marginal temporal setae 0.020-0.030 (152; 0.023 ± 0.0027) and 0.025-0.050 (152; 0.033 ± 0.0039) long, respectively. Prothorax width 0.255-0.310 (167; 0.278 ± 0.0117). Tergal setae: II, 9-16 (166; 12.2 ± 1.17); III, 14-24 (165; 19.0 ± 1.71); IV, 17-29 (163; 22.8 ± 2.15); V, 16-29 (168; 22.2 ± 2.12); VI, 14-27 (169; 20.9 ± 2.21); tergal and pleural setae on VII, 19-33 (169; 25.3 ± 2.25); medial setae on VIII, 2-4 (166; 2.1 ± 0.26); longest seta of medial pair on tergite VIII, 0.060-0.100 (148; 0.080 ± 0.0092). Last tergite with middle seta 0.070-0.130 (143; 0.100 ± 0.0125) long. Sternal setae: II, 7-14 (166; 10.5 ± 1.29); III, 8-17 (166; 13.5 ± 1.50); IV, 11-22 (164; 16.8 ± 1.81); V, 12-22 (165: 16.7 ± 1.79); VI, 11-21 (168; 13.9 ± 1.61); VII, 10-16 (169: 12.5 ± 1.65). Subgenital plate. With 18-33 (169; 24.7 ± 3.09) setae.

Remarks. The male genitalia of *G. zacatecae* are characterized by these of *G. birneyi* and thereby enable separation from *G. minor*; however, the placement of the sensilla on the dorsal terminalia is as in *G. minor*. The females are close to those of *G. minor*; most (96%) had only 2 medial setae on tergite VIII. For males, the best quantitative character separating *G. zacatecae* from *G. birneyi*, respectively, and the critical values for discrimination and probabilities of misidentification were the antennal scape length 0.103 (0.194) and 0.093 (0.158).

The fact that *G. zacatecae* occurs in 2 isolated populations, 1 in Mexico and the other in the USA (Colorado, Utah, and northern New Mexico and Arizona) caused us some concern. These lice appeared to us to be qualitatively inseparable, and analyzed quantitative characters gave us similar results. We, therefore, regard both populations as the same taxon.


Other specimens examined. MÉXICO: 10δ, 6♀, T. u. arragengis Dalquest, San Luis Potosi: 1 km S (2), 11 km N, 12 km E (2), 4 mi. (6.4 km) E (1) of Arriaga. 11δ, 5♀, T. u. atroradialis Nelson & Goldman, San Luis Potosi: Alvarez (3), 129δ, 141♀, T. u. chililatuae Nelson & Goldman, Durango: 3 mi. (4.8 km) NW (6), 15 mi. (24.1 km) W (1), 6 mi. (9.7 km) SW (2) of El Salto, 3 mi. (4.8 km) E of Las Adjuntas (1). 1 mi. (1.6 km) E (6), 7.7 mi. (12.4 km) W (5) of La Ciudad, 1.3 mi. (2.1 km) NE of Mil Dios (5), 83 km WSW of Durango (2). 45♀, 63♂, T. u. crassidens Nelson & Goldman, Zacatecas: 3 mi. (4.8 km) NW of Monte Escobedo (4), 3 mi. (4.8 km) SW (1), 10 km S, 1 km W (2) of Sombrerete. 34♀, 26♂, T. u. durangoi Nelson & Goldman, Durango: 22 mi. (35.4 km) WSW (2), at (1) Durango, 1.5 mi. (2.4 km) S of Morcillo (2). 25♀, 19♂, T. u. mexicus Nelson & Goldman, Aguascalientes: 3 mi. (4.8 km) N of Cerro del Jaguey (6); Zacatecas: 11 mi. (17.7 km) NW of Jalpa (4); El Plateado (1). 1♀, 4♂, T. u. goldmani Merriman, Coahuila: 3 mi. (4.8 km) SE of Toreon (1); Durango: 4 mi. (6.4 km) WSW of Lerdo (1).
11/17, T. u. newmani Dalquest, Jalisco: 10 mi. (16.1 km) NW (3), 2 mi. (3.2 km) SW (1) of Matanzas, 4.5 mi. (7.2 km) NE of Comanja de Corona (2); San Luis Potosi: Palma Pegada (1). 9/5/5, T. u. potosinus Nelson & Goldman, San Luis Potosi: La Tinaja (3). Ventura (2), 9/5/5, T. u. pullus Hall & Villa, Michoacan: 6.5 km S of Patzcuaro (1). USA: 9/5/5, T. b. akamadis Goldman, Utah: Garfield Co.: Henry Mts (2), 9/5/5, T. b. internus, Colorado: Chaffee Co.: 2 mi. (3.2 km) N of Salida (1); El Paso Co.: 1.25 mi. (2.0 km) S of Colorado Springs (1). 9/5/5, T. b. osoool Goldman, Utah: Carbon Co.: 0.5 mi. (0.8 km) NW (1), at (1) Spring Glen; Emery Co.: 5 mi. (8.0 km) S of Castle Dale (2), Green River, 3/2/5 (32.5 mi. (52.3 km) NE of Hanksville (1); Wayne Co.: Notom (1). 9/5/5, T. b. peramplus Goldman, Arizona: Apache Co.: Tumimba Mts (1); New Mexico: San Juan Co.: Chuska Mts (3).

**Geomydousc (Thomomydousc) timmi** Price & Hellenthal, *new species*  
Fig. 8, 11

**Type-host.** *Thomomyx bater nigricans* Rhoads.

**δ.** Much as in Fig. 1, Temple width 0.325-0.380 (110: 0.350 ± 0.009); head length 0.250-0.295 (110: 0.266 ± 0.0076); submarginal and inner marginal temple setae 0.020-0.040 (92: 0.029 ± 0.0059) and 0.025-0.045 (92: 0.034 ± 0.0046) long, respectively. **Antennal scale length** 0.075-0.110 (105: 0.097 ± 0.0058); scale width 0.055-0.080 (105: 0.070 ± 0.0047); Prothorax width 0.225-0.275 (116: 0.248 ± 0.0092). **Tergal setae.** II, 8-14 (114: 10.8 ± 1.09); III, 12-18 (115: 14.6 ± 1.46); IV, 10-17 (113: 13.3 ± 1.48); V, 8-14 (111: 10.9 ± 1.38); VI, 5-12 (110: 8.0 ± 1.26); tegral and pleural setae on VII, 10-14 (112: 11.9 ± 0.73). Dorsal terminalia as in Fig. 11, with broad terminal setose portion, pair of sensilla on each side generally on line with slightly anterior to lateral paired setae.

**Remarks.** The shape of the male genitalian endomeral plate easily distinguishes the male of *G. timmi* from those of all other members of the *minor* group. We know of no qualitative or quantitative means for facilitating identification of the female. For males, the best quantitative characters separating them from the other taxa in the group and their critical values for discrimination and probabilities of misidentification were the length of the endomeral plate 0.068 (0.091), the width of the endomeral plate 0.025 (0.169), and the number of setae on tergite II 9.88 (0.180).

This species is named for Dr Robert M. Timm, University of Minnesota, in recognition of his interest and research on ectoparasites of vertebrates.

**Holotype δ, T. b. nigricans** (San Diego Natural History Museum-1489), USA: California: San Diego Co.: Witch Creek, 25.VII.1925, F. Stephens, in collection of San Diego Natural History Museum. Paratypes: 18/5, 26/5, T. b. nigricans, USA: California: San Diego Co.: Witch Creek (4), Laguna Mts (2); MEXICO: Baja California: Agua Hechicera (1).

**Other specimens examined.** USA: 11/5, T. b. abanuos Goldman, Arizona: Coconino Co.: 0.5 mi. (0.8 km) W of Fredonia (1), Jacobs Pool (1); Utah: Garfield Co.: 8 mi. (12.9 km) E of Boulder (1); Kane Co.: 2.2 mi. (3.5 km) N of Kanab (2). 16/5, T. b. affinis Huey, California: San Diego Co.: Jacumba (5). 18/5, T. b. alpinus Merriam, California: Inyo Co.: Cottonwood Lakes (2); Tulare Co.: Jackass Meadow (1). Kennedy Meadows (2), Taylor Meadow (1), 5/5/5, T. b. altivallis Rhoads, California: San Bernardino Co.: Fawskin Valley (1), Bluff Lake (1), Holcomb Valley (1), Sugarloaf (3), Big Pine Flat (1). 7/5, T. b. avahne Merriam, California: Tulare Co.: Halstead Meadow (3). Big Meadow (1), Giant Forest (1). 3/5, T. b. burchiei Goldman, Utah: Washington Co.: Pine Valley (5), Mountain Meadows (1). 12/5, T. b. buttar, California: Kern Co.: Old Fort Tejon (1); Los Angeles Co.: South Gate (1). North Long Beach (1), Long Beach (1); Ventura Co.: 0.5 mi. (0.8 km) W of Fillmore (1), 1/5, T. b. caucobrs Merriam, California: Riverside Co.: Ban-

The following 5 species are included in the dickermani group of the minor complex. They are placed there on the basis of the males having a relatively pronounced flecking of the genitalic parameral arch (Fig. 13-17.B) and endosomal plate (Fig. 13-17.C). The presence of several differentiating quantitative characters discussed earlier for the minor group further supports this grouping.

**Geomydoecus (Thomomydoecus) dickermani**

Price & Emerson

Fig. 13, 19

**Geomydoecus (Thomomydoecus) dickermani** Price & Emerson, 1972, J. Med. Entomol. 9: 467. **Type-host.** Thomomyus umbritus Nelson & Goldman.

3. Much as in Fig. 1. Temple width 0.320-0.360 (39: 0.337 ± 0.0092); head length 0.290-0.275 (39: 0.305 ± 0.0073); submarginal and inner marginal temple setae 0.020-0.030 (28: 0.026 ± 0.0026) and 0.025-0.053 (24: 0.039 ± 0.0021) long, respectively. Antenna with scape length 0.080-0.090 (39: 0.084 ± 0.0032), scape width 0.055-0.065 (39: 0.061 ± 0.0026). **Prothorax** width 0.220-0.265 (39: 0.241 ± 0.0107). **Tergal setae.** II. 9-15 (38: 11.2 ± 1.13); III. 12-19 (38: 15.3 ± 1.44); IV. 10-13 (37: 11.9 ± 1.34); V. 8-11 (36: 9.7 ± 0.91); VI. 5-9 (38: 7.0 ± 0.91); tergal and pleural setae on VII. 16-18 (39: 11.5 ± 0.68). Dorsal terminalia as in Fig. 19, with broad terminal setose portion, paired sensilla anterior to paired lateral setae. **Sternal setae.** II. 7-11 (39: 9.2 ± 1.17); III. 10-15 (39: 12.4 ± 1.41); IV. 11-19 (39: 15.3 ± 1.69); V. 9-15 (39: 12.4 ± 1.51); VI. 8-13 (39: 11.5 ± 1.07); VII. 9-11 (39: 10.1 ± 0.66); VIII. 4-8 (39: 5.9 ± 0.92). Total length 0.990-1.165 (34: 1.058 ± 0.0412). **Genitalia.** As in Fig. 15A: parameral arch as in Fig. 13B, width 0.050-0.065 (35: 0.059 ± 0.0030); endosomal plate (Fig. 15C) tapered to narrow point, width 0.035-0.045 (35: 0.039 ± 0.0028), length 0.056-0.070 (32: 0.063 ± 0.0051).

4. Much as in Fig. 5. Temple width 0.360-0.420 (32: 0.393 ± 0.0194); head length 0.253-0.285 (32: 0.266 ± 0.0107); submarginal and inner marginal temple setae 0.020-0.055 (26: 0.026 ± 0.0029) and 0.030-0.040 (24: 0.035 ± 0.0099) long, respectively. **Prothorax** width 0.275-0.320 (33: 0.290 ± 0.0117). **Tergal setae.** II. 12-17 (31: 14.7 ± 1.24); III. 16-24 (30: 20.2 ± 1.78); IV. 21-30 (33: 25.3 ± 2.08); V. 20-29 (33: 24.5 ± 2.14); VI. 19-27 (33: 22.3 ± 2.09); tergal and pleural setae on VII. 22-31 (33: 27.0 ± 2.01); medial setae on VIII. 1-4 (21: 2.4 ± 0.67). Longest seta of medial 10 on tergicle VI. 0.095-0.115 (33: 0.107 ± 0.0061); on tergicle VII. 0.100-0.125 (32: 0.110 ± 0.0076), with 0-8 (31: 3.1 ± 2.58) of these longer than 10.0. Longest of medial setae on tergicle VIII. 0.070-0.105 (29: 0.094 ± 0.0076). Last tergicle with outer seta 0.085-0.125 (30: 0.106 ± 0.0104), middle seta 0.060-0.100 (21: 0.088 ± 0.0089), inner seta 0.050-0.075 (31: 0.064 ± 0.0058) long. **Sternal setae.** II. 9-13 (32: 11.3 ± 1.33); III. 12-17 (31: 14.3 ± 1.49); IV. 14-25 (31: 18.6 ± 2.50); V. 15-22 (32: 18.8 ± 1.60); VI. 15-22 (32: 17.8 ± 1.59); VII. 12-17 (33: 14.4 ± 1.08). **Subgenital plate.** Much as in Fig. 4, with 22-35 (32: 27.8 ± 2.04) setae. Total length 1.085-1.315 (30: 1.195 ± 0.0605).

Remarks. The male of *G. dickermani* is recognized from the other members of the group by the shape of the genitalic endosomal plate and parameral arch; there are no known qualitative features for recognizing the female. Quantitatively, there is little to aid in separating *G. dickermani*. For males, the best quantitative character and its critical value for discrimination and probability of misidentification were the width of the endosomal plate 0.036 (0.200). For females, 66% of the specimens had only 2 medial setae on tergicle VIII and only 6 of 71 had 4 setae.

**Specimens examined.** MEXICO: 18♂, 15♀, T. u. tolucana, Ojo de Agua (1), N slope of Nevado de Toluca (2), 18 km S, 12 km W (1), 10 km S, 16 km W (3) of Toluca. 37♂, 57♀, T. u. peregrinus Merriam, 1.5 mi. (2.4 km) S (3), 10 mi.
(16.1 km) N, 6 mi. (9.7 km) E (3) of Valle de Bravo, 1 mi. (1.6 km) W (1), at (4) Salazar.

**Geomydoecus (Thomomydoecus) markhafneri**

Price & Hennethal, new species  Fig. 14

_Type-host._ Thomomys unirimus unirimus (Richardson).

♂. Close to G. dickermani, differing as follows. _Sternal setae._ II, 6-11 (20: 8.9 ± 1.18); III, 9-13 (19: 11.2 ± 0.96); VI, 9-12 (20: 10.6 ± 0.94); VIII, 4-5 (20: 4.6 ± 0.50). _Genitalia._ As in Fig. 14A, parameral arch as in Fig. 14B, with more deeply indented anterior portion; endosomal plate (Fig. 14C) with sharper flexion and pronounced convexity on flexion side, width 0.025-0.030 (20: 0.029 ± 0.0022), length 0.065-0.080 (17: 0.071 ± 0.0045).

♀. Close to G. dickermani, differing as follows. Setae on sternite VII, 11-14 (14: 12.7 ± 0.99); on subgenital plate, 20-30 (14: 25.4 ± 2.08).

**Remarks.** The shape of the genitalic parameral arch and endosomal plate offer excellent means for separating males of _G. markhafneri_ from _G. dickermani_. There are no known qualitative features for distinguishing females of these 2 species. For males, the best quantitative characters and their critical values for discrimination and probabilities of misidentification were the width of the endosomal plate 0.034 (0.024), the length of the endosomal plate 0.067 (0.208), and the number of setae on sternite VII 5.24 (0.216). For females, the only quantitative character of possible value was the number of setae on sternite VII 13.54 (0.218).

This species is named for Mr Mark S. Hafner, Museum of Vertebrate Zoology, University of California, Berkeley, in recognition of his interest in mammalian ectoparasites and his efforts in collecting many important gopher specimens.

_Holotype_ ♂, _T. u. unirimus_ (University of California Museum of Vertebrate Zoology-153880), MEXICO: Puebla: 3.5 km S, 3 km E of Esperanza, Boca del Monte, 13.XIII.1977, M. S. Hafner; in collection of University of Minnesota. _Paratypes_: 43♀, 43♂, _T. u. unirimus_, MEXICO: Puebla: 3.5 km S, 3 km E of Esperanza, Boca del Monte (6), Boca del Monte (3).

**Geomydoecus (Thomomydoecus) williamsi** Price & Hennethal, new species  Fig. 15, 22

_Type-host._ Thomomys unirimus subsp. species.

♂. As for _G. dickermani_, except as follows. Temple width 0.350-0.375 (12: 0.360 ± 0.0065); head length 0.255-0.270 (12: 0.260 ± 0.0045). Antenna with scape length 0.085-0.105 (12: 0.101 ± 0.0057), scape width 0.070-0.075 (12: 0.073 ± 0.0026). Prothorax width 0.230-0.270 (12: 0.25 ± 0.0107). _Tergal setae._ IV, 12-16 (10: 14.1 ± 1.20); V, 11-14 (12: 12.4 ± 0.90); VI, 8-10 (11: 9.0 ± 0.89); _tergal and pleural setae_ on VII, 11-14 (10: 12.5 ± 1.08). Dorsal terminalia as in Fig. 22, with somewhat smaller terminal setose portion. _Sternal setae._ V, 11-15 (12: 13.8 ± 1.19); VI, 11-15 (12: 12.6 ± 1.31); VII, 10-14 (12: 11.5 ± 1.17). Total length 1.145-1.245 (12: 1.184 ± 0.0329). _Genitalia._ As in Fig. 15A; parameral arch as in Fig. 15B, width 0.065-0.075 (12: 0.068 ± 0.0040); endosomal plate as in Fig. 15C.

♀. As for _G. dickermani_, except as follows. _Tergal setae_ on II, 12-15 (11: 13.3 ± 1.10); _medial setae_ on VIII, 2-5 (19: 3.3 ± 0.95). Longest seta of _medial_ 10 on tergite VII, 0.110-0.125 (10: 0.118 ± 0.0053), with 2-4 (10: 6.3 ± 2.16) of these longer than 0.100. Total length 1.185-1.360 (11: 1.261 ± 0.0563).

**Remarks.** The shapes of the male genitalic parameral arch and endosomal plate of _G. williamsi_ are close to those of _G. markhafneri_, and, therefore, are quite different from those of _G. dickermani_. The broader appearance of the endosomal plate of _G. williamsi_ affords separation from _G. markhafneri_. For males, the best quantitative characters between _G. williamsi_ and _G. markhafneri_ and their critical values for discrimination and the probabilities of misidentification were the width of the endosomal plate 0.034 (0.001), the length of the antennal scape 0.092 (0.026), and the width of the head 0.347 (0.028). For females, the best character was the number of setae on tergite II 14.34 (0.189). There are no known qualitative or quantitative means for consistently recognizing the female of _G. williamsi_ from the other 2 taxa, although over 50% of _G. williamsi_ have 4 or 5 medial setae on tergite VIII as contrasted to less than 10% of the females of the others.

This species is named for Mr Stephen L. Williams, Carnegie Museum of Natural History, in recognition of the numerous valuable gopher specimens he has collected.


**Geomydoecus (Thomomydoecus) orizabae** Price & Hennethal, new species  Fig. 16, 18, 20

_Type-host._ Thomomys unirimus orizabae Merriam.

♂. Grossly as in Fig. 1. _Temple width_ 0.310-0.345 (16: 0.333 ± 0.0110); _head length_ 0.240-0.260 (16: 0.249 ± 0.0062); _submarginal and inner marginal temple setae_ 0.025-0.030 (15-
0.027 ± 0.0024) and 0.030–0.040 (14: 0.034 ± 0.0019) long, respectively. Antenna with scape length 0.085–0.100 (16: 0.095 ± 0.0035), scape width 0.060–0.070 (16: 0.064 ± 0.0035), Prothorax width 0.235–0.260 (16: 0.248 ± 0.0063). 

**Terminal setae.** 11: 8–10 (15: 9.9 ± 0.81); III: 11–16 (16: 13.9 ± 1.26); IV: 10–14 (16: 11.8 ± 1.24); V: 8–13 (16: 10.6 ± 1.41); VI: 5–9 (15: 7.6 ± 1.06); tergal and pleural setae on VII: 10–12 (16: 11.8 ± 0.58). Dorsal terminalia as in Fig. 20, with tapered terminal setose portion having deep medioanterior indentation; only 1 seta on each side lateral to paired sensilla; pair of longer setae on each side anterior to very short seta. 

**Sternal setae.** II: 6–10 (16: 8.1 ± 1.02); III: 10–13 (16: 11.3 ± 1.00); IV: 13–16 (15: 14.3 ± 1.16); V: 10–14 (16: 12.0 ± 1.21); VI: 10–13 (16: 11.1 ± 0.81); VII: 7–11 (15: 9.1 ± 0.92); VIII: 3–6 (15: 4.5 ± 0.59). Total length 1.050–1.170 (16: 1.114 ± 0.0322). 

*Genitalia.* As in Fig. 16A; parameral arch as in Fig. 16B, width 0.045–0.055 (16: 0.052 ± 0.0055); endomeral plate (Fig. 16C) with lighter area along concave side, width 0.030–0.035 (16: 0.035 ± 0.0024), length 0.075–0.090 (15: 0.084 ± 0.0041).

Grossly as in Fig. 5. Temple width 0.370–0.410 (15: 0.387 ± 0.0121); head length 0.255–0.290 (15: 0.266 ± 0.0080); submarginal and inner marginal temple setae 0.025–0.030 (15: 0.027 ± 0.0025) and 0.035–0.050 (16: 0.042 ± 0.0044) long, respectively. Prothorax width 0.270–0.305 (15: 0.290 ± 0.0090). 

**Terminal setae.** II: 12–16 (15: 13.5 ± 1.23); III: 16–20 (15: 18.5 ± 1.19); IV: 20–24 (14: 21.9 ± 1.07); V: 18–26 (14: 21.9 ± 1.16); VI: 17–24 (14: 20.4 ± 1.99); tergal and pleural setae on VII: 21–25 (16: 22.6 ± 3.01); medial setae on VIII: 3–9 (15: 4.6 ± 1.18) (Fig. 18). Longest seta of medial 10 on tergite VI, 0.090–0.120 (15: 0.108 ± 0.0079); on tergite VII, 0.095–0.125 (15: 0.112 ± 0.0072), with 0–8 (15: 3.9 ± 2.13) of these longer than 0.100. Longest of medial setae on tergite VIII, 0.085–0.115 (14: 0.100 ± 0.0081). Last tergite with setae distributed in 1 + 4 + 1 arrangement (Fig. 18); each side with outer seta 0.055–0.095 (15: 0.086 ± 0.0068), middle seta 0.060–0.080 (15: 0.072 ± 0.0058), inner seta 0.050–0.075 (14: 0.062 ± 0.0065) long. 

**Sternal setae.** II: 9–11 (15: 10.1 ± 0.88); III: 11–16 (15: 13.3 ± 1.35); IV: 16–20 (15: 17.9 ± 1.30); V: 14–20 (15: 17.7 ± 1.50); VI: 14–19 (15: 16.7 ± 1.40); VII: 11–14 (15: 12.5 ± 0.92). Subgenital plate. Much as in Fig. 4, with 21–28 (15: 24.2 ± 1.70) setae. Total length 1.085–1.270 (15: 1.161 ± 0.0522).

**Remarks.** The shape of the genital endomeral plate in conjunction with the chaetotaxy and structure of the dorsal terminalia affords ready separation of males of *G. orizaba* from those of the foregoing 3 species of this group. The unique position of 4 medial setae on the last tergite and the consistent presence of more than 2 medial setae on tergite VIII separate females of *G. orizaba* from all other members of the group and complex.

Holotype ♂, T. u. orizaba (California Academy of Sciences-4871), MEXICO: Veracruz; S slope of Mt Orizaba, vicinity of Maltrata, 12.VII.1965, C. E. Wemmer; in collection of California Academy of Sciences. Paratypes: 15♂, 24♀, T. u. orizaba, MEXICO: Veracruz, S slope of Mt Orizaba, vicinity of Maltrata (3), Pico de Orizaba (2).

*Other specimens examined.* MEXICO: 4♂, 3♀, T. u. albiligularis Nelson & Goldman, Hidalgo: 5 mi. (8.0 km) E (2), at (1) Tulancingo. 1♂, 5♀, T. umbrinus subsp., Tlaxcala: 9 km N, 7 km E of Apizaco (1), 8 km S, 7 km W of Calpulalpan (3).

**Geomydocus (Thomomydocus) johnhafneri** Price & Hellenthal, new species 

*Fig. 17, 21*

Type-host. *Thomomyis umbrinus vulcanicola* Nelson & Goldman.

♂. Close to *G. orizaba*, except as follows. Antennal scape length 0.075–0.090 (21: 0.085 ± 0.0032). Tergal setae. II: 9–15 (21: 12.0 ± 1.36); III: 14–18 (20: 15.6 ± 1.39); IV: 11–16 (21: 13.2 ± 1.08). Dorsal terminalia as in Fig. 21, with setose terminal portion shorter, wider, but with deep medioanterior indentation; paired sensilla on line with to posterior to lateral paired setae; only 1 longer seta on each side anterior to sensilla. Total length 0.915–1.000 (21: 0.995 ± 0.0046). 

♀. Close to *G. orizaba*, except as follows. Inner marginal temple seta 0.030–0.040 (18: 0.035 ± 0.0034) long. 

**Sternal setae.** II: 12–17 (20: 14.8 ± 1.47); III: 17–26 (19: 21.1 ± 2.25); IV: 22–30 (20: 25.0 ± 1.91); V: 21–28 (19: 24.4 ± 1.80); VI: 19–25 (19: 22.6 ± 1.74); medial setae on VIII, 2–6 (15: 3.3 ± 0.90). Last tergite with outer seta 0.085–0.120 (19: 0.102 ± 0.0096), middle seta 0.075–0.115 (19: 0.087 ± 0.0098) long. Subgenital plate. With 22–51 (19: 26.8 ± 3.72) setae. Total length 1.085–1.270 (19: 1.161 ± 0.0522).

**Remarks.** The shapes of the genitalic parameral arch and endomeral plate and the structure and chaetotaxy of the dorsal terminalia separate males of *G. johnhafneri* from those of the other species of the group. The distribution of the setae on the last tergite distinguishes the female of *G. johnhafneri* from that of *G. orizaba*. For males, the best quantitative characters between *G. johnhafneri* and *G. orizaba* and their critical values for discrimination and the probabilities of misidentification were the length of the endomeral plate 0.075 (0.015), the total length 1.055 (0.073), and the length of the antennal scape 0.089 (0.117). For females, the best characters were the number of setae on tergite IV (STG4) 23.46 (0.171), the length of the outer seta on the last tergite 0.094 (0.177), and the length of the middle seta on the last tergite (MSLTG) 0.080 (0.185). Because of high probability of female misidentification using any 1 of these quantitative characters, discriminant functions were calculated using these 3 and each combination of 2 of these 3 characters. An explanation of the use of discriminant functions for female identification is given in Price & Hellenthal (1975). The use of STG4 and MSLTG in combination provided much improved discrimination, giving a probability of misidentifi-
cation of 0.060, with respective discriminant function coefficients of 0.0582 and 0.0107 and a critical value of 2.218 (discriminant means and standard deviations for *G. johnhafneri* were 2.396 ± 0.1296 and for *G. orizabae* 2.041 ± 0.0888).

This species is named for Mr John C. Hafner, Museum of Vertebrate Zoology, University of California, Berkeley, in recognition of his interest in mammalian ectoparasites and his efforts in collecting many important gopher specimens.


Although the taxa included in the *minor* complex generally demonstrated sufficient character differences to enable their separation, even the best quantitative characters showed some overlap. However, this overlap is not unexpected given the individual variability and moderate sample sizes. Because of this variability, we felt it desirable to find further supporting evidence for recognition.
of taxa. Principal components analysis of pooled quantitative data offers added support for our separations. Using the centered R-technique, as described by Orloci (1967), for 7 characters for males of the minor and dickermani groups, the first 3 components were found to account for 72% of the variation. Scattergrams with coordinates representing the 1st, 2nd, and 3rd principal axes in reduced character space generally supported our separation into the 2 groups, with the best separation achieved by graphing the 1st and 2nd axes (Fig. 23). Applying the same technique to the taxa within each of the 2 groups, using 6 characters for the minor group and 11 characters for the dickermani group, the first 3 components accounted for 77% of the variation of the former and 69% of the latter. The best separation for each of these was again achieved by graphing the 1st and 2nd axes. Within
the minor group (Fig. 24), G. timmi showed almost perfect separation, G. minor was next, and the greatest mix was demonstrated between G. zacatecensis and G. birneyi; these are consistent with the qualitative similarities that we had noted. Within the dickermani group (Fig. 25), G. williamsi was clearly separated; G. dickermani and G. orizaba were fairly distinct at the lower and upper levels; the greatest mix was found between G. johnhaferi and G. markhaferi.

The males of the minor complex will all be identified as G. minor in the 1st half of couplet 12 of the key to males given by Price & Emerson (1971). From there, they may be identified by the following modification:

12a. With relatively straight terminal portion of parameral arch and endomeral plate (Fig. 6-8); width of endomeral plate usually under 0.029

12b. With flexion of terminal portion of parameral arch
and endomeral plate (Fig. 13–17); width of endomeral plate usually over 0.029 ... dickermani

12b. Endomeral plate with deep medioanterior concavity and asymmetrical lateroanterior projections (Fig. 8C) ... minor

12c. Endomeral plate anteriorly symmetrical and without deep medioanterior concavity (Fig. 7C, 8C) ... 12c

12d. Endomeral plate as in Fig. 7C. timmi, n. sp.

12e. Dorsal terminalis as in Fig. 10, with sensilla on line with two anterior to lateral paired setae ... binneyi, n. sp.

12f. Dorsal terminalis as in Fig. 20, with each side having 2 longer setae anterior to sensilla and only 1 lateral seta ... ortizae, n. sp.

12g. Dorsal terminalis (Fig. 19, 21, 22) with each side having 2 setae lateral to sensilla and only 1 longer anterior seta ... 12f

12h. Endomeral plate with pronounced convexity on flexed side (Fig. 14C, 15C) ... 12g

12i. Endomeral plate without such well-developed convexity (Fig. 13C, 17C) ... 12h

12j. Width of endomeral plate usually under 0.034 (Fig. 14C); antennal scape length usually under 0.092 ... (ex T. u. umbrenus, Puebla, Mexico) ... markhaferi, n. sp.

12k. Width of endomeral plate usually over 0.034 (Fig. 15C); antennal scape length usually over 0.092 ... (ex T. u. umbrenus, Tlaxcala, Mexico) ... williamsi, n. sp.

12l. Parameral arch with deep medioanterior concavity (Fig. 17B); dorsal terminalis (Fig. 21) with relatively short terminal setose portion shaped as shown ... (ex T. u. vallecoras ... johnhaferi, n. sp.

12m. Parameral arch without such deep medioanterior concavity (Fig. 13B); dorsal terminalis (Fig. 19) with longer terminal setose portion shaped as shown ... (ex T. u. tilcura, T. u. ferugnum) ... dickermani

Because of their unique 1 + 4 + 1 setal distribution across the last tergite, females of G. orizabor will fit neither portion of couplet 1 of the key to females given by Price & Emerson (1971). Females of the other 8 species will all come out in the 2nd half of couplet 6. Whereas males of the minor complex offer excellent morphological features for specific recognition, these females are for the most part inseparable; those of G. binneyi, G. williamsi, and G. johnhaferi frequently have 3 or more median setae on tergite VIII. However, other than this, females are at best difficult to distinguish morphologically and should be placed to species by association with identified males and/or by host association.

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LITERATURE CITED


