Two New Subgenera of Chewing Lice (Phthiraptera: Trichodectidae) from Pocket Gophers (Rodentia: Geomyidae), with a Key to All Included Taxa

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ABSTRACT The new subgenera *Thaelerius* and *Jamespattonius* are described, respectively, for the eight species of *Geomydoecus* in the *thomomyus* complex of lice and the four species of *Thomomydoecus* in the *wardi* complex. Except for *T. byersi* Hellenthal & Price from *Thomomys bottae* (Eydoux & Gervais), these lice are restricted to the *Thomomys talpoides* (Richardson) complex of pocket gophers and are the only lice found on these hosts. A key is given for the identification of the currently recognized 122 taxa of pocket gopher lice.

KEY WORDS Mallophaga, *Geomydoecus*, *Thomomydoecus*

ONCE THE TAXONOMIC STUDY OF THE LICE of pocket gophers had been completed and the results subsequently summarized by Hellenthal & Price (1991), we became increasingly aware of a problem involving the supraspecific classification of these lice. All pocket gopher lice had been included in the genus *Geomydoecus* Ewing until they were divided into two subgenera by Price & Emerson (1972), the nominate subgenus and *Thomomydoecus* Price & Emerson. The latter included the slenderer tapered smaller form that typically occurred on the same host individuals as *Geomydoecus*. Later, Hellenthal & Price (1984) elevated *Thomomydoecus* to generic status.

Lyal (1985), in his cladistic study of supraspecific trichodectid classification, rejected the generic status of *Thomomydoecus*, relegating it again to subgenus. In doing so, he theorized that *Geomydoecus* may be paraphyletic and that *Thomomydoecus* may also be paraphyletic or possibly even polyphyletic. Since then, Nadler & Hafner (1989) substantiated the generic validity of *Geomydoecus* and *Thomomydoecus* on both morphological and genetic grounds. At the time of Lyal's analysis, 20 new pocket gopher louse taxa were yet to be described in nine taxonomic publications, including those treating the *thomomyus* complex and the *wardi* complex, both of which constitute the members of the new subgenera described here. We believe that his conclusions were a consequence of an incomplete comprehension of these louse complexes and that an understanding of the full spectrum of chewing lice of pocket gophers warrants a taxonomic reconsideration of these genera.

One of the purposes of this paper is to divide each of *Geomydoecus* and *Thomomydoecus* into two subgenera, thereby recognizing that the lice found on hosts in the *Thomomys talpoides* (Richardson) complex of pocket gophers are quite distinct from those on all other geomyid hosts. This action further substantiates the division of *Thomomys* pocket gophers into two subgenera, *Thomomys* and *Megascapheus*, by Thaeler (1980). The subgenus *Thomomys* includes the three species of the *talpoides* complex that carry only specimens of our two new subgenera; the subgenus *Megascapheus* includes four species of the *bottae* complex that carry, with one exception, members of the two nominate louse subgenera. A further discussion of this may be found in Hellenthal & Price (1991).

The extensive taxonomic work and numerous publications on pocket gopher lice that have appeared since the last published keys to the species of *Geomydoecus* in Price & Emerson (1971) have made identification extremely difficult. Since 1971, the number of recognized pocket gopher louse species and subspecies has increased from 45 to 122. These new taxa are treated in 25 separate publications. Although an effort was made in some taxonomic treatments to provide modifications for the keys in Price & Emerson (1971), many pocket gopher louse taxa can be identified only through comparison with original descriptions. Because the known associations between pocket gophers and their lice are now well documented (Hellenthal & Price 1991), we are concerned that workers may turn to host association as a short-cut method of species determination. Therefore, we present here a new key to the lice of pocket gophers that incorporates all known taxa.

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Thaelerius Hellenthal & Price, new subgenus
(Figs. 12, 20, 54–57, 135–141)

Type species. *Geomydoecus thomomyus* (McGregor).

Diagnosis. Male antennal scape without median process; lateral temple margin (Fig. 12) with very long seta at least 0.09 mm long and with adjacent marginal setae slender, none stout spiniform; genitalia with relatively large pointed subtriangular endomeral plate overlying reduced parameral arch (Fig. 20) and with sac usually bearing 2 slender elongate spines and 1–5 shorter spines (Figs. 54–57). Female with temple as for male; last tergite with 2+2+2 setae; genital sac (Figs. 135–141) only weakly to moderately developed, subrectangular with mediposterior stalk and lines, if present, restricted to lateral areas.

Remarks. The eight species of this subgenus, which identify in couplets 22–28 of the accompanying key, possess the general features of the genus *Geomydoecus*; their descriptions may be found in Hellenthal & Price (1989a). The unique male genitalia and female genital sac, along with the chaetotaxy of the temple margin, readily separate the members of this subgenus from all other taxa in the nominate subgenus.

Etymology. This subgenus is named for Charles S. Thaeler, Jr., New Mexico State University, in recognition of his extensive research on pocket gophers of the *Thomomys talpoides* complex (i.e., subgenus *Thomomys*) and his generous cooperation with us in our pocket gopher/louse investigations.

Jamespattonius Hellenthal & Price, new subgenus
(Figs. 22, 23, 31, 32, 133, 134)

Type species. *Thomomydoecus wardi* (Price & Emerson).

Diagnosis. Male antennal scape without median process; lateral temple lacking either very long setae or short stout spiniform setae; abdominal tergites II-III with long closely set clustered setae extending well into following tergite; abdomen posteriorly somewhat tapered; genitalia with wide (at least 0.10 mm wide) broadly rounded parameral arch crossing endomeral plate near latter's midpoint (Figs. 22 and 23), conspicuous elongate tapered endomeral plate (Figs. 22, 23, 31, 32), and prominent spinose sac without large spines. Female with temple as for male and lacking clustered setae on tergites II-III; last tergite with 2+2+2 setae; subgenital plate U-shaped, fringed on each side with irregular row of short to medium setae; genital sac of moderate size, with close-set faint lines (Figs. 133 and 134).

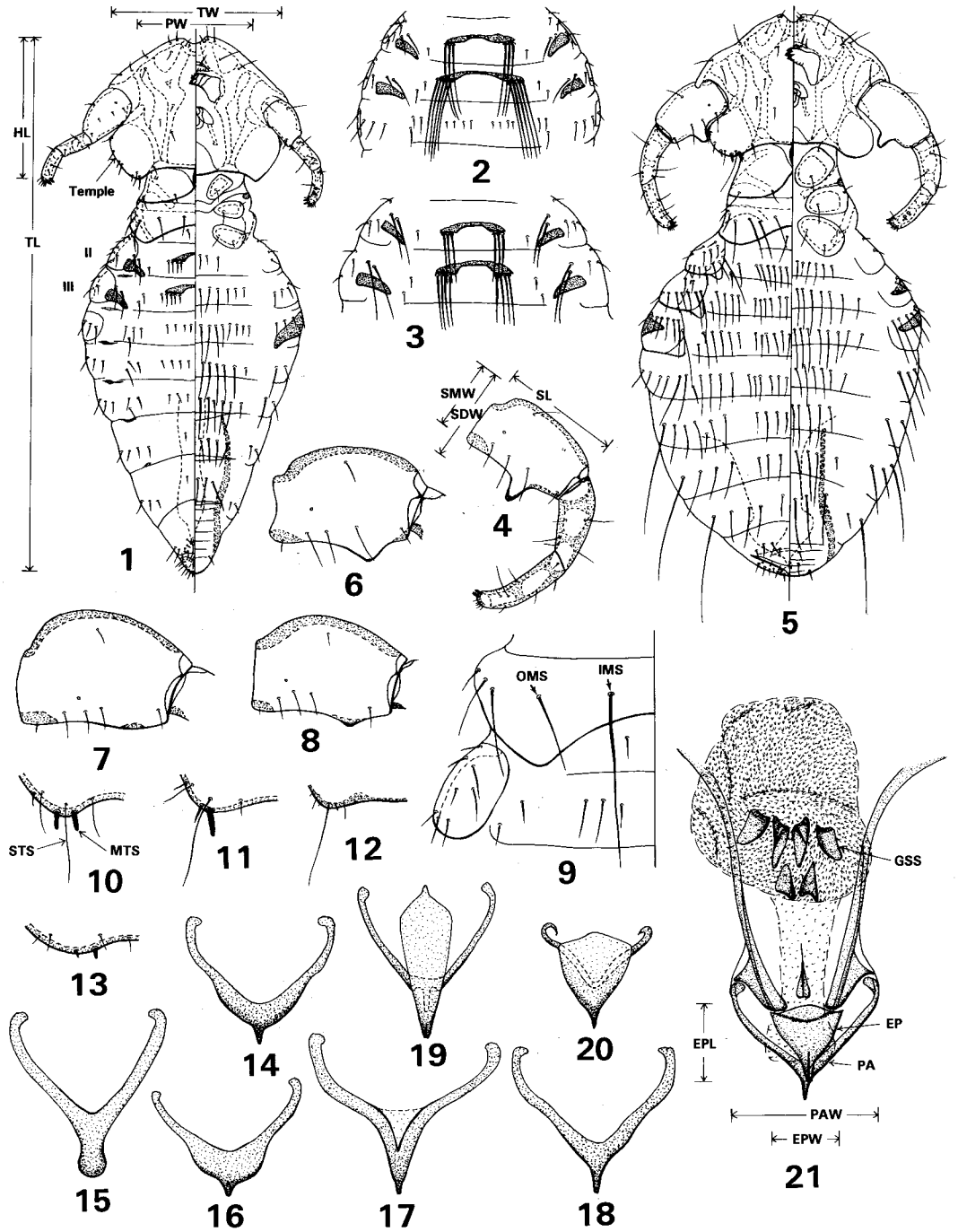
Remarks. The four species of this subgenus, which identify in couplets 4–6 of the accompanying key, possess the general features of the genus *Thomomydoecus*; their descriptions may be found in Hellenthal & Price (1989b). The unique male genitalia, with the orientation and shape of the parameral arch and endomeral plate as given above and the conspicuous sac, and female genital sac structure are grossly different from those of all other taxa in the nominate subgenus.

Etymology. This subgenus is named for James L. Patton, University of California, Berkeley, in recognition of his extensive research on pocket gophers, especially of the large *Thomomys bottae* (Eydoux & Gervais) complex, and his generous cooperation with us in our pocket gopher/louse investigations.

The following key stresses morphological characters in separating the 122 species and subspecies of pocket gopher lice currently recognized. The sequence of characters within a couplet gives those for both sexes followed by those of the male, then those of the female. In some couplets, the only features presented are those of one or two of these categories. Under certain circumstances, we have included host or locality information as a confirmatory feature, especially where the morphological details are considered marginally successful for separation or where there are major breaks in the key and the user may be alerted to avoid going the wrong direction. All measurements are in millimeters. The accompanying illustrations are drawn to various scales and are not intended for size comparison with equivalent parts, but are included simply to illustrate qualitative features.

Key to Lice from Pocket Gophers

1. Male tergites II-III with paired groups of clustered setae (Figs. 1–3); temple width <0.410. Female subgenital plate U-shaped (Figs. 115, 122); weak to inconspicuous genital sac; temple as in Fig. 129. Ex *Thomomys* (genus *Thomomydoecus*) 2
   Male tergites II-III without clustered setae (Fig. 5) or temple width >0.410. Female (Fig. 120) with subgenital plate not as above; conspicuous genital sac; temple variable, not as above. Ex all genera (genus *Geomydoecus*) 21
2(1). Male tergites II-III with long, closely set setae (Figs. 2, 3) 3
   Male tergites II-III with short, moderately separated setae (Fig. 1) (subgenus *Thomomydoecus*: *minor* complex) 13
3(2). Male parameral arch ≥0.100 wide or shaped as in Figs. 22 or 23. Female genital sac with faint lines (Figs. 133, 134) (subgenus *Jamespattonius*) 4
   Male parameral arch <0.100 wide, shaped otherwise (Figs. 24–26, 29). Female gen-



Figs. 1–21. Males. Fig. 1. *Thomomydoecus minor*, dorsal-ventral view (TW, temple width; PW, prothorax width; HL, head length; TL, total length). Figs. 2 and 3. Abdominal terga II-III: (2) *T. potteri*; (3) *T. genowaysi*. Figs. 4 and 5. *Geomydoecus subcalifornicus*: (4) antenna (SMW, scape medial width; SDW, scape distal width; SL, scape length); (5) dorsal-ventral view. Figs. 6–8. Antennal scape: (6) *G. extimi*; (7) *G. expansus*; (8) *G. geomydis*. Fig. 9. *G. yucatanensis*, metanotum (OMS, outer metanotal seta; IMS, inner metanotal seta). Figs. 10–13. Left temple: (10) *G. subcalifornicus* (STS, submarginal temple seta; MTS, inner marginal temple seta); (11) *G. fulvi*; (12) *G. thomomyus*; (13) *G. yucatanensis*. Figs. 14–18. Genitalic parameral arch: (14) *G. c. chihuahuae*; (15) *G. pattoni*; (16) *G. tolucae*; (17) *G. alcorni*; (18) *G. c. emersoni*. Figs. 19 and 20. Genitalic parameral arch and endomeral plate: (19) *G. traubi*; (20) *G. thomomyus*. Fig. 21. *G. umbrini*, genitalia (GSS, genital sac spine; EP, endomeral plate; EPL, endomeral plate length; EPW, endomeral plate width; PA, parameral arch; PAW, parameral arch width).

ital sac inapparent (subgenus *Thomomydoecus*: *neocopei* complex) 7

4(3). Male parameral arch and endomeral plate as in Fig. 23. Female genital sac as in Fig. 134. Ex *T. bottae*
. . . . . *T. byersi* Hellenthal & Price
Male parameral arch and endomeral plate near those shown in Fig. 22. Female genital sac as in Fig. 133. Ex *T. talpoides* . 5

5(4). Male endomeral plate as in Fig. 22, ≤0.045 wide
. . . . . *T. wardi* (Price & Emerson)
Male endomeral plate as in Figs. 31 or 32, ≥0.045 wide 6

6(5). Male endomeral plate as in Fig. 31
. . . . . *T. barbarae* Hellenthal & Price
Male endomeral plate as in Fig. 32
. . . . . *T. arleneae* Hellenthal & Price

7(3). Male parameral arch >0.070 wide (Fig. 24); endomeral plate >0.040 wide (Fig. 33)
. . . . . *T. neocopei* (Price & Emerson)
Male parameral arch otherwise, ≤0.070 wide; endomeral plate otherwise, <0.040 wide 8

8(7). Male tergite II with clustered setae at most extending only slightly beyond bases of those on III (Fig. 3); dorsal terminalia with sensilla (Figs. 47, 48) (*genowaysi* group) 9
Male tergite II with most clustered setae extending far beyond bases of those on III (Fig. 2); dorsal terminalia without sensilla (Figs. 45, 49) (*jamesbeeri* group) . . 11

9(8). Male parameral arch markedly asymmetrical (Fig. 25)
. . . *T. asymmetricus* (Price & Hellenthal)
Male parameral arch more or less symmetrical 10

10(9). Male dorsal terminal portion (Fig. 47) with prominent pigmented V-shaped medioanterior area; endomeral plate (Fig. 34) >0.073 long
. . . . . *T. genowaysi* (Price & Emerson)
Male dorsal terminalia (Fig. 48) without such pigmented area; endomeral plate (Fig. 36) <0.073 long
. . . . . *T. greeri* (Price & Hellenthal)

11(8). Male with wide, short, dorsal terminal portion (Fig. 45); endomeral plate broad (Fig. 35); parameral arch as in Fig. 26
. . . . . *T. potteri* (Price & Hellenthal)
Male with narrow, long, dorsal terminal portion (Fig. 49); endomeral plate narrow (Fig. 37); parameral arch as in Fig. 29 . 12

12(11). Male head length >0.260. Ex *T. umbrinus supernus* Nelson & Goldman
. . . . . *T. jamesbeeri* (Price & Emerson)
Male head length <0.260. Ex *T. u. peregrinus* Merriam
. . . . . *T. peregrini* (Price & Hellenthal)

13(2). Male terminal portion of endomeral plate and parameral arch relatively straight (Figs. 27, 38–40); endomeral plate <0.029 wide (*minor* group) 14
Male terminal portion of endomeral plate and parameral arch distinctly flexed (Figs. 28, 30, 41–44); endomeral plate >0.029 wide (*dickermani* group) 17

14(13). Male endomeral plate with deep medioanterior concavity and asymmetrical lateroanterior projections (Fig. 38)
. . . . . *T. minor* (Werneck)
Male endomeral plate anteriorly symmetrical and without deep medioanterior concavity (Figs. 39, 40) 15

15(14). Male endomeral plate T-shaped (Fig. 39)
. . . . . *T. timmi* (Price & Hellenthal)
Male endomeral plate near that shown in Fig. 40 16

16(15). Male dorsal terminalia with sensilla (SN) posterior to lateral paired setae (Fig. 46). Female tergite VIII with only 2 median setae (Fig. 122)
. . . . . *T. zacatecae* (Price & Hellenthal)
Male dorsal terminalia with sensilla on line with to anterior to lateral paired setae (Fig. 50). Female tergite VIII with >2 median setae
. . . . . *T. birneyi* (Price & Hellenthal)

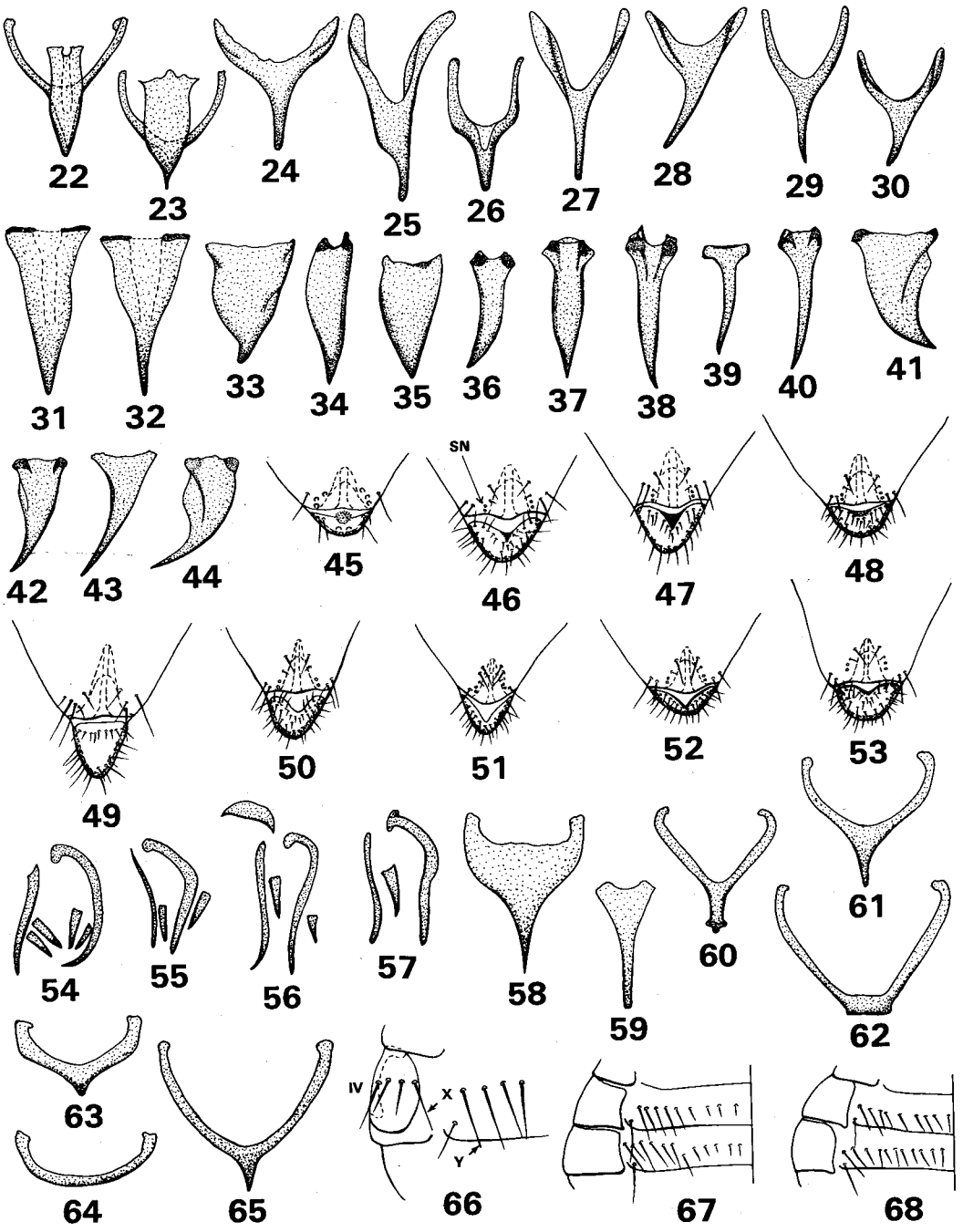
17(13). Each side of male dorsal terminalia with 1 lateral and 2 longer setae anterior to sensilla (Fig. 51). Female last tergite with 1+4+1 setae
. . . . . *T. orizabae* (Price & Hellenthal)
Each side of male dorsal terminalia with 2 lateral and 1 longer setae anterior to sensilla (Figs. 52, 53). Female last tergite with 2+2+2 setae (Fig. 122) 18

18(17). Male endomeral plate with pronounced convexity on flexed side (Figs. 41, 44) 19
Male endomeral plate without well-developed convexity (Figs. 42, 43) 20

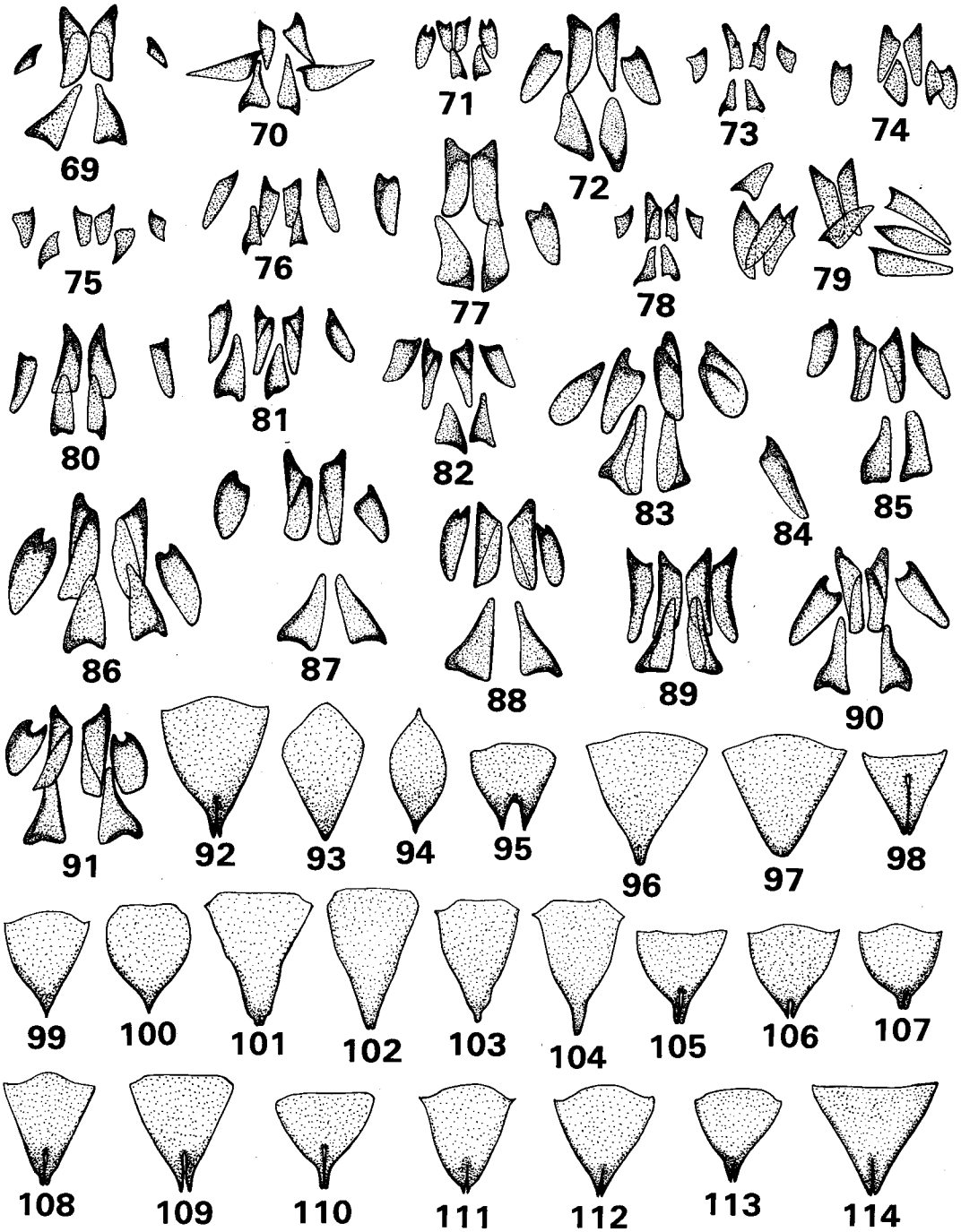
19(18). Male endomeral plate <0.034 wide (Fig. 44); scape length <0.092
. . . . *T. markhafneri* (Price & Hellenthal)
Male endomeral plate >0.034 wide (Fig. 41); scape length >0.092
. . . . . *T. williamsi* (Price & Hellenthal)

20(18). Male parameral arch with deep medioanterior concavity (Fig. 30); dorsal terminalia with short terminal setose portion (Fig. 52)
. . . . . *T. johnhafneri* (Price & Hellenthal)
Male parameral arch without such deep medioanterior concavity (Fig. 28); dorsal terminalia with long terminal setose portion (Fig. 53)
. . . . . *T. dickermani* (Price & Emerson)

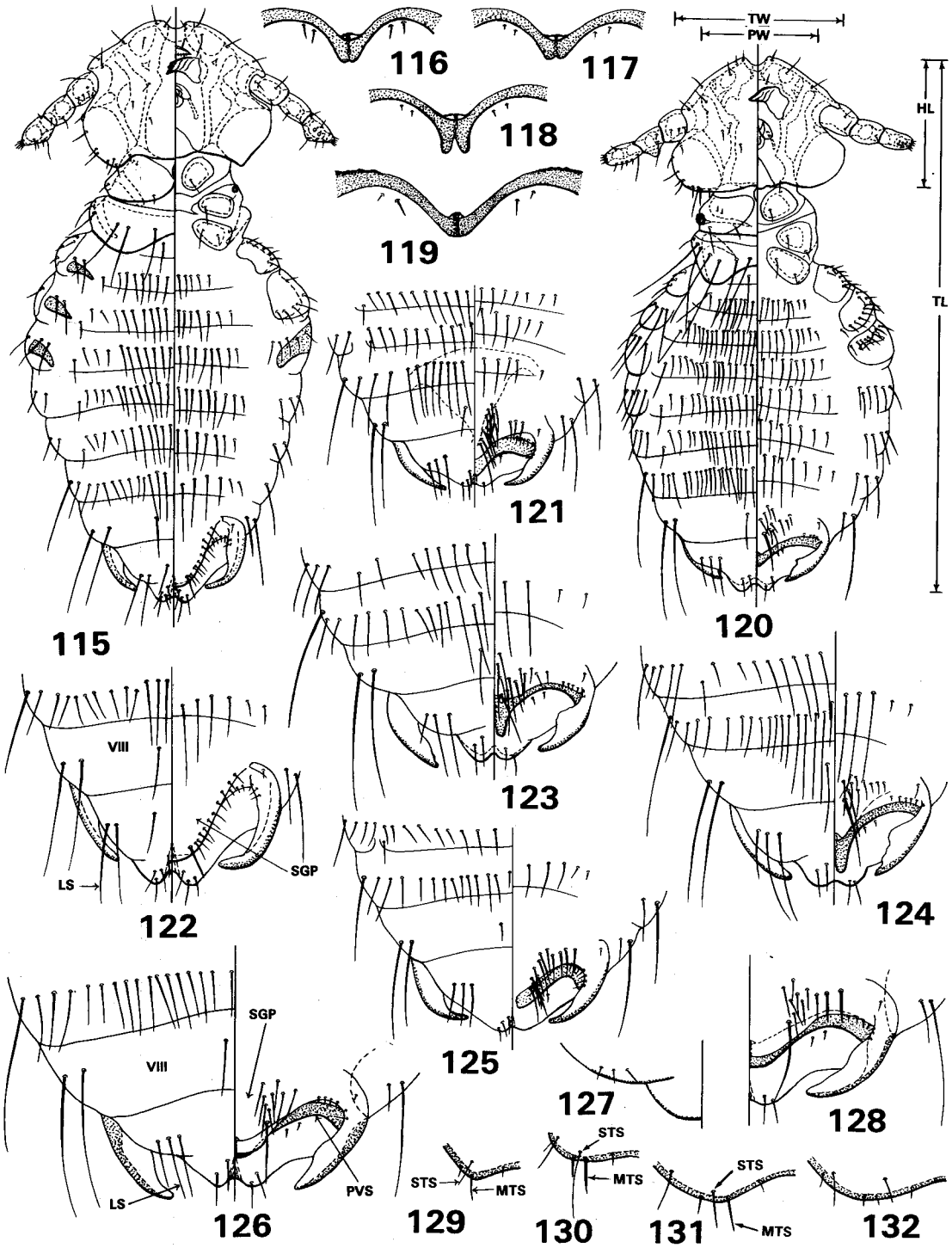
21(1). Temple chaetotaxy as in Fig. 12. Male parameral arch and endomeral plate as in Fig. 20; usually with elongate genital sac



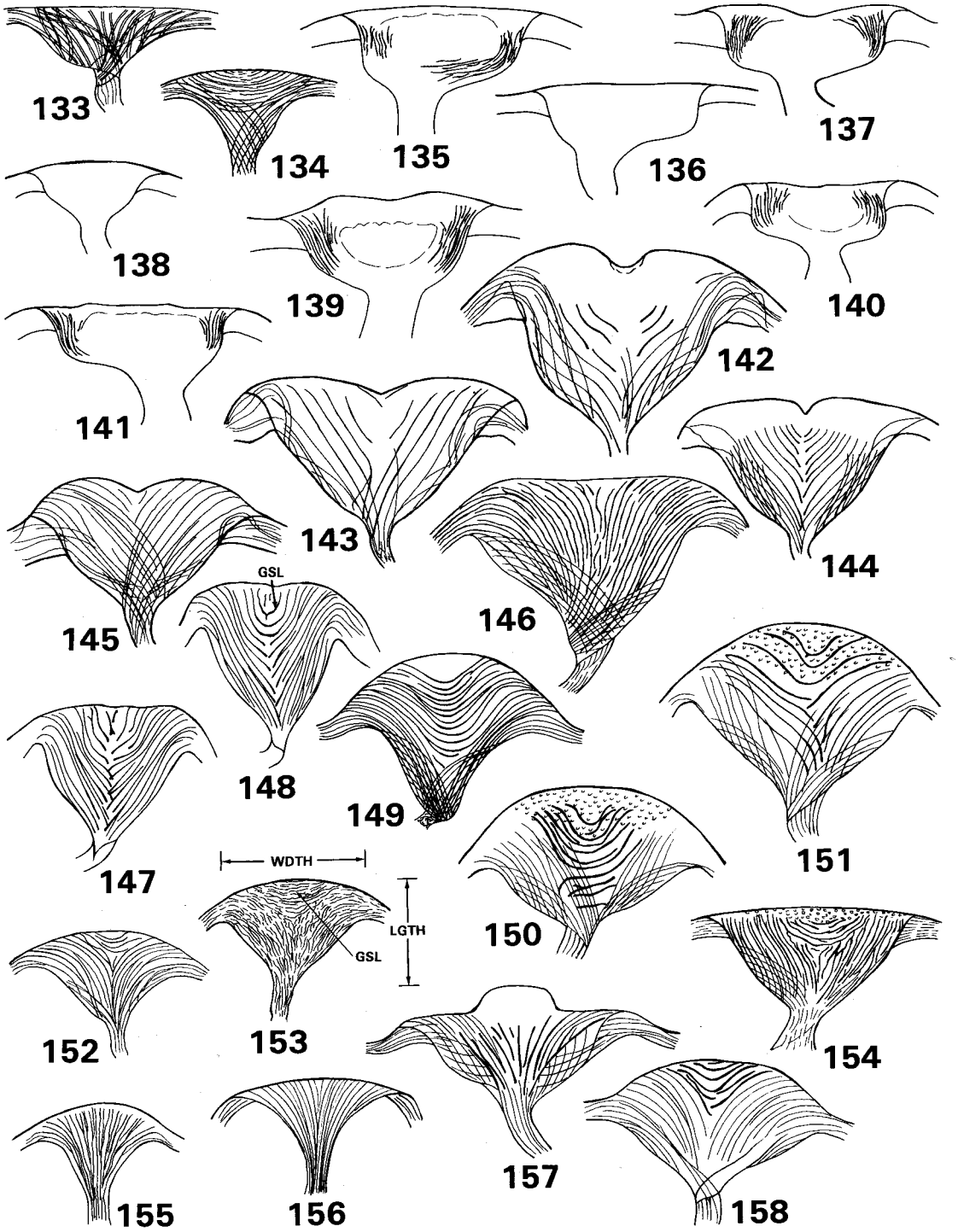
Figs. 22–68. Males. Figs. 22 and 23. Genitalic parameral arch and endomeral plate: (22) *Thomomydoecus wardi*; (23) *T. byersi*. Figs. 24–30. Genitalic parameral arch: (24) *T. neocopei*; (25) *T. asymmetricus*; (26) *T. potteri*; (27) *T. minor*; (28) *T. dickermani*; (29) *T. jamesbeeri*; (30) *T. johnhafneri*. Figs. 31–44. Genitalic endomeral plate: (31) *T. barbarae*; (32) *T. arleneae*; (33) *T. neocopei*; (34) *T. genowaysi*; (35) *T. potteri*; (36) *T. greeri*; (37) *T. jamesbeeri*; (38) *T. minor*; (39) *T. timmi*; (40) *T. birneyi*; (41) *T. williamsi*; (42) *T. johnhafneri*; (43) *T. dickermani*; (44) *T. markhafneri*. Figs. 45–53. Dorsal terminalia: (45) *T. potteri*; (46) *T. minor* (SN, sensilla); (47) *T. genowaysi*; (48) *T. greeri*; (49) *T. jamesbeeri*; (50) *T. birneyi*; (51) *T. orizabae*; (52) *T. johnhafneri*; (53) *T. dickermani*. Figs. 54–57. Genital sac spines: (54) *Geomydoecus dakotensis*; (55) *G. craigi*; (56) *G. thaeleri*; (57) *G. thomomyus*. Figs. 58–65. Genitalic parameral arch: (58) *G. yucatanensis*; (59) *G. copei*; (60) *G. scleritus*; (61) *G. nadleri*; (62) *G. truncatus*; (63) *G. fulvescens*; (64) *G. mexicanus*; (65) *G. merriami*. Fig. 66. *G. tamaulipensis*, abdominal pleuron and tergum IV. Figs. 67 and 68. Abdominal terga III-IV: (67) *G. p. perotensis*; (68) *G. mexicanus*.



Figs. 69–114. Males. Figs. 69–91. Genital sac spines: (69) *Geomydoecus crovelloi*; (70) *G. pattoni*; (71) *G. oregonus*; (72) *G. hueyi*; (73) *G. geomydis*; (74) *G. idahoensis*; (75) *G. merriami*; (76) *G. c. coronadoi*; (77) *G. shastensis*; (78) *G. nebrathkensis*; (79) *G. p. polydentatus*; (80) *G. w. welleri*; (81) *G. cliftoni*; (82) *G. umbrini*; (83) *G. californicus*; (84) *G. a. grahamensis*, single lateral spine; (85) *G. l. limitaris*; (86) *G. clausonae*; (87) *G. bajaiensis*; (88) *G. sinaloae*; (89) *G. warmanae*; (90) *G. a. aurei*; (91) *G. actuosi*. Figs. 92–114. Genitalic endomeral plate: (92) *G. subnubili*; (93) *G. fulvescens*; (94) *G. mexicanus*; (95) *G. costaricensis*; (96) *G. t. texanus*; (97) *G. tamaulipensis*; (98) *G. telli*; (99) *G. davidhafneri*; (100) *G. setzeri*; (101) *G. mcgregori* (102) *G. alcorni*; (103) *G. nadleri*; (104) *G. b. bulleri*; (105) *G. fulvi*; (106) *G. shastensis*; (107) *G. hueyi*; (108) *G. c. chihuahuae*; (109) *G. expansus*; (110) *G. martini*; (111) *G. veracruzensis*; (112) *G. merriami*; (113) *G. c. coronadoi*; (114) *G. californicus*.



Figs. 115–132. Females. Fig. 115. *Thomomydoecus minor*, dorsal-ventral view. Figs. 116–119. Postvulval sclerite and setae: (116) *Geomydoecus fulvi*; (117) *G. tolucae*; (118) *G. c. chihuahuae*; (119) *G. w. welleri*. Fig. 120. *G. tolucae*, dorsal-ventral view (TW, temple width; PW, prothorax width; HL, head length; TL, total length). Figs. 121–126. Dorsal-ventral terminalia (LS, lateral seta; SGP, subgenital plate; PVS, postvulval sclerite): (121) *G. t. texanus*; (122) *T. minor*; (123) *G. pattoni*; (124) *G. c. chihuahuae*; (125) *G. subnubili*; (126) *G. californicus*. Fig. 127. *G. c. coronadoi*, dorsal terminalia. Fig. 128. *G. bajaiensis*, ventral terminalia. Figs. 129–132. Left temple (STS, submarginal temple seta; MTS, inner marginal temple seta): (129) *T. minor*; (130) *G. tolucae*; (131) *G. expansus*; (132) *G. alleni*.



Figs. 133–158. Female genital sac (GSL, genital sac loop): (133) *Thomomydoecus wardi*; (134) *T. byersi*; (135) *Geomydoecus fuchsi*; (136) *G. thaeleri*; (137) *G. thomomyus*; (138) *G. duchesnensis*; (139) *G. craigi*; (140) *G. biagiae*; (141) *G. dakotensis*; (142) *G. setzeri*; (143) *G. costaricensis*; (144) *G. p. panamensis*; (145) *G. cherriei*; (146) *G. alleni*; (147, 148) *G. t. texanus*; (149) *G. subcalifornicus*; (150) *G. alcorni*; (151) *G. mcgregori*; (152) *G. yucatanensis*; (153) *G. scleritus*; (154) *G. truncatus*; (155) *G. copei*; (156) *G. mexicanus*; (157) *G. telli*; (158) *G. trichopi*.

spines (Figs. 54–57). Female genital sac with shape and lines as in Figs. 135–141. Ex *Thomomys talpoides* complex (subgenus *Thaelerius*) 22
Temple chaetotaxy, male parameral arch, endomeral plate, and genital sac spines, and female genital sac otherwise. Ex other hosts (subgenus *Geomydoecus*) . . 29
22(21). Male unknown; species parthenogenetic. Female genital sac as in Figs. 136, 140 23
Male genital sac usually with 1–7 prominent spines (Figs. 54–57). Female genital sac as in Figs. 135–139, 141 24
23(22). Female without dark lines on genital sac; sac with off-center posterior stalk (Fig. 136)
. . . . . *G. betleyae* Hellenthal & Price
Female with dark lines on genital sac; sac with centered posterior stalk (Fig. 140)
. . . . . *G. biagiae* Hellenthal & Price
24(22). Male genital sac with >4 prominent spines (Fig. 54). Female genital sac as in Figs. 135, 141 25
Male genital sac with ≤4 such spines (Figs. 55–57). Female genital sac as in Figs. 136–139 26
25(24). Male prothorax width >0.272; temple width >0.376. Female genital sac with dark lines as in Fig. 141. Ex *T. talpoides rufescens* Weid-Neuwied
. . . . . *G. dakotensis* Price & Emerson
Male smaller than above. Female genital sac with dark lines as in Fig. 135. Ex other *T. talpoides* subspp.
. . . . . *G. fuchsi* Hellenthal & Price
26(24). Male genital sac with accessory transverse sclerite in addition to spines (Fig. 56). Female genital sac without dark lines and with off-center posterior stalk (Fig. 136). Principally ex *T. mazama* Merriam
. . . . . *G. thaeleri* Hellenthal & Price
Male genital sac without accessory transverse sclerite. Female genital sac otherwise (Figs. 137–139). Principally ex *T. talpoides* 27
27(26). Male genital sac with 0–2 spines. Female genital sac without dark lines (Fig. 138)
. . . . . *G. duchesnensis* Price & Emerson
Male genital sac with 3–4 spines (Figs. 55, 57). Female genital sac with dark lines (Figs. 137, 139) 28
28(27). Male genital sac with 4 spines (Fig. 55). Female genital sac as in Fig. 139
. . . . . *G. craigi* Hellenthal & Price
Male genital sac with 3 spines (Fig. 57). Female genital sac as in Fig. 137
. . . . . *G. thomomyus* (McGregor)
29(21). Male genital sac with <3 spines. Female genital sac small, ≤0.240 wide, often with only anteriorly directed lines (Figs. 152, 155, 156) 30
Male genital sac with ≥3 spines (Fig. 21: GSS). Female genital sac variable 38
30(29). Submarginal temple seta inserted medioanterior to inner marginal seta (Figs. 13, 132). Male parameral arch Y-shaped (Figs. 58, 59). Female last tergite with 3+0+3 setae (Figs. 123–126). Ex *Orthogeomys hispidus* (Le Conte) (*copei* complex) 31
Submarginal temple seta (STS) inserted between outer and inner marginal setae (MTS) (Figs. 10, 11, 130, 131). Male parameral arch evenly oval (Fig. 64) or with short medioposterior process (Figs. 19, 63). Female last tergite usually with 2+2+2 setae (Figs. 115, 122) or, if 3+0+3, then genital sac not >0.200 wide and as in Fig. 156. Ex *Pappogeomys* (*mexicanus* complex) 34
31(30). Male tergites II-III with long clustered setae (Fig. 3); parameral arch apically blunt (Fig. 59). Female genital sac as in Fig. 155 . . . . . *G. copei* Werneck
Male tergites II-III without long clustered setae; parameral arch apically pointed (Fig. 58). Female genital sac near that shown in Fig. 152 32
32(31). Male inner metanotal setae (IMS) much longer than outer setae (OMS) (Fig. 9) . . . . *G. yucatanensis* Price & Emerson
Male inner metanotal setae not longer than outer setae 33
33(32). Male outer metanotal setae 2–6× length of inner setae
. . . . . *G. hoffmanni* Price & Hellenthal
Male outer metanotal setae <1.5× length of inner setae . . . . . *G. chapini* Werneck
34(30). Male genital sac with 2 large spines; parameral arch and endomeral plate as in Fig. 19 . . . . . *G. traubi* Price & Emerson
Male genital sac without large spines; parameral arch as in Figs. 63 or 64; endomeral plate as in Figs. 93 or 94 35
35(34). Male parameral arch with medioposterior process (Fig. 63); endomeral plate diamond-shaped (Fig. 93)
. . . . . *G. fulvescens* Price & Emerson
Male parameral arch rounded (Fig. 64); endomeral plate ovoid (Fig. 94) 36
36(35). Male parameral arch >0.105 wide; with longer median tergal setae (Fig. 68). Female last tergite with 3+0+3 setae
. . . . . *G. mexicanus* Price & Emerson
Male parameral arch <0.105 wide; with shorter median tergal setae (Fig. 67). Female last tergite with 2+2+2 setae 37
37(36). Male parameral arch >0.097 wide. Female medial seta on tergite VIII <0.058 long; sternite III with <11 setae. Ex *P.*

merriami irolonis (Thomas), *P. t. tylorhinus* (Merriam)
. . *G. perotensis irolonis* Price & Emerson
Male parameral arch <0.097 wide. Female medial seta on tergite VIII >0.058 long; sternite III with 11 setae. Ex *P. m. estor* (Merriam), *P. m. perotensis* (Merriam)
. . . . . *G. perotensis perotensis* Price & Emerson

38(29). Male genital sac with only 3–4 prominent spines; scape without process on posterior margin (Fig. 7); submarginal temple seta ≤0.040 long. Female genital sac as in Figs. 143, 145-148 39
Male genital sac with >4 prominent spines and/or scape with process on posterior margin (Fig. 4) and/or submarginal temple seta >0.040 long. Female genital sac variable, including as shown in Fig. 153 48

39(38). Temple width >0.600. Male marginal temple setae as for female (Fig. 132), not stout or spiniform (*jonesi* complex) 40
Temple width <0.600. Male marginal temple setae stout and spiniform 41

40(39). Male parameral arch <0.227 wide. Female temple not >0.690 wide; tergite IV with 24 setae . *G. alleni* Price & Emerson
Larger than above. Female tergite IV with 24 setae . . . . . *G. jonesi* Price & Emerson

41(39). Male endomeral plate widely bifurcate (Fig. 95). Female genital sac medioanteriorly indented (Figs. 143, 145); head width 0.515 (*panamensis* complex, in part) 42
Male endomeral plate triangular, not widely bifurcate (Figs. 92, 96, 97). Female genital sac not medioanteriorly indentated (Figs. 147, 148); head width 0.520 (*texanus* complex) 43

42(41). Male genital sac with 4 large spines. Female genital sac as in Fig. 143, head length >0.362, and inner seta on each side of last tergite 0.100 long. Ex *O. herodus* (Peters)
. . . . . *G. costaricensis* Price & Emerson
Male genital sac with 3 large spines. Female genital sac as in Fig. 145, head length <0.362, and inner seta on each side of last tergite 0.100 long. Ex *O. cherriei* (Allen), *O. matagalpae* (Allen)
. . . . . *G. cherriei* Price

43(41). Male endomeral plate with deep apical division (Fig. 92). Female metanotum with 1+1 medial very long setae (Fig. 115), rarely 2+1; shorter abdominal setae (Fig. 125), with 0–1 of medial 10 on tergite VII >0.100 long
. . . . . *G. subnubili* Price & Hellenthal
Male endomeral plate without such division (Figs. 96, 97). Female metanotum with 2+2 medial very long setae (Fig. 120), less often 2+1; longer abdominal setae (Fig. 121), with 2 or more of medial 10 on tergite VII >0.100 long 44

44(43). Male pleural seta x on IV <1.4× length of tergal seta y (Fig. 66); endomeral plate apically broad (Fig. 97). Female subgenital plate with lateral setae of each cluster extending at least to tips of short setae at inner margin of gonapophyses (Fig. 125), or, if doubtful, ≤24 total setae on sternites III-IV. Ex *Pappogeomys* 45
Male pleural seta x on IV >1.4× length of tergal seta y; endomeral plate apically narrow (Fig. 96). Female subgenital plate with lateral setae of each cluster not extending greatly beyond bases of short setae at inner margin of gonapophyses (Fig. 121), and >24 total setae on sternites III-IV. Ex *Geomys* 47

45(44). Male tergite II with ≥18 setae, tergite III ≥25. Female tergites III-VI with >100 total setae; longest seta of medial 10 on tergite VII ≥0.150 long
. . . . *G. tamaulipensis* Price & Hellenthal
Male tergite II with <18 setae, tergite III <25. Female tergites III-VI with <100 total setae; longest seta of medial 10 on tergite VII <0.150 long 46

46(45). Male temple width ≥0.450; prothorax width ≥0.330; scape length >0.170. Female temple ≥0.480 wide; prothorax >0.340 wide
. . *G. ustulati ustulati* Price & Hellenthal
Smaller than above
. . . *G. ustulati clarkii* Price & Hellenthal

47(44). Male prothorax width ≥0.340; total length ≥1.370. Female head 0.330 long; prothorax ≥0.350 wide. Ex *G. personatus* True . . . . . *G. texanus texanus* Ewing
Smaller than above. Ex *G. tropicalis* Goldman
. *G. texanus tropicalis* Price & Hellenthal

48(38). Male parameral arch medioposteriorly flattened (Fig. 62). Female genital sac as in Fig. 154 (*truncatus* complex) 49
Male parameral arch and female genital sac otherwise 50

49(48). Male temple width >0.435; prothorax width >0.320. Female temple width >0.466; prothorax width >0.343. Ex *G. personatus fallax* (Merriam)
. . . . . *G. truncatus* Werneck
Smaller than above. Ex *G. p. streckeri* Davis
. . . . *G. neotruncatus* Hellenthal & Price

50(48). Male parameral arch apically trifurcate (Fig. 60); male rare, species usually parthenogenetic. Female genital sac with weak lines (Fig. 153). Ex *Geomys* in southeastern United States (*scleritus* complex) 51
Male parameral arch not apically trifur-

cate. Female genital sac and host otherwise 52

51(50). Female tergite VII with 0–5 of medial 10 setae longer than 0.100, longest seta ≤0.115 long. Ex *G. pinetis mobilensis* Merriam (male unknown) . . . . . *G. mobilensis* Price

Female tergite VII with 5–8 of medial 10 setae longer than 0.100, longest seta 0.115 long. Ex other *G. pinetis* Rafinesque subspp. and *Geomys* spp. . . . . *G. scleritus* (McGregor)

52(50). Male endomeral plate triangular, with deep division >1/2 plate length (Fig. 98). Female genital sac with conspicuous medioanterior protrusion (Fig. 157) . . . . . *G. telli* Price & Hellenthal

Male endomeral plate and female genital sac otherwise 53

53(52). Male endomeral plate without apical division or with very short division of elongate nontriangular plate (Figs. 99–104). Female last tergite with 2+2+2 setae (Figs. 115, 122) or, if 3+0+3, genital sac with medioanterior concavity and without loops (Figs. 142, 144) 54

Male endomeral plate with apical division extending 1/4 to 1/2 plate length (Figs. 105–114). Female last tergite with 3+0+3 setae (Figs. 123–126) and genital sac otherwise 67

54(53). Male endomeral plate apically pointed (Figs. 99, 100). Female genital sac as in Figs. 142, 144, 158 (*panamensis* complex, in part; *trichopi*) 55

Male endomeral plate apically blunt (Figs. 101–104). Female genital sac as in Figs. 150, 151, 159, 160 (*bulleri* complex; *mcgregori* complex) 59

55(54). Male temple width >0.525. Female temple width >0.550; genital sac as in Fig. 144 56

Smaller than above. Female genital sac much as in Figs. 142 or 158 57

56(55). Male sternite VII with >5 setae; temple width <0.605. Female temple width <0.640. Ex *O. cavator* (Bangs) . . . . . *G. panamensis panamensis* Price & Emerson

Male sternite VII with ≤5 setae; temple width >0.605. Female temple width 0.640. Ex *O. dariensis* (Goldman) . . . . . *G. panamensis dariensis* Price & Emerson

57(55). Male submarginal temple seta >0.060 long. Female genital sac as in Fig. 158 . . . . . *G. trichopi* Price & Emerson

Male submarginal temple seta <0.060 long. Female genital sac as in Fig. 142 58

58(57). Male endomeral plate shaped as in Fig. 99, >0.087 wide; parameral arch >0.162 wide . . . . . *G. davidhafneri* Price & Hellenthal

Male endomeral plate shaped as in Fig. 100, <0.087 wide; parameral arch <0.162 wide . . . . . *G. setzeri* Price

59(54). Male endomeral plate as in Figs. 101, 102; parameral arch near that shown in Fig. 17. Female genital sac with anterior papillose portion (Figs. 150, 151) (*mcgregori* complex) 60

Male endomeral plate as in Figs. 103, 104; parameral arch near that shown in Fig. 61. Female genital sac lacking papillose portion (Figs. 159, 160) (*bulleri* complex) . 63

60(59). Male endomeral plate near that shown in Fig. 102; parameral arch with inner medioposterior margin deeply indented (Fig. 17). Female genital sac with >7 loops (Fig. 150); temple width <0.512 . . . . . *G. alcorni* Price & Emerson

Male endomeral plate near that shown in Fig. 101; parameral arch without such deep indentation. Female genital sac with ≤7 loops (Fig. 151) and/or temple width >0.512 61

61(60). Male genital sac with only 5 large spines. Female genital sac with <5 loops, posteriormost loop <0.105 from anterior sac margin . . . . . *G. mcgregori* Price & Emerson

Male genital sac with 6 large spines. Female genital sac with ≥5 loops, posteriormost loop ≥0.105 from anterior sac margin 62

62(61). Male temple width >0.536; endomeral plate >0.094 wide. Female temple width >0.585 . . . . . *G. wernecki planiceps* Price & Hellenthal

Smaller than above . . *G. wernecki wernecki* Price & Emerson

63(59). Male endomeral plate as in Fig. 103. Female genital sac lines as in Fig. 159. Ex *P. bulleri nayaritensis* Goldman . . . . . *G. nadleri* Price & Hellenthal

Male endomeral plate as in Fig. 104. Female genital sac lines as in Fig. 160. Ex other *P. bulleri* (Thomas) subspp. 64

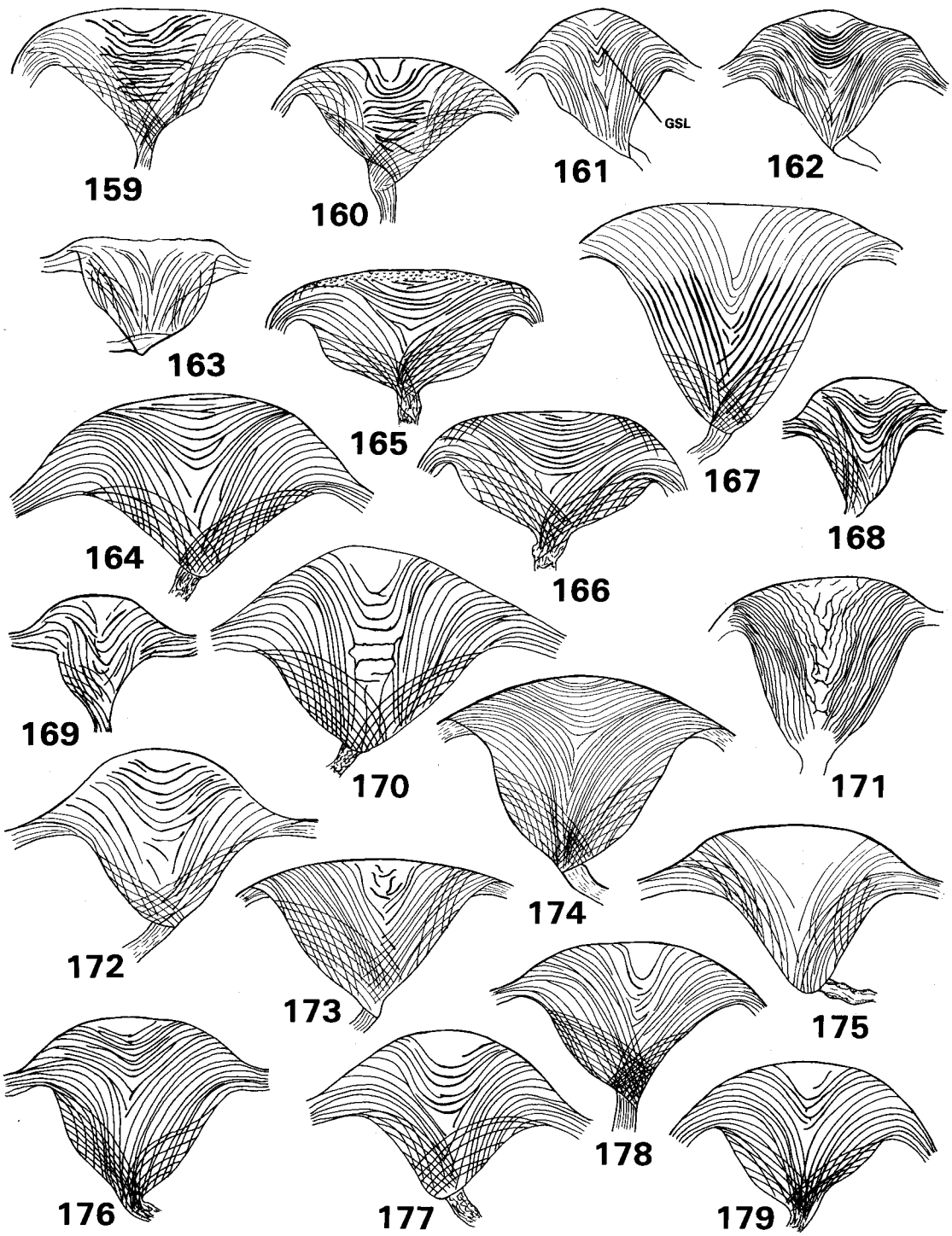
64(63). Male temple width >0.474; parameral arch >0.177 wide. Female temple width >0.500; prothorax width >0.356. Ex *P. bulleri burti* Goldman . . . . . *G. burti* Price & Hellenthal

Smaller than above. Ex other *P. bulleri* subspp. 65

65(64). Male temple width >0.467. Female temple width >0.487. Ex *P. bulleri melanurus* Genoways & Jones . . *G. bulleri melanuri* Price & Hellenthal

Smaller than above. Ex other *P. bulleri* subspp. 66

66(65). Female tergite VII with 0–2 of medial



Figs. 159–179. Female genital sac (GSL, genital sac loop): (159) *Geomydoecus nadleri*; (160) *G. b. bulleri*; (161) *G. expansus*; (162) *G. martini*; (163) *G. tolucae*; (164) *G. angularis*; (165) *G. shastensis*; (166) *G. hueyi*; (167) *G. p. polydentatus*; (168) *G. geomydis*; (169) *G. nebrathkensis*; (170) *G. clausonae*; (171) *G. illinoensis*; (172) *G. veracruzensis*; (173) *G. c. coronadoi*; (174) *G. merriami*; (175) *G. dalgleishi*; (176) *G. w. multilineatus*; (177) *G. bajaiensis*; (178) *G. quadridentatus*; (179) *G. w. welleri*.

10 setae >0.100 long, longest <0.104. From Jalisco
..... *G. bulleri bulleri* Price & Emerson
Female tergite VII with >2 of medial 10 setae >0.100 long, longest >0.104. From Colima ..... *G. bulleri intermedius* Price & Hellenthal

67(53). Male temple width >0.570. Female temple width >0.600 68
Smaller than above 69

68(67). Male tergite VI with <21 setae; temple width <0.672. Female temple width <0.700 . . . *G. chiapensis* Price & Emerson
Larger than above. Male tergite VI with ≥21 setae
..... *G. pygacanthi* Price & Hellenthal

69(67). Male genital sac with 4 large spines, occasionally very small additional spine on 1 or both sides (Fig. 69) 70
Male genital sac with at least 6 large spines (Fig. 21) 74

70(69). Submarginal temple seta <0.067 long 71
Submarginal temple seta >0.067 long . . 72

71(70). Male scape with prominent process on posterior margin (Fig. 4). Female submarginal temple seta not extending much beyond apex of longer adjacent marginal seta. Ex *G. arenarius* Merriam
.... *G. quadridentatus* Price & Emerson
Male scape with at most only moderately developed process on posterior margin (Fig. 6). Female submarginal temple seta extending well beyond apex of longer adjacent marginal seta. Ex *G. bursarius* (Shaw) ..... *G. ewingi* Price & Emerson

72(70). Male genital sac with 4 large, 2 very small spines (Fig. 69). Female genital sac with 2–6 loops. Ex *T. umbrinus* (Richardson) .... *G. crovelloi* Price & Hellenthal
Male genital sac with only 4 large spines. Female genital sac with 4–21 loops. Ex 3 *T. umbrinus* and over 40 *T. bottae* subspp. 73

73(72). Male scape distal width <0.135; scape length <0.159. Female genital sac with <11 loops, posteriormost loop <0.120 from anterior sac margin. Ex *T. bottae* in New Mexico, Texas, Coahuila
.... *G. guadalupensis* Hellenthal & Price
Male scape distal width >0.135; scape length >0.159. Female genital sac (Fig. 149) with 11 loops, posteriormost loop >0.120 from anterior sac margin. Ex *T. bottae* in California, Arizona, Utah, Nevada, Baja California, Sonora, and *T. umbrinus*
.... *G. subcalifornicus* Price & Emerson

74(69). Male scape without well-developed process on posterior margin (Figs. 6–8) . 75
Male scape with well-developed process on posterior margin (Fig. 4) 99

75(74). Submarginal temple seta >0.073 long (Fig. 130) (*tolucae* complex; *oregonus* complex) 76
Submarginal temple seta <0.073 long . . 83

76(75). Male lateral pair of genital sac spines elongate, slender, transversely oriented (Fig. 70) 77
Male lateral pair of genital sac spines vertically oriented and not shaped as above 78

77(76). Male parameral arch apically expanded, rounded (Fig. 15). Female postvulval sclerite with median portion >0.053 long (Fig. 118)
..... *G. pattoni* Price & Hellenthal
Male parameral arch with small tapered apical point (Fig. 16). Female postvulval sclerite with median portion <0.052 long (Fig. 117) . . . *G. tolucae* Price & Emerson

78(76). Male outer marginal temple seta slender, pointed, and inner variable (Fig. 11) 79
Male with both inner and outer marginal temple setae blunt, spiniform (Fig. 10), with outer slightly smaller than inner (*oregonus* complex) 80

79(78). Male endomeral plate with narrow elongate apical portion (Fig. 105); temple width ≥0.385
..... *G. fulvi* Price & Hellenthal
Male endomeral plate with broader apical portion (Fig. 108); temple width ≤0.385 92

80(78). Male outer pair of genital sac spines deeply indented anteriorly, with apices near anterior margin of medioanterior pair (Fig. 71); head width ≥0.435; endomeral plate >0.085 wide. Female temple ≥0.465 wide; subgenital plate with >21 setae. Ex *T. bulbivorus* (Richardson)
..... *G. oregonus* Price & Emerson
Male outer pair of genital sac spines not so deeply indented, with apex of at least 1 spine displaced posterior to anterior margin of medioanterior pair (Figs. 72, 74, 77); head width <0.435; endomeral plate ≤0.085 wide. Female temple <0.465 wide; subgenital plate with ≤21 setae. Ex other *Thomomys* spp. 81

81(80). Male outer pair of genital sac spines symmetrically displaced from medioanterior pair (Fig. 74); sternite III with <15 setae. Female sternites III-IV each with <15 setae. Ex *T. townsendii* (Bachman)
..... *G. idahoensis* Price & Emerson
Male outer pair of genital sac spines either asymmetrically placed (Fig. 77) or symmetrically close to medioanterior pair (Fig. 72); sternite III with 15 setae. Female sternites III-IV each with ≥15 setae. Ex *T. bottae* 82

82(81). Male outer pair of genital sac spines

placed asymmetrically and distant from medioanterior pair (Fig. 77); endomeral plate without narrow posterior tip (Fig. 106). Female genital sac (Fig. 165) with <10 transverse lines or loops; posteriormost loop ≤0.075 from anterior sac margin.
. . . . . *G. shastensis* Price & Hellenthal

Male outer pair of genital sac spines symmetrically close to medioanterior pair (Fig. 72); endomeral plate with short narrow posterior tip (Fig. 107). Female genital sac (Fig. 166) with ≥10 transverse lines or loops; posteriormost loop >0.075 from anterior sac margin
. . . . . *G. hueyi* Price & Hellenthal

83(75). Male scape with weak process on posterior margin (Figs. 6, 8).
Ex *Geomys, Thomomys* 84

Male scape with no suggestion of process on posterior margin (Fig. 7).
Ex *Pappogeomys, Thomomys* 89

84(83). Male medioanterior genital sac spines separated by deep, wide space (Fig. 73) . 85

Male medioanterior genital sac spines close together, separated by shallow space (Fig. 78) 86

85(84). Male scape length <0.180. Female genital sac with >7 loops (Fig. 168). Ex 3 *G. bursarius* subspp. (*bursarius, majusculus* Swenk, *wisconsinensis* Jackson)
. . . . . *G. geomydis* (Osborn)

Male scape length >0.180. Female genital sac with irregular lines interconnecting medially (Fig. 171). Ex *G. b. illinoensis* Komarek & Spencer
. . . . . *G. illinoensis* Price & Emerson

86(84). Male temple width <0.423. Female genital sac with 0–8 complete loops.
Ex *Geomys* (if ex *Thomomys* or *G. bursarius missouriensis* McLaughlin, go to couplet 99) 87

Male temple width >0.423. Female genital sac with 7–14 complete loops. Ex *Thomomys* 88

87(86). Male total length <1.300; temple width <0.390. Female genital sac with >3 complete loops. Ex *G. bursarius attwateri* Merriam, *G. b. sagittalis* Merriam
. . . . . *G. subgeomydis* Price & Emerson

Male larger than above. Female genital sac with 3 complete loops (Fig. 169).
Ex *G. bursarius lutescens* Merriam
. . . . . *G. nebrathkensis* Timm & Price

88(86). Male temple width >0.444; tergite V with >20 setae. Female head length >0.333; tergite V with ≥23 setae
. . . . . *G. extimi* Price & Hellenthal

Male temple width <0.444; tergite V with ≤20 setae. Female head length <0.333; tergite V with 23 setae
. . . . . *G. nayaritensis* Price & Hellenthal

89(83). Male genital sac with 8–12 large spines (Fig. 79). Female genital sac with 0–7 faint angulate loops anteriorly, lines much more pronounced posteriorly (Fig. 167) 90

Male genital sac with only 6 large spines. Female genital sac usually otherwise . . 91

90(89). Male head length <0.324. Female total length <1.378; temple width <0.503. Ex *P. tylorhinus angustirostris* (Merriam), *P. gymnurus imparilis* (Goldman)
. . . . . *G. polydentatus angustirostris* Price & Hellenthal

Larger than above. Ex *P. zinseri* (Goldman), other *P. tylorhinus* subspp.
. . . . . *G. polydentatus polydentatus* Price & Emerson

91(89). Male temple width <0.387; parameral arch as in Figs. 14, 18; endomeral plate near that shown in Fig. 108. Female temple width <0.415; genital sac close to that shown in Fig. 163 92

Male temple width >0.387; parameral arch otherwise (Fig. 65); endomeral plate more as in Figs. 109–113. Female temple width >0.415; genital sac otherwise . . . 93

92(79,91). Male parameral arch as in Fig. 14. Female with >30 tergal and pleural setae on VII, >7 on sternite IV. In Chihuahua, Arizona . . . . . *G. chihuahuae chihuahuae* Price & Hellenthal

Male parameral arch as in Fig. 18. Female with <38 tergal and pleural setae on VII, <13 on sternite IV. In southern Chihuahua, Durango . . *G. chihuahuae emersoni* Price & Hellenthal

93(91). Female last tergite with inner seta >0.068 long; genital sac as in Figs. 161, 162. Ex *P. castanops* (Baird) (*expansus* complex) 94

Female last tergite with inner seta <0.067 long (Fig. 127); genital sac as in Figs. 172–174. Ex *P. merriami* (Thomas), *P. tylorhinus* (*coronadoi* complex, in part) . . 95

94(93). Male endomeral plate as in Fig. 109. Female genital sac with 2–8 faint angulate loops (Fig. 161)
. . . . . *G. expansus* (Dugès)

Male endomeral plate as in Fig. 110. Female genital sac with 6–11 well-defined loops (Fig. 162)
. . . . . *G. martini* Price & Hellenthal

95(93). Male endomeral plate as in Fig. 111. Female genital sac with 6–9 loops (Fig. 172); inner seta on last tergite >0.045 long
. . . . . *G. veracruzensis* Price & Emerson

Male endomeral plate as in Figs. 112, 113. Female genital sac with 0–8 (Fig. 173) or 9–16 (Fig. 174) loops; inner seta on last tergite ≤0.045 long 96

96(95). Male genital sac with short outer spines

(Fig. 75); endomeral plate >0.090 long. Female genital sac with >8 loops (Fig. 174)
. . . . . *G. merriami* Price & Emerson
Male genital sac with long outer spines (Fig. 76); endomeral plate <0.090 long. Female genital sac with ≤8 loops (Fig. 173) 97

97(96). Male sternite II with 11 setae; sternite IV with ≥13 setae; tergite IV with ≥24 setae. Ex *P. merriami estor, P. m. perotensis*
. . . . . *G. coronadoi coronadoi* Barrera
Male sternite II with ≤11 setae; sternite IV with ≤13 setae; tergite IV with 24 setae. Ex other *P. merriami* subspp. 98

98(97). Male tergite VI with ≤16 setae; temple width <0.437; total length <1.334. Ex *P. m. saccharalis* (Nelson & Goldman)
. . . . . *G. coronadoi saccharalis* Price & Hellenthal
Male tergite VI with >16 setae; larger than above. Ex *P. m. merriami*
. . . . . *G. coronadoi submerriami* Price & Hellenthal

99(74). Submarginal temple seta ≤0.070 long. Ex *Geomys* or Mexican *T. umbrinus* . . 100
Submarginal temple seta ≥0.065 long. Mostly ex *T. bottae*, except *G. warmanae* from 11 *T. umbrinus* subspp. (*californicus* complex, in part) 110

100(99). Female genital sac devoid of lines medioanteriorly (Fig. 175). Ex *G. personatus*
. . . . . *G. dalgleishi* Timm & Price
Female genital sac with loops or lines medioanteriorly. Ex other host species . . 101

101(100). Female genital sac with 0–3 loops. Ex *Geomys* spp. 102
Female genital sac with 3–13 loops. Ex *T. umbrinus* (*umbrini* complex, in part) . 105

102(101). Female subgenital plate with ≥24 setae. Ex *G. bursarius lutescens*
. . . . . *G. nebrathkensis* Timm & Price
Female subgenital plate with <24 setae. Ex other *Geomys* taxa 103

103(102). Male total length >1.300; temple width ≥0.410; scape >0.180 long. Female genital sac ≥0.185 long; total length ≥1.300. Ex *G. bursarius missouriensis*
. . . . . *G. spickai* Timm & Price
Smaller than above. Ex 5 other *Geomys* taxa 104

104(103). Male endomeral plate <0.070 long; scape length <0.165. Female total body length ≤1.200; head length <0.300. Ex 2 *G. bursarius* subspp. (*llanensis* Bailey, *texensis* Merriam)
. . . . . *G. heaneyi* Timm & Price
Larger than above. Ex 3 *G. bursarius* subspp. (*halli* Sudman, Choate & Zimmerman, *knoxjonesi* Baker & Genoways, *major* Davis)
. . . . . *G. oklahomensis* Price & Emerson

105(101). Male outer genital sac spines markedly lateroposterior to medioanterior pair (Fig. 80); scape length <0.165; temple width <0.395. Female inner postvulval sclerite setae longer and thicker than outer setae (Fig. 119) 106
Male outer genital sac spines not markedly lateroposterior to medioanterior pair (Figs. 81, 82); scape length 0.165 and/or temple width ≥0.395. Female postvulval sclerite setae equally long and thick (Figs. 116–118) 107

106(105). Female genital sac with ≥6 loops (Fig. 176). Ex 6 *T. umbrinus* subspp. (*atrodorsalis* Nelson & Goldman, *crassidens* Nelson & Goldman, *enixus* Nelson & Goldman, *newmani* Dalquest, *supernus* Nelson & Goldman, *zacatecae* Nelson & Goldman)
. . . . . *G. welleri multilineatus* Price & Hellenthal
Female genital sac with <6 loops (Fig. 179). Ex 11 other *T. umbrinus* subspp.
. . . . . *welleri welleri* Price & Hellenthal

107(105). Male lateroanterior pair of genital sac spines tapered, narrowed apically (Fig. 81). From Jalisco 108
Male lateroanterior pair of genital sac spines apically broad (Fig. 82). From Sinaloa 109

108(107). Male tergite III with <20 setae; temple width ≤0.410; scape distal width <0.145. Female temple width <0.445
. . . . . *G. cliftoni* Price & Hellenthal
Male tergite III with 20 setae. Dimensions larger than above . . . . . *G. jaliscoensis* Price & Hellenthal

109(107). Male scape length >0.175; temple width >0.415. Female with <9 genital sac loops; temple width ≥0.450
. . . . . *G. musculi* Price & Hellenthal
Male smaller than above. Female with ≥9 genital sac loops and/or temple width <0.450
. . . . . *G. umbrini* Price & Emerson

110(99). Male medioanterior pair of genital sac spines with 1 recessed posteriorly and different in appearance (Fig. 83) 111
Male medioanterior pair of genital sac spines similar in position and appearance 114

111(110). Male endomeral plate apically attenuate, narrowed (Fig. 110). Widely distributed in Nevada, Utah, southwestern New Mexico, northwestern and southeastern Arizona, eastern California, northern Sinaloa, southeastern Sonora, northwestern Chihuahua
. . . . . *G. centralis* Price & Hellenthal

Male endomeral plate triangular (Fig. 114). Limited to California, southwestern Arizona, northwestern Sonora, northern Baja California 112

112(111). Male endomeral plate <0.078 wide. Ex 4 *T. bottae* subspp. (*albatus*, *depauperatus* Grinnell & Hill, *phasma* Goldman, *vanrossemi* Huey)
. . . . . *G. albati* Price & Hellenthal

Male endomeral plate >0.078 wide. Ex other *T. bottae* subspp. in California, Baja California 113

113(112). Female genital sac with shallow curved transverse lines extending to anterior margin (Fig. 164). Ex hosts mostly north and west of Los Angeles, CA
. . . . . *G. angularis* Price & Hellenthal

Female genital sac with curved loops not extending to anterior margin (Fig. 162). Ex hosts mostly south and east of Los Angeles . . . . . *G. californicus* (Chapman)

114(110). Male lateral genital sac spines with principal margin directed mediad (Fig. 85) 115

Male lateral genital sac spines with principal margin directed laterad 118

115(114). Female genital sac with 6–16 loops. Ex hosts in Texas, Coahuila
. . . *limitaris limitaris* Price & Hellenthal

Female genital sac with 1–15 loops. Ex hosts in Arizona, New Mexico, Sonora, Chihuahua 116

116(115). Male scape medial width >0.111. Ex 3 *T. bottae* subspp. (*proximus* Burt & Campbell, *caneloensis* Lange, *operosus* Hatfield)
. . . . *G. limitaris halli* Price & Hellenthal

Male scape medial width <0.111. Ex other *T. bottae* subspp. and *T. umbrinus*. . . 117

117(116). Female genital sac with ≥9 loops. Ex 5 *T. bottae* subspp. (*collinus* Goldman, *extenuatus* Goldman, *fulvus* (Woodhouse), *modicus* Goldman, *toltecus* Allen)
. . . *G. limitaris tolteci* Price & Hellenthal

Female genital sac with <9 loops. Ex 7 *T. bottae* subspp. (*fulvus*, *hualpaiensis* Goldman, *modicus*, *muralis* Goldman, *mutabilis* Goldman, *opulentis* Goldman, *toltecus*) and *T. umbrinus intermedius* Mearns
. . . *G. limitaris bakeri* Price & Hellenthal

118(114). Female subgenital plate with thick setae laterally (Fig. 128). Ex hosts in Baja California 119

Female subgenital plate with only thin setae laterally (Figs. 123–126). Ex hosts elsewhere in the United States, Mexico . 120

119(118). Male lateral genital sac spines relatively long compared with medioanterior pair, with markedly concave anterior margin (Fig. 86). Female genital sac with transverse parallel lines on posterior portion (Fig. 170). Ex 2 *T. bottae* subspp. (*anitae* Allen, *alticolus* Allen)
. . . . . *G. clausonae* Price & Hellenthal

Male lateral genital sac spines relatively short, with flatter anterior margin (Fig. 87). Female genital sac without such parallel lines (Fig. 177). Ex other *T. bottae* subspp.
. . . . . *G. bajaiensis* Price & Hellenthal

120(118). Male lateral and medioanterior pairs of genital sac spines of similar size, transversely aligned (Fig. 89). Female genital sac with >5 loops. Mostly ex *T. umbrinus* subspp.
. . . . . *G. warmanae* Price & Hellenthal

Male lateral genital sac spines smaller than medioanterior pair, somewhat posteriorly displaced (Figs. 88, 90, 91). Female genital sac with variable number of loops. Ex *T. bottae* subspp. 121

121(120). Male lateral genital sac spines relatively short, outer margin curved, with deep anterior concavity and converging corners (Figs. 88, 91). Female genital sac with ≥7 loops 122

Male lateral genital sac spines longer, outer margin straighter, with at most shallow anterior concavity (Figs. 84, 90). Female genital sac with <7 loops 123

122(121). Male lateral genital sac spines as in Fig. 88. Ex *T. bottae sinaloae* Merriam, *T. b. simulus* Nelson & Goldman in Sinaloa
. . . . . *G. sinaloae* Price & Hellenthal

Male lateral genital sac spines as in Fig. 91. Ex other *T. bottae* subspp. in the United States, elsewhere in Mexico
. . . . . *G. actuosi* Price & Hellenthal

123(121). Male lateral genital sac spines with shallow anterior concavity (Fig. 90)
. . . . . *G. aurei aurei* Price & Hellenthal

Male lateral genital sac spines without such anterior concavity (Fig. 84)
. *G. aurei grahamensis* Price & Hellenthal

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References Cited

Hellenthal, R. A. & R. D. Price. 1984. A new species of *Thomomydoecus* (Mallophaga: Trichodectidae) from *Thomomys bottae* pocket gophers (Ro-

dentia: Geomydiae). J. Kans. Entomol. Soc. 57: 231–236.

1989a. *Geomydoecus thomomyus* complex (Mallophaga: Trichodectidae) from pocket gophers of the *Thomomys talpoides* complex (Rodentia: Geomyidae) of the United States and Canada. Ann. Entomol. Soc. Am. 82: 286–297.

1989b. The *Thomomydoecus wardi* complex (Mallophaga: Trichodectidae) of the pocket gopher, *Thomomys talpoides* (Rodentia: Geomyidae). J. Kans. Entomol. Soc. 62: 245–253.

1991. Biosystematics of the chewing lice of pocket gophers. Annu. Rev. Entomol. 36: 185–203.

Lyal, C.H.C. 1985. A cladistic analysis and classification of trichodectid mammal lice (Phthiraptera: Ischnocera). Bull. Br. Mus. (Nat. Hist.) Entomol. 51: 187–346.

Nadler, S. A. & M. S. Hafner. 1989. Genetic differentiation in sympatric species of chewing lice (Mallophaga: Trichodectidae). Ann. Entomol. Soc. Am. 82: 109–113.

Price, R. D. & K. C. Emerson. 1971. A revision of the genus *Geomydoecus* (Mallophaga: Trichodectidae) of the New World pocket gophers (Rodentia: Geomyidae). J. Med. Entomol. 8:228–257.

1972. A new subgenus and three new species of *Geomydoecus* (Mallophaga: Trichodectidae) from *Thomomys* (Rodentia: Geomyidae). J. Med. Entomol. 9: 463–467.

Thaeler, C. S., Jr. 1980. Chromosome numbers and systematic relations in the genus *Thomomys* (Rodentia: Geomyidae). J. Mammal. 61: 414–422.

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