

A REVIEW OF THE *GEOMYDOECUS TEXANUS* COMPLEX (MALLOPHAGA: TRICHODECTIDAE) FROM *GEOMYS* AND *PAPPOGEOMYS* (RODENTIA: GEOMYIDAE)¹

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Abstract: *Geomydoecus texanus* is redescribed and illustrated, with the nominate subspecies restricted to material from *Geomys personatus*. Five new species and subspecies of *Geomydoecus* are described: *G. texanus tropicalis* from *Geomys tropicalis*; *G. ustulati ustulati* from 5 subspecies of *Pappogeomys castanops* (type-host: *P. c. ustulatus*); *G. u. clarkii* from 2 subspecies of *P. castanops* (type-host: *P. c. clarkii*); *G. tamaulipensis* from *P. c. tamaulipensis*; *G. subnubili* from 9 subspecies of *P. castanops* (type-host: *P. c. subnubilis*). Distinctions between these taxa are shown using qualitative and quantitative characters, and principal components analysis of quantitative characters. A key is given for identifying these 6 taxa.

Price & Emerson (1971) reported *Geomydoecus texanus* Ewing from *Geomys tropicalis* Goldman and 3 subspecies of *Geomys personatus* True. They added 2 questionable records for 3 specimens of lice from *Pappogeomys castanops jucundus* (Russell & Baker) and *P. c. rubellus* (Nelson & Goldman). The uncertainty of these last records was based on the paucity of material and the occurrence of these lice on a different host genus. However, since then, extensive collecting of lice from all subspecies of *P. castanops* recognized by Russell (1968) has shown members of the *texanus*-complex to occur widely among them and to be largely sympatric with the *expansus*-complex discussed by Price & Hellenthal (1975). The abundance of the *texanus*-complex material, taken from 17 *P. castanops* subspecies, allowed a thorough reexamination of the entire group and has resulted in the recognition of 5 new species and subspecies. It is our purpose here to describe these taxa.

In the following descriptions, measured or counted characters are followed by the minimum and maximum observed values, and, in parentheses, the sample size, mean, and standard deviation. All measurements are in millimeters. In evaluating character usefulness for specific and subspecific discrimination, critical values for each character were calculated at the point where the likelihood of single character misidentification of the 2 most similar 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 corre-

sponding probabilities of misidentification are given.

Host nomenclature is that of Russell (1968). Abbreviations used for host accession numbers in the "Material examined" section are KU (University of Kansas Museum of Natural History), UC (University of California Museum of Vertebrate Zoology), and CAS (California Academy of Sciences); in this same section, a number in parentheses following a locality represents the total 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.

The principal components analysis described in this paper used a computer program adapted from program PCFLOR in Goldstein & Grigal (1972). Most other calculations for this study were done using computer programs written by the junior author.

Geomydoecus texanus Ewing FIG. 1-10, 16
Geomydoecus texanus Ewing, 1936, J. Parasitol. **22**:
241. Type-host: *Geomys personatus fallax* Merriam.

♀. As in FIG. 3. Temple width (TW) 0.450-0.510 (25: 0.477 ± 0.0179); head length (HL) 0.295-0.360 (25: 0.328 ± 0.0165); submarginal and marginal temple setae (STS, MTS; FIG. 1) 0.020-0.045 and 0.020-0.035 long, respectively, with STS variably slightly more laterad to mediad of inner MTS than shown. Prothorax width 0.320-0.380 (25: 0.351 ± 0.0150). Metanotum usually with 2 + 2 very long setae on each side, as in FIG. 3. Tergal setae: I, 2; II, 15-21 (25: 17.1 ± 1.30); III, 21-27 (22: 24.7 ± 1.39); IV, 21-30 (22: 25.6 ± 2.02); V, 20-27 (21: 23.2 ± 2.04); VI, 20-27 (22: 23.4 ± 1.81); tergal and pleural setae on VII, 24-33 (22: 29.7 ± 2.30). Longest seta of medial 10 on tergite VI, 0.070-0.095 (23: 0.084 ± 0.0068); on tergite VII, 0.105-0.130 (20: 0.116 ± 0.0074), with 2-8 (17: 6.0 ± 2.29) of these longer than 0.100. Longest seta of medial pair on tergite VIII, 0.045-0.075 (20: 0.062 ± 0.0085). Last tergite with 3 lateral setae (LS; FIG. 16) close together on each side, subequal in length, 0.075-0.120, with alveoli usually angled forward toward midline. Sternal setae: II, 8-12 (24: 10.4 ± 0.92); III, 10-16 (23: 12.3 ± 1.58); IV, 13-19 (23: 16.0 ± 1.61); V, 11-16 (21: 13.3 ± 1.19); VI, 11-14 (21: 12.1 ± 0.89); VII, 9-13 (22: 10.2 ± 0.97). Subgenital plate (SGP; FIG. 16) with 24-35 (26: 28.5 ± 2.94) setae, with distribution and lengths as shown. Total length 1.180-1.390 (25: 1.273 ± 0.0608). Genital sac width 0.190-0.305, length 0.180-0.255, with 0 (FIG. 6) to 3 (GSL; FIG. 7) loops, with last complete loop extending back as far as 0.105 from anterior margin of sac; genital chamber particles latero-anteriorly as in top 2 rows of FIG. 5, medioposteriorly as in bottom 2 rows.

¹Paper No. 8831, Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul, Minnesota 55108, U.S.A.

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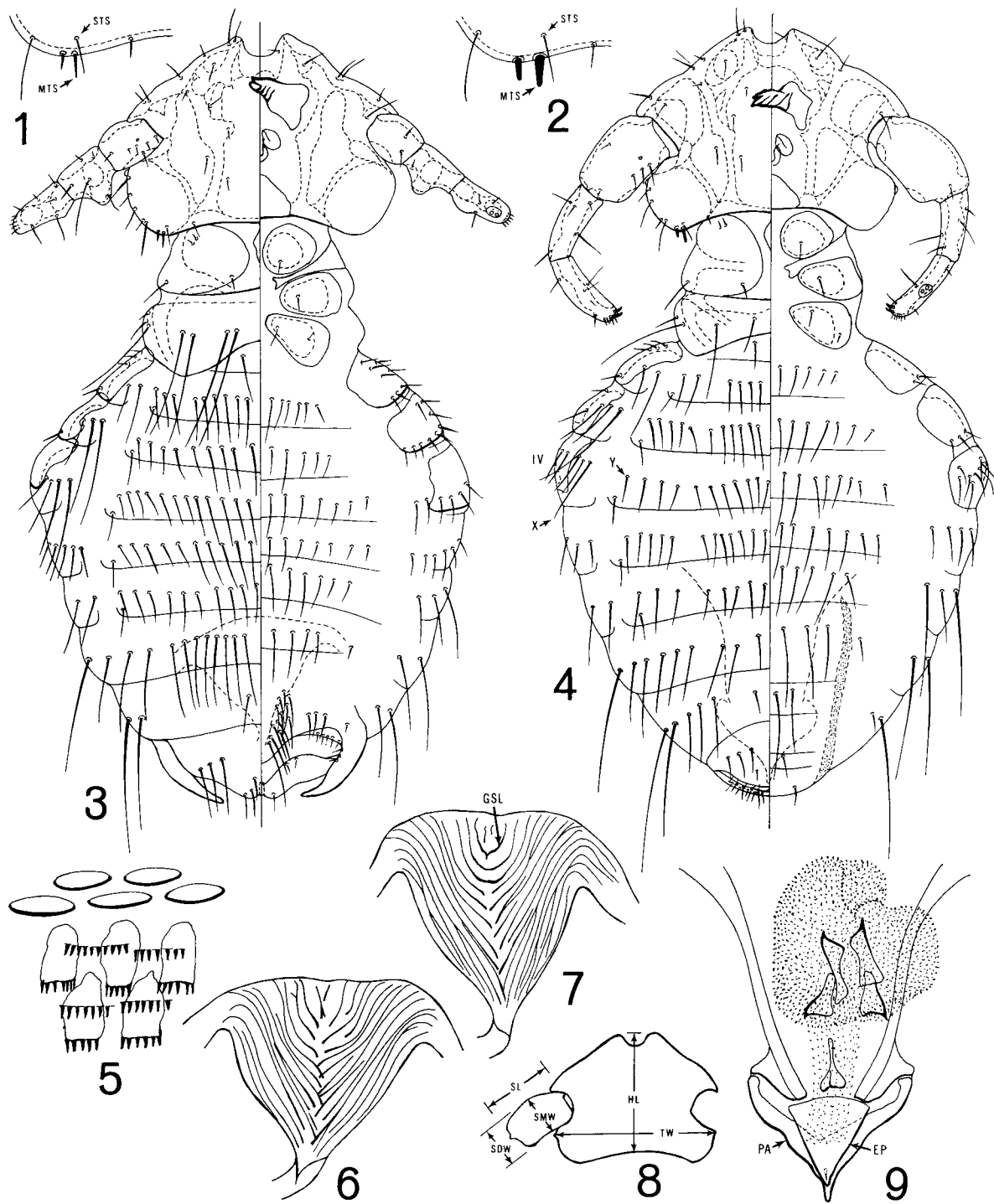


FIG. 1-9. *Geomydoecus texanus texanus*: (1) ♀ marginal temple; (2) ♂ marginal temple; (3) ♀; (4) ♂; (5) ♀ genital chamber particles; (6) ♀ genital sac; (7) ♀ genital sac; (8) ♂ head and scape; (9) ♂ genitalia.

♂. As in FIG. 4. Temple width (TW: FIG. 8) 0.435–0.490 (21: 0.455 ± 0.0144); head length (HL) 0.310–0.385 (21: 0.337 ± 0.0201); submarginal and marginal temple setae (STS, MTS: FIG. 2) 0.025–0.040 (15: 0.035 ± 0.0042) and 0.020–0.025 long, respectively, with STS variably slightly more laterad to mediad of blunt spiniform inner MTS. Antenna with scape length (SL: FIG. 8) 0.160–0.195 (19: 0.173 ± 0.0083), scape medial width (SMW) 0.105–0.120 (19: 0.111 ± 0.0043), scape distal width (SDW) 0.110–0.125 (19: 0.117 ± 0.0043). Prothorax width 0.315–0.370 (23: 0.339 ± 0.0156). Tergal setae: I, 2; II, 13–18 (25: 16.1 ± 1.36); III, 19–27 (24: 23.5 ± 1.61); IV, 23–28 (24: 25.6 ± 1.50); V, 19–25 (24: 22.2 ± 1.64); VI, 15–20 (24: 17.4 ± 1.24); tergal and pleural setae on VII, 19–27 (24: 22.7 ± 1.97). Pleural seta x on IV usually more than $1.4\times$ longer than tergal seta y (FIG. 4). Sternal setae: II, 8–12 (25: 9.7 ± 1.10); III, 10–15 (23: 11.9 ± 1.56); IV, 12–17 (22: 14.5 ± 1.50); V, 9–13 (24: 11.5 ± 0.98); VI, 8–12 (25: 10.0 ± 0.96); VII, 6–10 (25: 8.0 ± 0.98); VIII, 4–7 (25: 5.6 ± 0.82). Total length 1.195–1.505 (21: 1.360 ± 0.0819). Genitalia as in FIG. 9, with sac having 4 large spines; parameral arch (PA) width 0.160–0.190 (25: 0.178 ± 0.0085); endomerale plate (EP) width 0.085–0.100 (25: 0.094 ± 0.0041), length 0.080–0.110 (25: 0.096 ± 0.0064), shaped as in FIG. 10, triangular, apically tapered without distinct division.

Geomydoecus texanus texanus Ewing FIG.
1–10, 16

♀. Temple width 0.465–0.510 (14: 0.486 ± 0.0174); head length 0.325–0.360 (14: 0.339 ± 0.0101); submarginal temple seta length 0.020–0.040 (9: 0.030 ± 0.0062); prothorax width 0.345–0.380 (14: 0.359 ± 0.0103); sternal setae on III, 10–13 (12: 11.4 ± 0.90).

♂. Temple width 0.450–0.490 (9: 0.465 ± 0.0144); head length 0.325–0.385 (9: 0.354 ± 0.0181); submarginal temple seta length 0.025–0.035 (6: 0.031 ± 0.0038); scape length 0.175–0.195 (7: 0.181 ± 0.0074); scape medial width 0.110–0.120 (7: 0.115 ± 0.0034); prothorax width 0.335–0.370 (11: 0.351 ± 0.0104). Sternal setae: II, 8–11 (13: 9.3 ± 0.94); III, 10–12 (12: 10.9 ± 0.79). Total length 1.355–1.505 (9: 1.429 ± 0.0474); parameral arch width 0.175–0.190 (13: 0.184 ± 0.0057).

Material examined: 3 ♀♀, 1 ♂ (holotype of *G. texanus*), *G. p. fallax*, U.S.A., Texas, Corpus Christi Bay (1). 16 ♀♀, 13 ♂♂, *G. p. personatus*, U.S.A., Texas, Padre Island (1), Mustang Island (5); Mexico, Tamaulipas, 73 mi. (117.7 km) S of Washington Beach (5), 35 mi. (56.6 km) SSE of Matamoros (1). 2 ♀♀, 2 ♂♂, *G. p. megapotamus* Davis, U.S.A., Texas, 4 mi. (6.4 km) SE of Oilton (1).

Geomydoecus texanus tropicalis Price & Hellenthal, n. subsp.

Type-host: *Geomys tropicalis* Goldman.

♀. Temple width 0.450–0.490 (11: 0.466 ± 0.0108); head length 0.295–0.330 (11: 0.313 ± 0.0101); submarginal temple seta length 0.030–0.045 (9: 0.039 ± 0.0044); prothorax width 0.320–0.370 (11: 0.339 ± 0.0125); sternal setae on III, 11–16 (11: 13.4 ± 1.57).

♂. Temple width 0.435–0.460 (12: 0.447 ± 0.0079); head length 0.310–0.340 (12: 0.324 ± 0.0094); submarginal temple seta length 0.035–0.040 (9: 0.037 ± 0.0025); scape length 0.160–0.175 (12: 0.169 ± 0.0045); scape medial width 0.105–0.110 (12: 0.109 ± 0.0026); prothorax width 0.315–0.345 (12: 0.327 ± 0.0092). Sternal setae: II, 10–12 (12: 10.7 ± 0.78);

III, 10–15 (11: 13.0 ± 1.48). Total length 1.195–1.440 (12: 1.308 ± 0.0613); parameral arch width 0.160–0.180 (12: 0.172 ± 0.0063).

Diagnosis: Both sexes of *G. t. tropicalis* are very close to those of the nominate subspecies, but a number of dimensional differences, all smaller except the longer submarginal temple seta, and some slightly greater sternal setal counts, justify the separation of these populations into subspecies. For ♀♀, critical values for separation and probabilities of misidentification for the best discriminating characters were head length 0.326 (0.10) and prothorax width 0.349 (0.19). For ♂♂, the best characters were prothorax width 0.339 (0.11), head length 0.339 (0.14), total length 1.368 (0.14), scape length 0.175 (0.14), scape medial width 0.112 (0.14), parameral arch width 0.178 (0.16), submarginal temple seta length 0.034 (0.17), and setae on sternite III 11.9 (0.19).

Material examined: Holotype ♂, *G. tropicalis*, 1 mi. (1.6 km) S of Altamira, Tamaulipas, Mexico, 4.VII.1953, G. H. Heinrich, KU-55542; in collection of the University of Kansas. Paratypes: 3 ♀♀, 1 ♂, same as holotype; 29 ♀♀, 15 ♂♂, same, except KU-55540, 55541, 55543; 7 ♀♀, 5 ♂♂, same, except 5.VII.1953, KU-55545, 55546, 55548, 55551.

Geomydoecus ustulati Price & Hellenthal, n. sp.

FIG. 11

Type-host: *Pappogeomys castanops ustulatus* (Russell & Baker).

♀. Much as for *G. texanus*, except as follows. Temple width 0.430–0.520 (87: 0.484 ± 0.0243); head length 0.280–0.350 (87: 0.318 ± 0.0154); prothorax width 0.310–0.380 (88: 0.347 ± 0.0168). Tergal setae: II, 10–18 (88: 14.0 ± 1.61); III, 17–25 (88: 21.0 ± 1.96); IV, 17–28 (87: 22.7 ± 2.36); V, 16–27 (89: 21.3 ± 2.20); VI, 17–28 (89: 21.1 ± 2.04); tergal and pleural setae on VII, 23–34 (90: 28.1 ± 1.99). Longest seta of medial 10 on tergite VI, 0.055–0.095 (86: 0.074 ± 0.0080); on tergite VII, 0.095–0.145 (87: 0.115 ± 0.0097), with 0–8 (84: 4.6 ± 2.81) of these longer than 0.100. Length of 3 lateral setae on each side of last tergite 0.070–0.125. Sternal setae: II, 7–12 (90: 9.1 ± 1.04); III, 6–12 (88: 9.0 ± 1.08); IV, 10–15 (89: 12.8 ± 1.11). Subgenital plate with 19–31 (90: 22.9 ± 2.25) setae, with distribution and lengths much as in FIG. 17. Total length 1.010–1.465 (86: 1.288 ± 0.0993). Genital sac with 0–5 loops, with last complete loop extending back as far as 0.105 from anterior margin of sac.

♂. Much as for *G. texanus*, except as follows. Temple width 0.400–0.495 (73: 0.457 ± 0.0238); head length 0.285–0.360 (73: 0.329 ± 0.0182); scape length 0.145–0.190 (73: 0.175 ± 0.0115); prothorax width 0.300–0.365 (72: 0.337 ± 0.0155). Tergal setae: II, 10–17 (73: 12.8 ± 1.51); III, 16–26 (73: 20.5 ± 1.89); IV, 19–27 (72: 22.6 ± 1.76); V, 14–26 (73: 18.8 ± 1.96). Pleural seta x on IV as long as to somewhat longer than tergal seta y . Sternal setae on III, 7–12 (73: 9.4 ± 1.09). Total length 1.175–1.505 (72: 1.363 ± 0.0779). Parameral arch width 0.160–0.190 (73: 0.177 ± 0.0087); endomerale plate length 0.065–0.100 (72: 0.086 ± 0.0066), variably shaped as in FIG. 11 or 12.

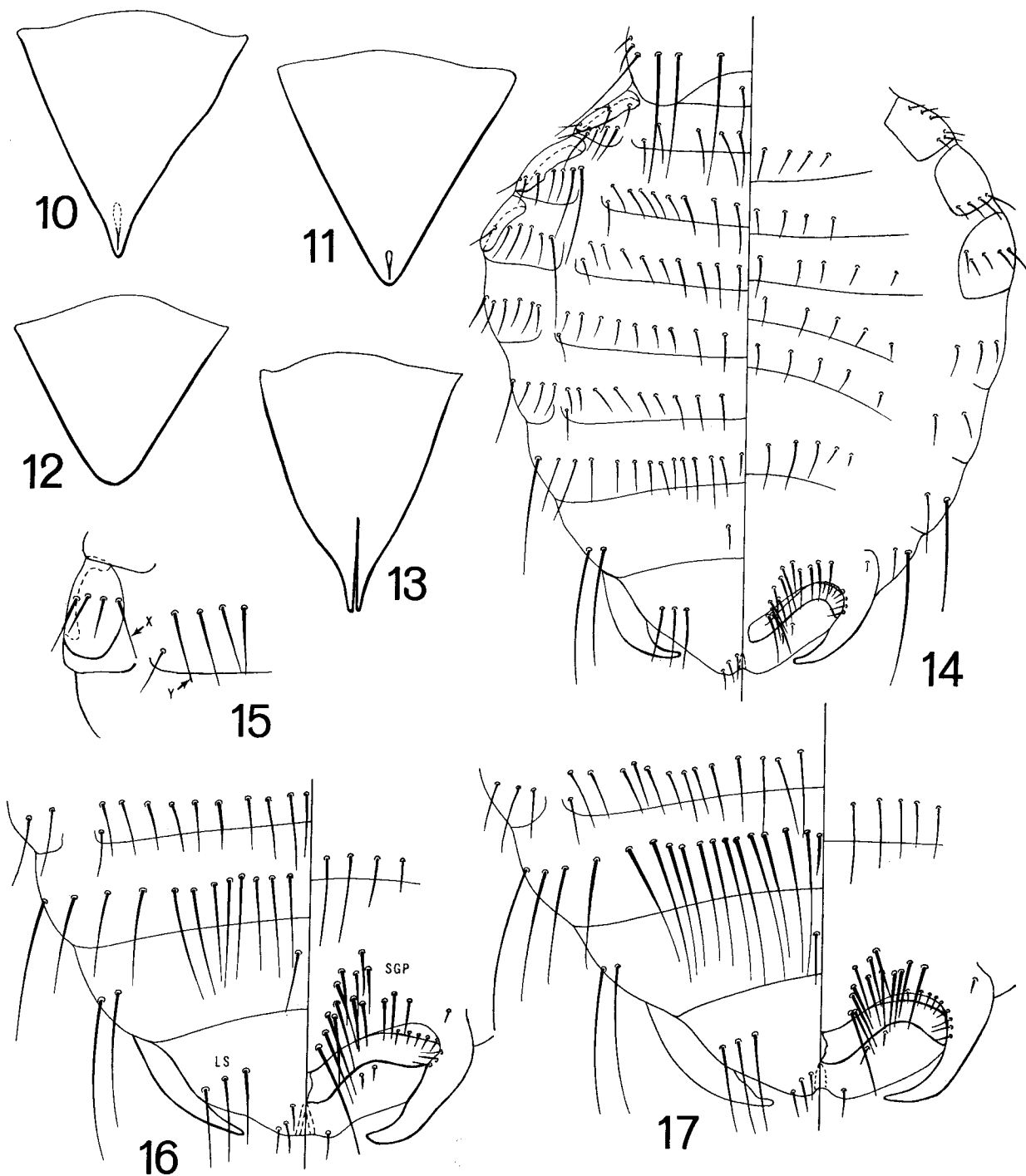


FIG. 10-17. ♂ endomerai plate: (10) *Geomydoecus texanus texanus*; (11) *G. ustulati ustulati*; (12) *G. tamaulipensis*; (13) *G. subnubili*. (14) *G. subnubili* ♀ metanotum and abdomen. (15) *G. tamaulipensis* ♂ dorsolateral abdominal segment IV. ♀ terminalia: (16) *G. texanus texanus*; (17) *G. tamaulipensis*.

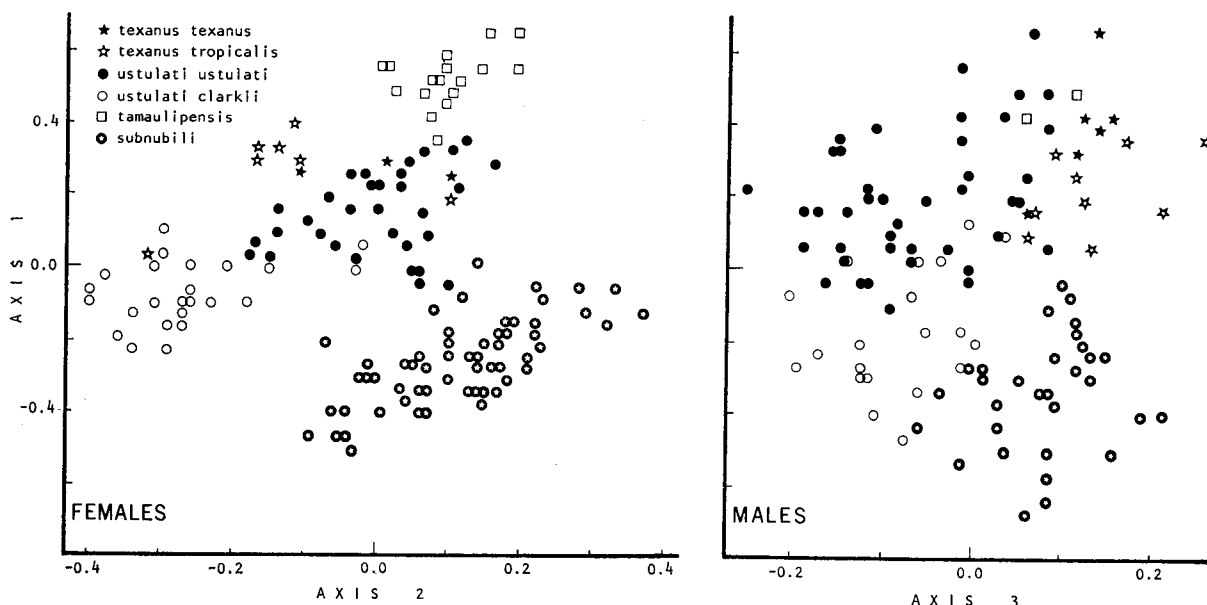


FIG. 18. Scattergrams of principal components axes for *Geomydoecus texanus* complex individuals.

Diagnosis: The best features for separating *G. ustulati* from *G. texanus* are associated with the chaetotaxy of the ♀ subgenital plate and the shape of the ♂ endomerale plate. With ♀ *G. ustulati*, the lateralmost setae of each subgenital plate cluster have their line of alveoli nearer the most anterior of the other setae and these setae overlap considerably the short setae lining the inner margin of the gonapophyses (FIG. 16 vs FIG. 17). The endomerale plate of the ♂ *G. ustulati* is somewhat shorter, variably shaped, but more broadly rounded apically (FIG. 11 or 12 vs FIG. 10). The ♀ *G. ustulati* also tends to have fewer tergal, sternal, and subgenital plate setae, and the ♂ fewer tergal setae. For ♀♀, critical values for separation and probabilities of misidentification for the best discriminating quantitative characters were setae on sternite III 10.208 (0.14), setae on sternite IV 14.023 (0.16), and setae on the subgenital plate 25.847 (0.17). For ♂♂, the best character was setae on tergite II 14.472 (0.17).

***Geomydoecus ustulati ustulati* Price & Hellenthal** FIG. 11

♀. Temple width 0.470–0.520 (57: 0.498 ± 0.0118); head length 0.300–0.350 (57: 0.325 ± 0.0112); prothorax width 0.335–0.380 (58: 0.357 ± 0.0099); total length 1.155–1.465 (57: 1.333 ± 0.0748).

♂. Temple width 0.450–0.495 (50: 0.470 ± 0.0134); head length 0.315–0.360 (50: 0.337 ± 0.0124); scape length 0.165–0.190 (50: 0.181 ± 0.0063); prothorax width 0.330–0.365 (49: 0.346 ± 0.0091); total length 1.260–1.505 (49: 1.401 ± 0.0555).

Material examined: Holotype ♀, *P. c. ustulatus*,

4 mi. (6.4 km) N, 1 mi. (1.6 km) W of Anahuac (=Rodrigues), Nuevo Leon, Mexico, 25.XI.1953, R. W. Dickerman, KU-56611; in collection of the University of Kansas. Paratypes (all from type-host): 5 ♀♀, 11 ♂♂, same as holotype; 30 ♀♀, 55 ♂♂, same, except KU-56609, 56610, 56612; 13 ♀♀, 8 ♂♂, 9 mi. (14.4 km) N, 2 mi. (3.2 km) W of Anahuac (=Rodrigues), Nuevo Leon, Mexico, 26.XI.1953, R. W. Dickerman, KU-56608; 15 ♀♀, 13 ♂♂, Don Martin, Coahuila, Mexico, 16.VIII.1949, W. K. Clark, KU-34584, 34585, 34587; 8 ♀♀, 1 ♂, 5 mi. (8 km) SE of Don Martin, Coahuila, Mexico, 7.XI.1951, J. R. Alcorn, KU-44308; 4 ♀♀, 11 ♂♂, Base of Don Martin Dam, Coahuila, Mexico, 27.XI.1953, R. W. Dickerman, KU-56596, 56597. Other material: 9 ♀♀, 8 ♂♂, *P. c. angusticeps* (Nelson & Goldman), U.S.A., Texas, Maverick Co., Eagle Pass (1). 73 ♀♀, 65 ♂♂, *P. c. bullatus* (Russell & Baker), Mexico, Nuevo Leon, 3 mi. (4.8 km) N of Lampazos (3), 1 mi. (1.6 km) N of (1) and at (2) Vallecillo; Coahuila, 29 mi. (46.4 km) N, 6 mi. (9.6 km) E of Sabinas (4), 12 mi. (19.2 km) E of Nava (1). 45 ♀♀, 27 ♂♂, *P. c. excelsus* (Nelson & Goldman), Mexico, Coahuila, 4 mi. (6.4 km) N of Acatita (4). 61 ♀♀, 69 ♂♂, *P. c. jucundus*, Mexico, Coahuila, Hermanas (5).

***Geomydoecus ustulati clarkii* Price & Hellenthal, n. subsp.**

Type-host: *Pappogeomys castanops clarkii* (Baird).

♀. Temple width 0.430–0.490 (30: 0.456 ± 0.0166); head length 0.280–0.330 (30: 0.303 ± 0.0118); prothorax width 0.310–0.350 (30: 0.328 ± 0.0101); total length 1.010–1.345 (29: 1.200 ± 0.0808).

♂. Temple width 0.400–0.450 (23: 0.429 ± 0.0151); head length 0.285–0.330 (23: 0.309 ± 0.0130); scape length 0.145–0.175 (23: 0.162 ± 0.0087); prothorax width 0.300–0.335 (23: 0.319 ± 0.0101); total length 1.175–1.385 (23: 1.283 ± 0.0552).

Diagnosis: Both sexes of *G. u. clarkii* tend to be smaller than *G. u. ustulati* in most dimensions. For ♀♀, critical values for separation and probabilities of misidentification for the best discriminating characters were temple width 0.477 (0.06), prothorax width 0.343 (0.08), and head length 0.314 (0.17). For ♂♂, the best characters were temple width 0.449 (0.07), prothorax width 0.333 (0.08), scape length 0.171 (0.09), head length 0.323 (0.14), and total length 1.342 (0.14).

Material examined: Holotype ♂, *P. c. clarkii*, Lajitas, Brewster Co., Texas, U.S.A., 16.VI.1959, C. A. Long, KU-81152; in collection of the University of Kansas. Paratypes (all from type-host): 28 ♀♀, 22 ♂♂, same as holotype; 32 ♀♀, 24 ♂♂, same, except 11.VI.1959, KU-81149, 81150. Other material: 36 ♀♀, 76 ♂♂, *P. c. torridus* Russell, U.S.A., Texas, Brewster Co., 4 mi. (6.4 km) E of (5) and 6 mi. (9.6 km) S of (1) Terlingua; Hudspeth Co., 2 mi. (3.2 km) E of (2) and at (1) Sierra Blanca.

Geomydoecus tamaulipensis Price & Hellenthal,
n. sp. FIG. 12, 15, 17

Type-host: *Pappogeomys castanops tamaulipensis* (Nelson & Goldman).

♀. Much as for *G. ustulati*, except as follows. Tergal setae: II, 13–20 (21: 17.1 ± 1.95); III, 23–27 (21: 24.9 ± 1.31); IV, 25–30 (21: 27.1 ± 1.70); V, 23–28 (21: 25.7 ± 1.38); VI, 24–28 (21: 26.5 ± 1.21); tergal and pleural setae on VII, 29–37 (20: 34.3 ± 2.12). Longest seta of medial 10 on tergite VI, 0.085–0.110 (21: 0.098 ± 0.0074); on tergite VII, 0.130–0.180 (21: 0.151 ± 0.0154), with all 8 longer than 0.100 (FIG. 17). Length of 3 lateral setae on each side of last tergite, 0.090–0.135.

♂. Much as for *G. ustulati*, except as follows. Tergal setae: II, 18–20 (2: 19.0 ± 1.41); III–IV, 25–27 (2: 26.0 ± 1.41). Pleural seta *x* on IV equal to or shorter than tergal seta *y* (FIG. 15). Parameral arch width 0.165; endomeral plate as in FIG. 12.

Diagnosis: The larger number of tergal setae in both sexes, in combination with longer setae in various positions on the ♀♀, enables *G. tamaulipensis* to be separated from both *G. texanus* and *G. ustulati*. For ♀♀, critical values for separation and probabilities of misidentification for the best discriminating characters were longest seta on tergite VII 0.134 (0.13), setae on tergite VII 32.125 (0.14), and setae on tergite VI 24.989 (0.16). For ♂♂, the very small sample size allowed for too great an error in estimation of the sample means to warrant calculation of character use criteria; however, the number of setae on tergite II appears to show the most promise.

Material examined: Holotype ♀, *P. c. tamaulipen-*

sis, 3 mi. (4.8 km) SE of Reynosa, Tamaulipas, Mexico, 3.III.1954, R. W. Dickerman, KU-58118; in collection of the University of Kansas. Paratypes (all from type-host): 38 ♀♀, same as holotype; 39 ♀♀, 2 ♂♂, same, except KU-58119, 58120.

Geomydoecus subnubili Price & Hellenthal,
n. sp. FIG. 13, 14

Type-host: *Pappogeomys castanops subnubilus* (Nelson & Goldman).

♀. Much as in FIG. 3, but abdomen as in FIG. 14. Temple width 0.440–0.510 (83: 0.478 ± 0.0158); head length 0.300–0.355 (84: 0.326 ± 0.0127); submarginal and marginal temple setae 0.020–0.040 and 0.020–0.030 long, respectively. Prothorax width 0.305–0.365 (86: 0.335 ± 0.0126). Metanotum usually (96% of specimens) with 2 + 1 very long setae on each side, as in FIG. 14, with 4% of specimens being 2 + 2 on a single side. Tergal setae: I, 2; II, 7–14 (85: 9.8 ± 0.97); III, 14–22 (85: 18.2 ± 1.71); IV, 17–26 (85: 21.4 ± 1.92); V, 18–27 (85: 21.6 ± 1.89); VI, 18–26 (86: 21.7 ± 1.74); tergal and pleural setae on VII, 26–38 (86: 30.7 ± 2.50). Longest seta of medial 10 on tergite VI, 0.040–0.070 (86: 0.056 ± 0.0061); on tergite VII, 0.065–0.110 (84: 0.085 ± 0.0096), with 0–1 (84: 0.02 ± 0.153) of these longer than 0.100. Longest seta of medial pair on tergite VIII, 0.015–0.055 (83: 0.036 ± 0.0078). Last tergite with 3 lateral setae close together on each side, subequal in length, 0.050–0.115, with alveoli aligned perpendicular to body axis. Sternal setae: II, 6–9 (86: 7.5 ± 0.72); III, 4–8 (86: 5.8 ± 1.05); IV, 7–14 (86: 10.3 ± 1.74); V, 7–14 (86: 10.1 ± 1.57); VI, 8–14 (84: 10.8 ± 1.43); VII, 7–12 (86: 9.4 ± 1.23). Subgenital plate with 19–30 (85: 23.2 ± 2.3) setae, with distribution and lengths as shown. Total length 1.155–1.470 (84: 1.323 ± 0.0660). Genital sac width 0.210–0.280, length 0.170–0.255, with 0–3 loops, with last loop extending back as far as 0.065 from anterior margin of sac; genital chamber particles as for *G. texanus* (FIG. 5).

♂. Much as in FIG. 4, but with somewhat shorter abdominal setae. Temple width 0.425–0.475 (36: 0.447 ± 0.0135); head length 0.300–0.355 (36: 0.325 ± 0.0139); submarginal and marginal temple setae as for *G. texanus* (FIG. 2). Antenna with scape length 0.150–0.180 (36: 0.165 ± 0.0084), scape medial width 0.090–0.115 (36: 0.102 ± 0.0064), scape distal width 0.095–0.120 (36: 0.107 ± 0.0067). Prothorax width 0.290–0.340 (36: 0.320 ± 0.0125). Tergal setae: I, 2; II, 8–14 (35: 9.7 ± 1.19); III, 15–21 (35: 17.5 ± 1.44); IV, 17–25 (36: 20.8 ± 1.94); V, 15–22 (35: 17.9 ± 1.90); VI, 10–16 (36: 12.8 ± 1.61); tergal and pleural setae on VII, 15–22 (36: 18.1 ± 1.93). Pleural seta *x* on IV subequal to tergal seta *y*. Sternal setae: II, 6–8 (36: 7.6 ± 0.55); III, 5–8 (35: 6.4 ± 0.92); IV, 8–14 (36: 11.2 ± 1.48); V, 6–11 (36: 9.6 ± 1.36); VI, 5–9 (36: 7.3 ± 0.89); VII, 5–7 (36: 6.0 ± 0.51); VIII, 4–6 (36: 4.4 ± 0.55). Total length 1.205–1.440 (36: 1.331 ± 0.0635). Genitalia as in FIG. 9, except endomeral plate as in FIG. 13, with distinct deep apical division; parameral arch width 0.150–0.185 (36: 0.167 ± 0.0087); endomeral plate width 0.075–0.095 (36: 0.085 ± 0.0050), length 0.085–0.105 (36: 0.097 ± 0.0065).

Diagnosis: Whereas *G. texanus*, *G. ustulati*, and *G. tamaulipensis* are morphologically very similar, *G. subnubili* differs from them in a number of important features. The ♀ of *G. subnubili* usually has only 1 + 1 long medial metanotal setae, has shorter abdominal setae, and has a tendency for fewer setae on the anterior abdominal segments. The ♂ of

G. subnubili has a distinctively different endomeral plate, as well as a tendency for shorter and fewer abdominal setae. For ♀♀, critical values for separation and probabilities of misidentification for the best discriminating characters were setae on tergite II 12.029 (0.05), setae on sternite III 7.407 (0.07), longest seta on tergite VII 0.097 (0.09), longest seta on tergite VI 0.065 (0.09), and setae longer than 0.100 on tergite VII 1.445 (0.10). For ♂♂, the best characters were setae on sternite III 7.754 (0.09), setae on tergite II 11.046 (0.13), and setae on sternite VI 8.551 (0.15).

Material examined: Holotype ♀, *P. c. subnubilus*, 15 mi. (24.0 km) S of Concepcion del Oro, Zacatecas, Mexico, 24.I.1954, R. W. Dickerman, KU-58130; in collection of the University of Kansas. Paratypes (all from type-host): 4 ♀♀, 5 ♂♂, same as holotype; 15 ♀♀, 9 ♂♂, same, except KU-58128, 58129; 8 ♀♀, 3 mi. (4.8 km) N of Lulu, Zacatecas, Mexico, 27-28.V.1940, E. V. Miller, UC-91270, 91271; 17 ♀♀, 10 ♂♂, 22 mi. (35.2 km) SW of Concepcion del Oro, Zacatecas, Mexico, 5.I.1964, G. W. Jones, CAS-12994, 12996; 11 ♀♀, 10 ♂♂, 8 mi. (12.8 km) N of La Ventura, Coahuila, Mexico, 22.VII. and 17.XI.1949, W. K. Clark, KU-33135, 34590, 34933; 1 ♀, 2 ♂♂, Sierra Guadalupe, 11 mi. (17.6 km) S, 4 mi. (6.4 km) W of General Cepeda, Coahuila, Mexico, 18.IV.1953, G. H. Heinrich, KU-55587; 14 ♀♀, 5 ♂♂, 1 mi. (1.6 km) N of Agua Nueva, Coahuila, Mexico, 18.VII.1949, W. K. Clark, KU-33127; 7 ♀♀, 4 ♂♂, Laguna, Nuevo Leon, Mexico, 25-26.II.1954, R. W. Dickerman, KU-58095, 58096, 58097, 58099; 19 ♀♀, 20 ♂♂, 5 mi. (8.0 km) W of Ascension, Nuevo Leon, Mexico, 23-24.II.1954, R. W. Dickerman, KU-58101, 58102, 58104, 58106, 58108, 58109, 58155; 22 ♀♀, 19 ♂♂, 1 mi. (1.6 km) W of Dr. Arroyo, Nuevo Leon, Mexico, 17-18.II.1954, R. W. Dickerman, KU-58114, 58115, 58116, 58117; 8 ♀♀, 4 ♂♂, 7 mi. (11.2 km) NW of Providencia, Nuevo Leon, Mexico, 23.IV.1965, P. L. Clifton, KU-100450, 100451, 100453. Other material: 89 ♀♀, 82 ♂♂, *P. c. elibatus* Russell, Mexico, Coahuila, 7 mi. (11.2 km) S, 4 mi. (6.4 km) E of Bella Union (4), 12 mi. (19.2 km) S, 2 mi. (3.2 km) E of Arteaga (5), 4 mi. (6.4 km) S, 6 mi. (9.6 km) E of Saltillo (4), 3 mi. (4.8 km) NE (1) and 12 mi. (19.2 km) W (4) of San Antonio de las Alazanas. 40 ♀♀, 36 ♂♂, *P. c. goldmani* (Merriam), Mexico, Coahuila, 1 mi. (1.6 km) S of Jimulco (4), "Pico de Jimulco" (1); Zacatecas, Canitas (1); Durango, Hacienda de Atotonilco (1). 22 ♀♀, 34 ♂♂, *P. c. perexiguus* Russell, Mexico, Coahuila, 21 mi. (33.6 km) S, 11 mi. (17.6 km) E of Australia (4). 17 ♀♀, 21 ♂♂,

P. c. peridoneus (Nelson & Goldman), Mexico, San Luis Potosi, 29 mi. (46.4 km) W, 14 mi. (22.4 km) N of Ciudad del Maiz (4). 41 ♀♀, 29 ♂♂, *P. c. planifrons* (Nelson & Goldman), Mexico, Tamaulipas, Miquihuana (4), 4 mi. (6.4 km) N of Jaumave (1), 8 mi. (12.8 km) N (1) and 9 mi. (14.4 km) SW (1) of Tula. 73 ♀♀, 83 ♂♂, *P. c. rubellus*, Mexico, Zacatecas, Ville de Cos (7); San Luis Potosi, 4.5 mi. (7.2 km) SW of Herradura (5); Tamaulipas, Nicolas, 56 km NW of Tula (7). 25 ♀♀, 27 ♂♂, *P. c. subsimus* (Nelson & Goldman), Mexico, Coahuila, 2 mi. (3.2 km) N of Santa Cruz (2), 3 mi. (4.8 km) S, 3 mi. (4.8 km) E of Muralla (2), San Antonio de Jaral (3), N foot Sierra Guadalupe, 9 mi. (14.4 km) S, 5 mi. (8.0 km) W of General Cepeda (1). 19 ♀♀, 19 ♂♂, *P. c. surculus* Russell, Mexico, Zacatecas, Concepcion del Oro (4), 8 mi. (12.8 km) S of Majoma (4).

The taxa comprising the *texanus*-complex generally showed considerable variation and some overlap for even the best quantitative characters. However, such overlap is not unexpected given the individual variability and moderate sample sizes. Qualitative characters, though subtle, also supported our separations.

Because of the subtle nature of the characters required for distinguishing taxa, we felt it desirable to find further supporting evidence. Principal components analysis of the pooled quantitative data offered added support for our separations. Using the centered R-technique as described by Orloci (1967) for 28 ♀ characters and for 23 ♂ characters, the first 3 components were found to account for 65% of the ♀ variation and for 73% of the ♂ variation.

Scattergrams with coordinates representing the 1st, 2nd, and 3rd principal axes in reduced character space for each sex all generally supported our separation of taxa. The best separations were achieved by graphing the 1st and 2nd axes for ♀♀ and the 1st and 3rd axes for ♂♂ (FIG. 18).

Members of all 6 taxa encompassed within the *texanus*-complex key to couplet 30 as *G. texanus* in both the ♀ and ♂ keys of Price & Emerson (1971). The following modifications of these keys will enable the identification of most specimens included therein. As would be anticipated when one is dealing with such a large number of specimens that in most cases do not demonstrate profound qualitative differences between taxa, character ranges tend to overlap to a degree and certain individuals will cause difficulty in proper identification. Overall character evaluation has convinced us of the validity of our taxa, but we wanted to caution the users of

our keys to verify their identifications with the host records.

Anyone identifying *Geomydoecus* taken from *P. castanops* should be aware that 2 other species, *G. expansus* (Duges) and *G. martini* Price & Hellenthal, also occur commonly on these gophers. A study of these lice, which are grossly separable from those in the *texanus*-complex, has been reported by Price & Hellenthal (1975).

KEY TO ♂♂ OF THE *texanus*-COMPLEX

30. Temple setae close to FIG. 2, with submarginal temple seta occasionally extending to or slightly beyond apex of marginal temple seta; temple width greater than 0.41; genitalia width 0.16 or more, grossly shaped as in FIG. 9 (*texanus*-complex).....30a
- Temple setae with submarginal temple seta extending well beyond apex of marginal temple seta; head width 0.41 or less; genitalia width 0.15 or less, grossly shaped otherwise.....**ewingi**
- 30a. Endomerale plate with distinct deep apical division (FIG. 13).....**subnubili**
- Endomerale plate with at most vague suggestion of apical division (FIG. 10-12).....30b
- 30b. Pleural seta x on both sides of IV more than 1.4 length of tergal seta y (FIG. 4); endomerale plate usually apically narrowed, as in FIG. 10; on *Geomys*.....**texanus**...30c
- Pleural seta x on both sides of IV less than 1.4 length of tergal seta y ; endomerale plate usually apically broader (FIG. 11, 12); on *Pappogeomys*.....30d
- 30c. Prothorax width 0.34 or greater; total length 1.37 or more; on *G. personatus*.....**texanus texanus**
- Prothorax width under 0.34; total length under 1.37; on *G. tropicalis*.....**texanus tropicalis**
- 30d. Tergite II with 18 or more setae; tergite III with more than 24 setae.....**tamaulipensis**
- Tergite II with up to 17 setae; tergite III with 24 or fewer setae.....**ustulati**...30e
- 30e. Head width 0.45 or more; prothorax width 0.33 or more; scape length over 0.17.....**ustulati ustulati**
- Head width under 0.45; prothorax width under 0.33; scape length 0.17 or less.....**ustulati clarkii**

KEY TO ♀♀ OF THE *texanus*-COMPLEX

30. Genital chamber sac varying from that shown in FIG. 6 to that in FIG. 7, with prominent lines converging medially (*texanus*-complex).....30a
- Genital chamber sac often faintly lined, without lines so obviously converging medially.....31
- 30a. Metanotum usually with only 1 + 1 medial very long setae, rarely with 2 + 1; generally shorter abdominal setae (FIG. 14), with 1 or fewer of medial 10 on tergite VII over 0.10 long; tergite II with up to 12 setae, sternite III with fewer than 8 setae...**subnubili**
- Metanotum often with 2 + 2 medial very long setae,

less often 2 + 1; generally longer abdominal setae (FIG. 3), usually 2 or more of medial 10 on tergite VII over 0.10 long; tergite II with more than 12 setae, sternite III with 8 or more.....30b

- 30b. Most lateral setae of each subgenital plate cluster not extending greatly beyond bases of short setae on inner margin of gonapophyses (FIG. 16) and usually with 25 or more total setae on sternites III-IV; on *Geomys*.....**texanus**...30c
- Most lateral setae of each subgenital plate cluster extending at least to tips of short setae on inner margin of gonapophyses (FIG. 14, 17), or, if doubtful, usually 24 or fewer total setae on sternites III-IV; on *Pappogeomys*.....30d
- 30c. Head length 0.33 or more; prothorax width 0.35 or more; on *G. personatus*.....**texanus texanus**
- Head length under 0.33; prothorax width under 0.35; on *G. tropicalis*.....**texanus tropicalis**
- 30d. Over 100 total setae on tergites III-VI; longest seta of medial 10 on tergite VII usually 0.15 or more; over 31 tergal and pleural setae on VII.....**tamaulipensis**
- Under 100 total setae on tergites III-VI; longest seta of medial 10 on tergite VII usually under 0.15; only up to 31 tergal and pleural setae on VII.....**ustulati**...30e
- 30e. Head width 0.48 or more; prothorax width over 0.34.....**ustulati ustulati**
- Head width under 0.48; prothorax width 0.34 or less.....**ustulati clarkii**

Acknowledgments: We thank the staff of University of Minnesota University Computer Center for a computer time grant and the use of its facilities, Dr D. F. Grigal for assistance in modifying his Principal Components Analysis program, and the following individuals for permitting us to brush pocket gopher skins or for otherwise helping us in the preparation of this paper: Dr K. C. Emerson, Arlington, Virginia; Dr Robert S. Hoffmann, KU; Dr J. Knox Jones and Dr Hugh H. Genoways, formerly at KU but now at Texas Tech University; Dr Robert T. Orr, CAS; and Dr James L. Patton, UC.

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