

A revision of the genus *Geopsammodius* Gordon and Pittino, 1992 (Scarabaeidae: Aphodiinae: Psammodiini)

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Abstract: The genus *Geopsammodius* Gordon and Pittino is revised. Eight new species are described: *G. atlantida* (Honduras: Atlantida), *G. fuscus* (Martin Co. and Palm Beach Co., Florida), *G. morrisoni* (eastern Polk Co., Florida), *G. ohoopae* (Tattall Co., Georgia), *G. rileyi* (coastal Louisiana and Texas), *G. subpedalis* (northern coastal Gulf of Mexico), *G. unsidensis* (inland Texas), and *G. withlacoochee* (Citrus Co. and Hernando Co., Florida), bringing the number of described species to 11. A key and illustrations are provided to aid in identification of taxa.

Key words: Scarabaeidae, Aphodiinae, Psammodiini, *Geopsammodius*

Introduction

Members of *Geopsammodius* have greatly reduced eyes and are presumed blind. They are flightless sand dwellers that are rare in collections. However, specialized collecting has shown they can be extremely abundant in suitable habitat, but this habitat is often restricted. Recently discovered species are here described to promote future studies of the genus.

Materials and Methods

Most species described here are known from several adjacent localities. Given their potential for isolation and speciation, it was felt best to limit the type series of any species to one isolated area. Data for specimens considered to be the same species are stated but they are not considered part of the type series. No subspecies are currently recognized. Isolated populations that were distinguishable from others are given full species status.

Materials studied are deposited in the following collections: **EGRC** - E. Riley, Texas A & M University, College Station, TX; **FSCA** - Florida State Collection of Arthropods, Gainesville, FL; **HAHC** - Henry and Anne Howden, Ottawa, Ontario, Canada; **JEWC** - James Wappes, San Antonio, TX; **MJPC** - M. J. Paulsen, Lincoln, NE; **PESC** - Paul E. Skelley, Gainesville, FL; **PJHC** - P. J. Harpootlian, Simpsonville, SC; **PKLC** - Paul K. Lago, University of Mississippi, University, MS; **RHTC** - Robert H. Turnbow, Fort Rucker, AL; **TAMU** - Texas A & M University, College Station, TX; **UNSM** - University of Nebraska State Museum, Lincoln, NE; **USNM** - U. S. National

Museum of Natural History, Smithsonian Institution, Washington, DC; **WBG** - W. Godwin, Stephen F. Austin State University, Nacogdoches, TX; **WBWC** - W. B. Warner, Chandler, AZ.

Geopsammodius Gordon and Pittino 1992

Geopsammodius Gordon and Pittino 1992: 267. Type species: *Psammodius hydropticus* Horn 1887, by original designation.

Diagnosis. Body globose (Figs. 18-19), reddish brown to dark brown, some nearly black, glossy. Head with eyes and frontal lobe greatly reduced, presumed blind. Meso- and metatibia strongly curved outward, broadly dilated at apex. Elytra with lateral stria 9 merging with stria 10 (margin) half way to apex, interval 10 not surpassing second abdominal sterna. Metatarsus shortened, segments 1-4 distinctly widened apically, basal segment usually asymmetrically triangular; tarsal claws greatly reduced. Flight wings reduced to membranous straps, except in *G. sabinae*. Meso- and metatibia curved outward, greatly dilated at apex. Male genitalia somewhat reduced, parameres short, cylindrical, apically rounded, often with ventral part bearing a membranous concavity; genitalia differing little, even between the most morphologically divergent species (Figs. 15-17). No external sexual dimorphism observed.

Species relationships. Within *Geopsammodius*, there are a few species that seem to form tight groups.

The relictillus species group (*G. fuscus*, *G. morrisoni*, *G. ohoopae*, *G. relictillus*, *G. withlacoochee*) has distinctly granulate clypeus, distinct punctures or

grooves on the pronotum, basal pronotal line usually broad and distinct, and the elytral margin near the humerus is sharply edged. This group is restricted to inland dunes of the southeastern United States; Florida and Georgia. During the Pleistocene, ocean levels rose and lowered several times, with each successive rise being less than the previous one (see Hubbell 1954). This created a series of dunes and, upon receding, marooned populations of beetles. The ridge systems these species occupy are often small and some are threatened by development.

The hydropticus species group (*G. hydropticus*, *G. subpedalis*) has larger body size, clypeal granules reduced in prominence, pronotal punctures and grooves greatly reduced, basal pronotal line fine to absent at middle, and the elytral margin near the humerus is rounded, smoothly edged. This group occupies present-day ocean beach dunes in the eastern United States.

The rileyi species group (*G. rileyi*, *G. unsideensis*) has smaller body size, reduced clypeal granules, pronotum with punctures and grooves indistinct, basal pronotal line fine, and the elytral margin near the humerus is rounded, smoothly edged. This group forms a complex occupying both coastal (*G. rileyi*) and inland (mostly *G. unsideensis*) dunes of Texas. Interestingly, specimens of both *G. rileyi* and *G. unsideensis* have been collected at Boca Chica, Cameron Co., TX. Much more work is needed to sort out this group.

Natural History. The majority of *Geopsammodius* species appear to inhabit wind-blown sand deposits associated with ocean beaches. *Geopsammodius* are most numerous in areas of open sand around the roots of dune stabilizing plants. Both adults and larvae are found in this situation. It is suspected that they feed on detritus trapped in this sand.

Being flightless, they disperse slowly, and densely populated spots can be separated by a matter of meters. To collect them, use a fine screen sifter (mesh slightly smaller than window screen is best), allowing sand to pass through while looking for beetles on the screen. If none are found in a few minutes, move a few meters. Because specimens are easily overlooked, sifted detritus should be saved and processed with a Berlese funnel.

Geopsammodius seem to prefer the interface between dry and damp sand. After a rain, beetles were found in clumps of grasses almost literally at the surface. Once the sand started drying, so that the upper 3-4 mm was dry, beetles were found scattered in this dry sand, often some distance from any vegetation. As the dry sand reached 2-3 cm deep, beetles were found closer to plants. When very dry

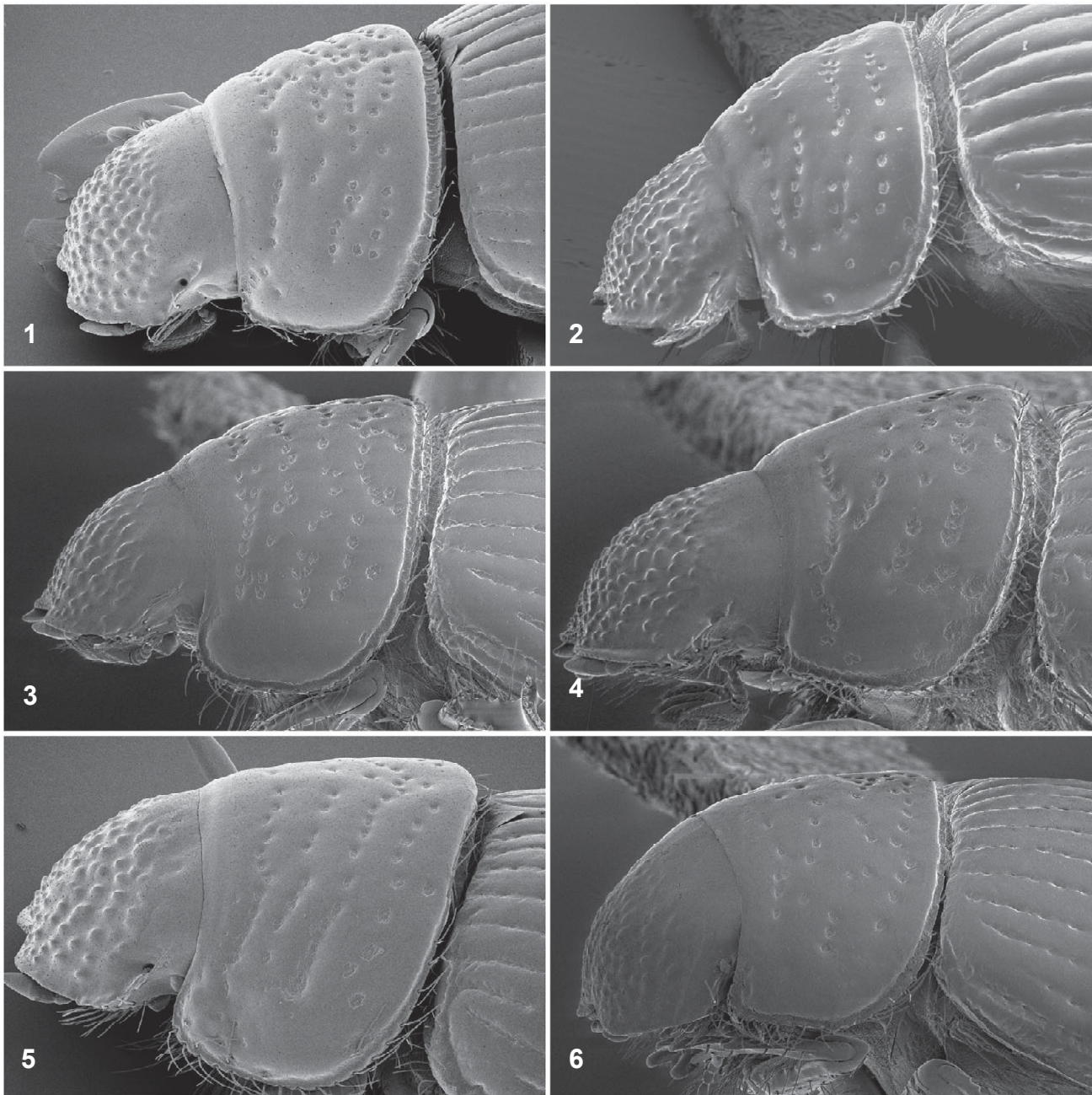
with no interface found, all beetles were found around the roots of plants at a depth of up to 25 cm.

Possible *Geopsammodius* larvae have been found in the spring with adults. However, adults can be found at any time of year. It is suspected they may live at least one year, maybe more.

Key to Species of *Geopsammodius*

Caution must be taken not to over-interpret some characters. Each population shows variation in stated characters and some individuals may not be as easily identified as their siblings. Most species can be identified by collection locality alone (see Remarks under *P. relictillus*), which should be considered when identifying specimens.

1. Pronotum with basal line complete and broad, distinct at middle in dorsal view (Figs. 1-3, 6); pronotal punctation strong, sharply defined; elytral margin at humerus sharply edged in most species 2
- Pronotum with basal line fine, usually absent at middle (Figs. 3-5, 7-8); if basal line appears broad, then pronotal punctation weakly defined; elytral margin at humerus rounded or sharply edged 6
- 2(1). Wings present; French Guiana
..... *G. sabinae* Lavalette
- Wings absent; North and Central America 3
- 3(2). Lateral margin of elytra near humerus bluntly rounded (Fig. 6); Honduras
..... *G. atlantida* n. sp.
- Lateral margin of elytra sharp, carinate (Fig. 1-2); eastern United States 4
- 4(3). Basal line of pronotum very broad, wider than pronotal punctures at middle, sculpturing in line prominent (Fig. 1); central Florida Ridge of Lake, Polk, and Highlands Co., Florida
..... *G. relictillus* (D. and W.)
- Basal line of pronotum narrower, width equal or less than pronotal punctures at middle, sculpturing of line not prominent (Figs. 2-3); Florida and Georgia 5
- 5(4). Granules of clypeus sharply prominent (Fig. 2); Tattall Co., Georgia *G. ohoopce* n. sp.
- Granules of clypeus bluntly rounded (Fig. 3); southern Brooksville Ridge, Citrus and Hernando Co., Florida *G. withlacoochee* n. sp.
- 6(1). Lateral margin of elytra near humerus sharp, carinate (Fig. 4); inland, eastern Florida peninsula 7



Figures 1-6. *Geopsammodius* spp. head and pronotum. 1) *G. relictillus* (Deyrup and Woodruff); 2) *G. ohoopee* n. sp.; 3) *G. withlacoochee* n. sp.; 4) *G. fuscus* n. sp.; 5) *G. morrisoni* n. sp.; 6) *G. atlantida* n. sp.

- Lateral margin of elytra near humerus blunt, rounded (Fig. 7-8); southeastern United States, coastal or inland 8
- 7(6). Punctures of pronotal mostly larger than granules of head, punctures distinct in lateral median groove (Fig. 4); body color dark reddish brown to black; southern Atlantic Coastal Ridge, Martin and Palm Beach Co., Florida *G. fuscus* n. sp.
- Punctures of pronotal disc mostly same size or smaller than granules of head, punctures not evident in lateral median groove (Fig. 5); body color usually reddish brown; eastern Polk Co., Florida *G. morrisoni* n. sp.
- 8(6). Metatibia with ventral surface bearing a longitudinally oblique line of teeth (Figs. 9-10); east of Mississippi River delta 9

- Metatibia with ventral surface bearing a line of teeth that turns inward at sharp angle, often carinate (Figs 11-12); west of Mississippi River delta 10
- 9(8). Last major setigerous tubercle in middle row of hind leg same distance from apex as last major external tubercle (Fig. 9), rarely otherwise; pronotum rarely with distinct punctures, grooves weak or absent (Fig. 7); apical half of pygidium mostly alutaceous; eastern coastal United States, Florida Keys to North Carolina
..... *G. hydropticus* (Horn)
- Last major setigerous tubercle in middle row of hind leg distinctly farther from apex than last major external tubercle (Fig. 10), rarely otherwise; pronotum often with punctures evident, often in shallow grooves; apical half of pygidium mostly glossy; coastal dunes of northern Gulf of Mexico, east of Mississippi River
..... *G. subpedalis* n. sp.
- 10(9). Pygidium with transverse dividing ridge weak to absent at midline (Fig. 13), lacking alutaceous patches or bands; hind tibia with median transverse row of tubercles often connected across middle with weak carina (Fig. 11); primarily coastal and southern Texas *G. rileyi* n. sp.
- Pygidium divided by a strong transverse ridge, always sharply carinate at middle (Fig. 14), followed by alutaceous patches or bands; hind tibia with median transverse row of tubercles separated (Fig. 12); primarily inland, central Texas *G. unsideensis* n. sp.

***Geopsammadius atlantida* Skelley
new species**

Fig. 6

Diagnosis. This is the only *Geopsammadius* species presently known from Central America. It is readily distinguished from all others by the sharply defined pronotal punctation, and rounded margin of elytra near humerus.

Description. Holotype, length 2.8 mm, width 1.7 mm. Body dark red brown. Head with granules present up to vertex in V-shaped pattern, not sharply defined; dorsoventral diameter of eye half width of frontal lobe at base immediately adjacent to eye; facets not visible. Pronotum with punctures sharply defined, grooves poorly defined, anterior groove indicated by row of puncture, lacking at middle, stopping well before level of eye; grooves of disc absent, some vaguely indicated by row of punctures; punctures near pronotal base scattered; basal marginal line distinct, sharply defined, about half as wide as punctures on disc, complete across middle, not alutaceous within. Elytra with striae with punctures prominent;

lateral epipleural edge of elytra near humerus rounded, not carinate, moderately alutaceous between stria 10 and edge. Metatibia with ventral surface bearing 3 setigerous tubercles, arranged longitudinally. Pygidium with transverse dividing ridge defined, but not prominent, followed by a broad alutaceous band.

Variation. There is little variation in the size of the two paratypes. One paratype has fewer pronotal punctures than the holotype.

Type material. Holotype and one paratype: "HONDURAS: Atlantida Dep., Playa del Peru, 28-V-1993, coll. M. C. Thomas" (FSCA). One additional paratype: HONDURAS: Atlantida, Playas de Peru, 28-V-1993, R. Turnbow (RHTC).

Etymology. Named after the department where this species was collected (noun in apposition).

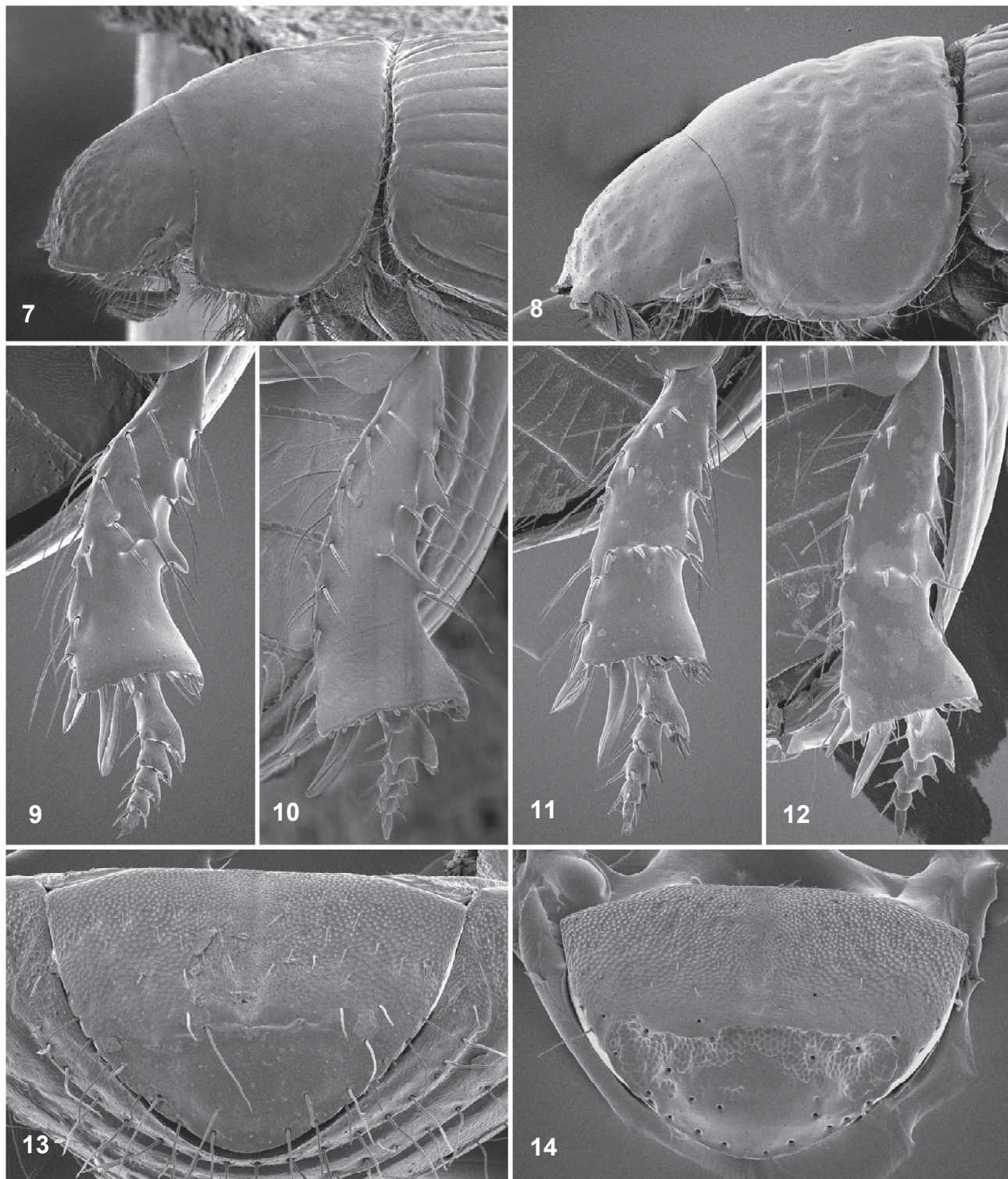
***Geopsammadius fuscus* Skelley
new species**

Fig. 4

Diagnosis. This species is restricted to the Atlantic Coastal Ridge of the eastern Florida peninsula. It is readily distinguished from all other species by its nearly black color, fine basal line at middle of pronotum, median lateral groove of pronotum with distinct punctures, and because the anterior pronotal groove is long, distinct and curves posteriorly behind the eyes.

Description. Holotype, length 2.8 mm, width 1.4 mm. Body dark red brown, nearly black. Head with granules large, distinct, not sharply defined, present up to vertex; dorsoventral diameter of eye half width of frontal lobe at base immediately adjacent to eye; facets not visible. Pronotum with anterior row of punctures in a distinct groove, broken at midline, groove stopping at level of eye, punctures extending laterally past level of eye, curving posteriorly; punctures of disc smaller than granules of head, grooves on disc moderately defined; basal marginal line distinct laterally, about as wide as pronotal punctures, medially line narrowed and distinctly narrower than pronotal punctures, not alutaceous within. Elytra with striae with punctures weakly defined; lateral epipleural edge of elytra near humerus sharp, carinate, distinctly alutaceous between stria 10 and edge. Metatibia with ventral surface bearing 3 setigerous tubercles, arranged longitudinally. Pygidium with transverse dividing ridge developed, followed by a narrow alutaceous band.

Variation. Length 2.5-2.8 mm; width 1.3-1.6 mm. Except for some possibly teneral specimens, all are dark reddish brown, nearly black.



Figures 7-14. *Geopsammadius* spp. 7) *G. hydropicus* (Horn) head and pronotum; 8) *G. rileyi* n. sp. head and pronotum; 9) *G. hydropicus* (Horn) metatibia; 10) *G. subpedalis* n. sp. metatibia; 11) *G. rileyi* n. sp. metatibia; 12) *G. unsideensis* n. sp. metatibia; 13) *G. rileyi* n. sp. pygidium; 14) *G. unsideensis* n. sp. pygidium.

Type material. Holotype (FSCA) and 35 paratypes: "FLORIDA: Martin Co., Johnathan Dickinson St. Pk., Hobe Mt., 18-XII-2005, P. Skelley, sifting sand, N27°00' - W80°06'." Three paratypes of *G. fuscus* were originally considered *G. relictillus* by Deyrup and Woodruff (1991): Johnathan Dickinson St. Pk., Martin Co., FL, 26 FEB 1989, M. Deyrup, sifted from scrub sand (FSCA). Additional 21 paratypes: FLORIDA: Palm Beach Co., jct SR-707 & US-1 [N. of Jupiter Inlet], 18-XII-2005, P. Skelley, sifting sand around oaks, N26°57' - W80°05'. Paratypes deposited in FSCA, HAHC, MJPC, PESC, USNM, WBWC.

Etymology. Referring to its dark coloration, the name '*fuscus*' was chosen, which is Latin meaning dark.

Geopsammodius hydropicus (Horn)

Figs. 7, 9, 18

Psammodius hydropicus Horn 1887: 97-98 ~ Cartwright 1955: 444-445.

Geopsammodius hydropicus (Horn) ~ Gordon and Pittino 1992: 267

Diagnosis. This species occurs in Atlantic coastal dunes of the southeastern United States, from the Florida Keys to North Carolina. It is easily identified by its large size, lack of pronotal sculpturing (Fig. 18), rounded elytral margin near the humerus, and in having the last median tubercle of the metatibia placed equidistant from the margin as the last lateral tooth.

Description. Length 2.7-3.8 mm, width 1.7-2.1 mm. Body red brown. Head with granules present up to frontal suture, not sharply defined except on clypeus; dorsoventral diameter of eye $\frac{3}{4}$ width of frontal lobe at base immediately adjacent to eye; some facets visible. Pronotum with punctures and grooves very poorly defined, anterior groove weakly indicated at each side near eye, stopping well before level of eye; grooves on disc weak, scattered, usually absent; basal marginal line indistinct most of length, nearly absent medially. Elytra with stria punctures absent; lateral epipleural edge of elytra near humerus rounded, not carinate, moderately alutaceous between stria 10 and edge. Metatibia with ventral surface bearing 3-4 setigerous tubercles, arranged longitudinally, last median tubercle placed further from apex than last lateral tooth, often last tubercle is a set of 2-3. Pygidium with transverse dividing ridge defined, somewhat prominent at middle, followed by a narrow alutaceous band.

Variation. This species shows more variation in pronotal and tibial development than does *G. subped-*

alis. The populations from the extreme southern end of its range (Monroe and Dade Co., FL) have greatly reduced head granules and pronotal grooves. Specimens from St. Lucie Co, FL, have these features more prominent, but still less so than specimens from the Carolinas. I presently feel that this variation is clinal.

Type material. "One specimen, Savannah, GA" (Horn 1887: 98). Holotype labeled "[red paper] MCZ TYPE 3728 / 38 / Ga / Ps. hydropicus Horn / [red paper, old ANSP number] TYPE no. 3621 Psammodius hydropicus H. G. Horn" is at the Museum of Comparative Zoology, Cambridge, MA. Images can be found at Perkins (2006).

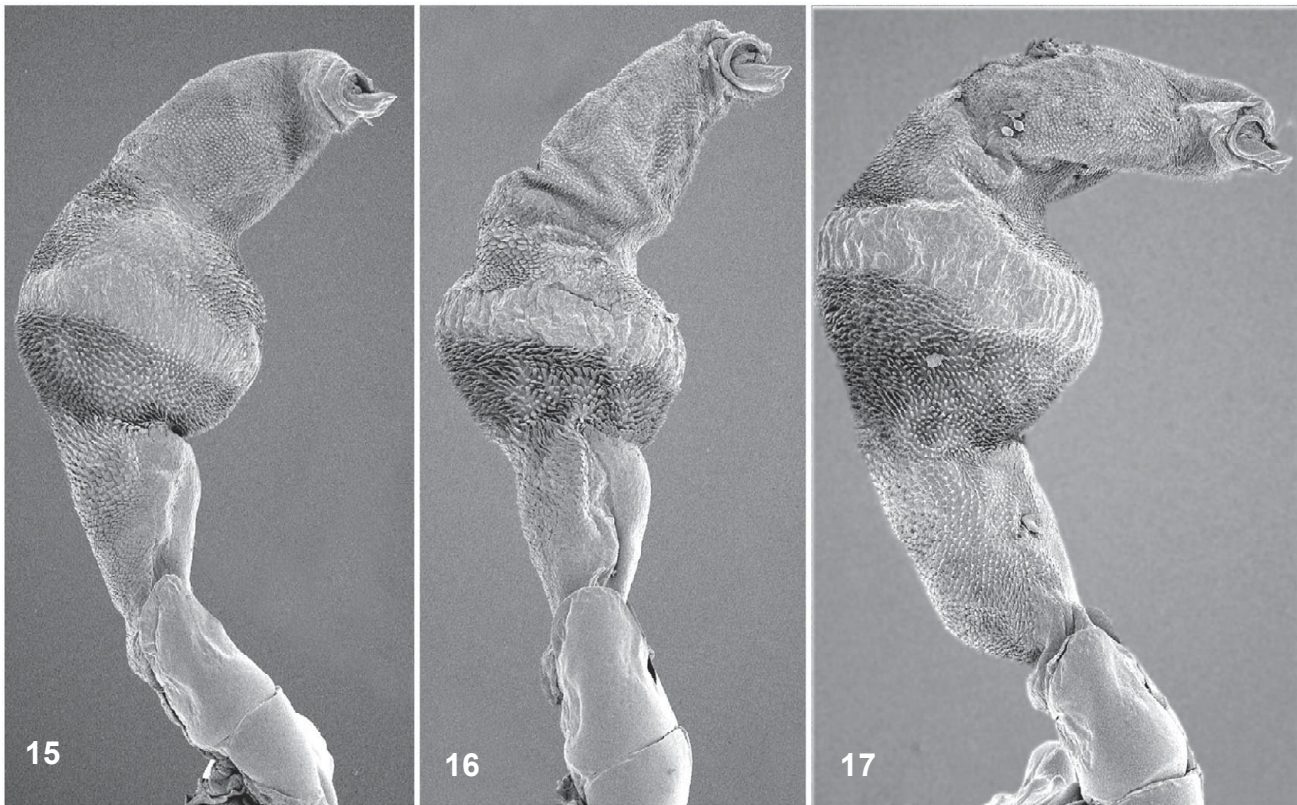
Other materials studied. A total of 173 specimens: **FLORIDA:** Miami-Dade Co., Key Biscayne, Bill Baggs Cape Florida St. Pk., N25°40'08" - W80°09'17", 30-VI-2005 (8 ex.); Monroe Co., Bahia Honda Key St. Park, SE end, 30-XI-1-XII-1999 (61 ex.); Monroe Co., Bahia Honda Key, 22-XI-1980 (1 ex.); St. Lucie Co., E. of Fort Pierce, 1 mi. S. Ft. Pierce inlet on Rt-A1A, 2-XII-1999 (10 ex.); St. Lucie Co., nr. Fort Pierce, 23-XII-1986 (1 ex.). **NORTH CAROLINA:** Carteret Co., Shackleford Island, 25 August 1987 (5 ex.); Dare Co., Buxton, 11-13 Sept. 1980 (7 ex.); Hyde Co., Ocracoke, 4 July 1980 (3 ex.). **SOUTH CAROLINA:** Beaufort Co., Hunting Island, 10-X-1999 (26 ex.); same data except 19-X-1999 (16 ex.); same data except 21-IX-1997 (2 ex.); Charleston Co., Seabrook Isle, 6 VI 1948 (1 ex.); Charleston Co., Isle of Palms, 5 VI 1948 (1 ex.); Colleton Co., Edisto Beach, 23 VI 1948 (1 ex.); Horry Co., Myrtle Beach, US-501 & Ocean Blvd., 29-IX-2003 (7 ex.); Horry Co., Surfside Beach, 30-IX-2003 (23 ex.). Specimens deposited in FSCA, MJPC, PKLC, PJHC, PESC, USNM, WBWC.

Geopsammodius morrisi Skelley new species

Figs. 5, 16

Diagnosis. This species has only been found on a small unnamed sand ridge in eastern Polk Co., Florida, around Lake Marion. It is most easily identified by its reddish brown color, median pronotal groove at sides with indistinct punctures, and fine basal line of the pronotum.

Description. Holotype, length 2.8 mm, width 1.4 mm. Body red brown. Head with granules distinct, not sharply defined, present up to vertex; dorsoventral diameter of eye half width of frontal lobe at base immediately adjacent to eye; facets not visible. Pronotum with anterior row of punctures in a distinct groove, broken at midline, groove extending laterally slightly past level of eye, not curving posteriorly; punctures of disc smaller than granules of head, grooves on disc moderately defined; basal marginal



Figures 15-17. *Geopsammadius* spp. male genitalia with internal sac everted, preparation method described in Skelley (1993). **15)** *G. relictillus* (Deyrup and Woodruff); **16)** *G. morrissi* n. sp.; **17)** *G. subpedalis* n. sp.

line distinct laterally where about as wide as pronotal punctures, medially line narrowed and distinctly narrower than pronotal punctures, not alutaceous within. Elytra with stria punctures weakly defined; lateral epipleural edge of elytra near humerus sharp, carinate, distinctly alutaceous between stria 10 and edge. Metatibia with ventral surface bearing 3 setigerous tubercles, arranged longitudinally. Pygidium with transverse dividing ridge developed, followed by a narrow alutaceous band.

Variation. Length 2.3-2.8 mm; width 1.3-1.6 mm. Although there is some variation in body color, none are dark brown or black. Male genitalia in Fig. 16.

Type material. Holotype (FSCA) and 7 paratypes: "FLORIDA: Polk Co., E. Lake Hamilton, 7.5 mi. E. Rt-17 on Rt-542, then 2.5 mi. N., 15-V-1998, Paul E. Skelley". Additional paratypes (922): FLORIDA: Polk Co., W. of Davenport, 0.2 mi. S. Rt-547 on US-27, 25-VII-1998, P. Skelley, sifted from sand (14 ex.); FLORIDA: Polk Co., E. Lake Hamilton, 7.5 mi. E. Rt-17 on Rt-542, then 2.5 mi. N., 7-V-1998, P. Skelley (20 ex.); same data except 28-IV-1998 (22 ex.); FLORIDA: Polk Co., S. of Lake Marion, 1 mi. S. CR-542 on Jennings Rd., 3-IV-2000, P. Skelley, sifting sandhill (2 ex.); Fla. Polk Co., Lake Marion Estates, 25 July 1998, R.

Turnbow (32 ex); FLORIDA: Polk Co., E. side of Lake Marion (SE. of Haines City), 10-IV-2002, P. E. Skelley, sifting sand and grasses (80 ex); FLORIDA: Polk Co., Lake Marion Estates, 7 mi. NE. Lake Hamilton (jct. Hemlock & Pine), 7-XI-2005, M. J. Paulsen & P. E. Skelley, sand sifts (600 ex); same data except 25-III-1999 (51 ex.); same data except 6-XI-1998 (17 ex.); FLORIDA: Polk Co., E. Lake Hamilton, nr. jct. Rt-542 & Jim Edwards Rd., 6-XII-1998, P. Skelley, sand sifts (84 ex.). Paratypes deposited in collections listed in the Materials and Methods.

Etymology. Named for a good friend and coleopterist, Roy F. Morris, without whose help this project would never have started.

***Geopsammadius ohoopee* Skelley
new species**

Fig. 2

Diagnosis. This is the only species of *Geopsammadius* presently known from central Georgia. It is readily identified by the prominent, sharply defined granules on the head, broad basal line of the pronotum

tum, and by the distinct pronotal punctation and grooves.

Description. Holotype, length 3.8 mm, width 1.6 mm. Body red brown. Head with granules distinct, sharply defined, present up to vertex; dorsoventral diameter of eye 3/4 width of frontal lobe at base immediately adjacent to eye; with vague facets visible. Pronotum with anterior row of punctures in a deep, complete groove, broken at midline, extending laterally to level of eye; punctures of disc same size as granules of head, in weakly defined grooves; basal marginal line broad, weakly defined, nearly as wide as pronotal punctures, not alutaceous within. Elytra with striae distinctly punctate; lateral epipleural edge of elytra near humerus sharp, carinate, distinctly alutaceous between stria 10 and edge. Metatibia with ventral surface bearing 3 setigerous tubercles, arranged longitudinally. Pygidium with transverse dividing ridge moderately developed, apical half posterior of transverse ridge nearly entirely alutaceous.

Variation. Length 2.3-3.2 mm; width 1.3-1.7 mm. There is some variation in the width and prominence of the basal pronotal line.

Type material. Although the data is slightly different, all specimens were from the same basic locality. Holotype (FSCA) and 173 paratypes: "GEORGIA: Tattnall Co., W. of Reidsville on Rt-280, E. side of Oohoopee River, 16-XII-1999, P. Skelley & R. Morris, sifting sand". Additional paratypes (40): GEORGIA: Tattnall Co., 4 km. W. Reidsville at Oohoopee River, 25 February 1984, W. E. Steiner, A. G. Gerberich, J. E. Lowry collectors (22 ex); GEORGIA: Tattnall Co., 4 km. W. Reidsville at Oohoopee River, 13 November 1982, W. Steiner, A. Gerberich, J. Boyd, & H Williams (17 ex); GEORGIA: Tattnall Co., 4 mi. W. Reidsville on Rt-280, 6-May-2000, sift sand, Phil Harpootlian (1 ex). Paratypes deposited in collections listed in Materials and Methods.

Etymology. Named for the Oohoopee River of central Georgia, along which this species was found (noun in apposition).

***Geopsammadius relictilus* (Deyrup and Woodruff)**

Figs. 1, 15

Psammadius relictilus Deyrup and Woodruff 1991:76
Geopsammadius relictilus (Deyrup and Woodruff) ~ Gordon and Pittino 1992: 267

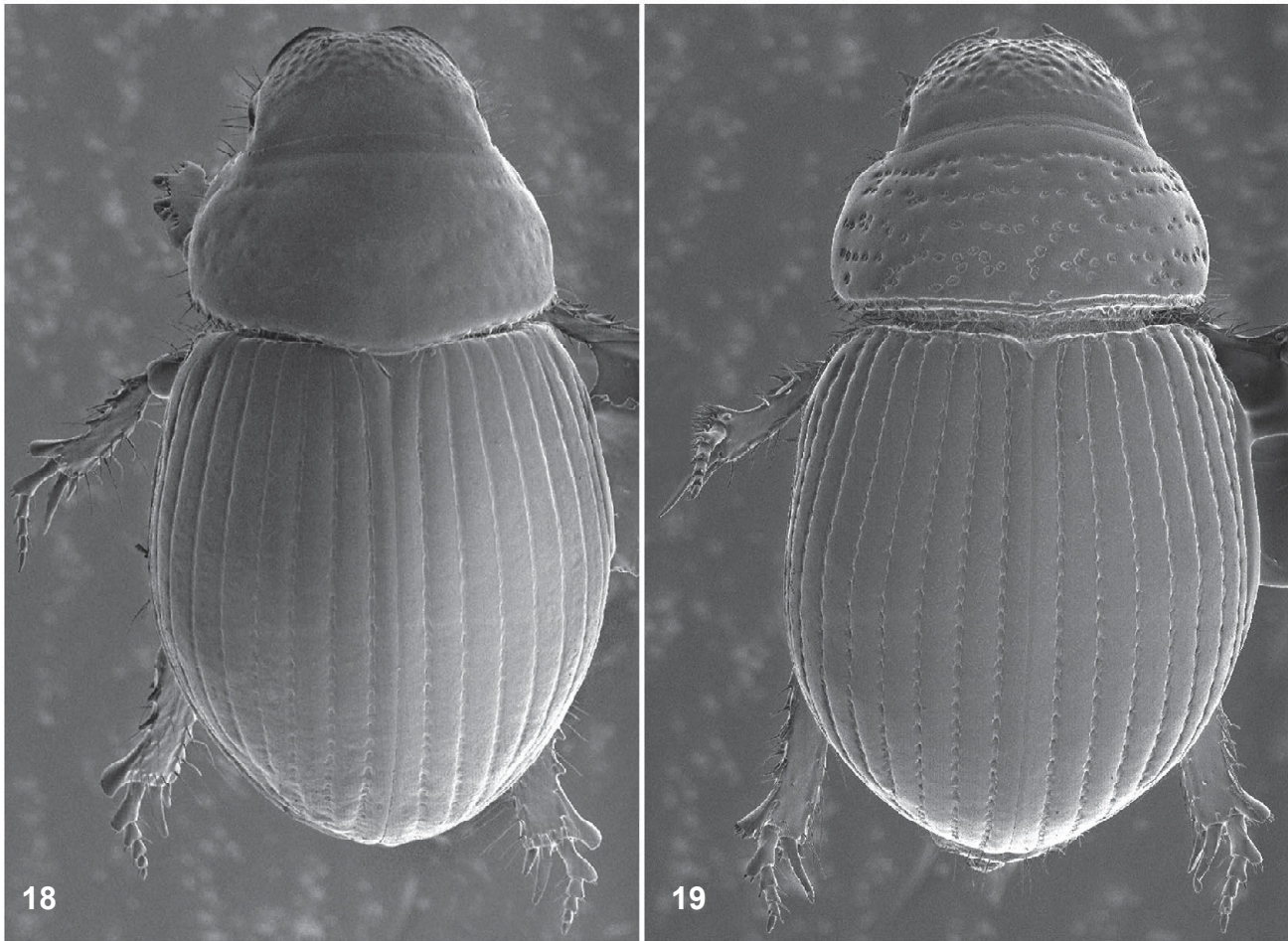
Diagnosis. This species is most readily distinguished from all others by its extremely wide, sharply defined

basal pronotal line in which sculpturing is visible. It is restricted to the central ridge of Florida extending from just south of the Ocala National Forest to the southern tip of the Lake Wales Ridge.

Description. Length 2.3-3.0 mm, width 1.2-1.6 mm. Body usually red brown, some specimens are paler. Head with granules distinct, sharply defined, present up to vertex; dorsoventral diameter of eye 3/4 width of frontal lobe at base immediately adjacent to eye; some with vague facets visible. Pronotum with anterior row of punctures in deep groove, occasionally broken at midline, extending laterally to level of eye; punctures of disc slightly larger than granules of head, usually in weakly defined grooves; basal marginal line broad, as wide or wider than pronotal punctures, distinctly alutaceous within. Elytra with striae distinctly punctate; lateral epipleural edge of elytra near humerus sharp, carinate, distinctly alutaceous between stria 10 and edge. Metatibia ventral surface bearing 2-3 setigerous tubercles, arranged longitudinally. Pygidium with transverse dividing ridge moderately developed, followed by an alutaceous band. Male genitalia in Fig. 15.

Type material. Holotype (FSCA) studied, label data: "Archbold Biol. Sta., Lk. Placid, Highlands Co., FLA., 8 JUNE 1988, M. Deyrup / Sifted from sand Scrubby Flatwoods". Paratypes studied, 45 from Archbold Biological Station and 5 from Sebring, FL (FSCA).

Other materials studied. A total of 1090 specimens were studied from the central Florida peninsula, with the following data: **Highlands Co.:** Archbold Biological Station, 7 mi. S. Lake Placid, 7-VII-1989 (6 ex.); same data except 14-VI-1998 (132 ex.); same data except 8-9-VIII-2000 (1 ex.); same data except ix-21-24-2000 (5 ex.); E. Avon Park, 0.2 mi. E. Rt.17 on Rt-64 (nr.Rt-17A), 24-VII-1998 (8 ex.); E. Avon Park, 4.5 mi. E. jct. Rt-17 & Rt-64 (not on Rt-64), 24-VII-1998 (20 ex.); S. of Sebring, SE corner jct.US-27 & Rt-66, 22-VII-1998 (6 ex.); W. of Sebring airport, 18-20-VII-1998 (47 ex.); Highlands Hammock St. Park, 4-VI-2002 (29 ex.). **Lake Co.:** 2.5 mi. E. Hwy-27 on Hwy-50, 1 MAY 1999 (4 ex.); E. Clermont, 2.2 mi. E. US-27 on Rt-50, 8-VI-1998 (9 ex.); same data except 20-V-2003 (56 ex.); S. Clermont, 5.3 mi.S.Rt.50 on US-27, 25-VII-1998 (5 ex.); 1.7 mi. N. jct. US-27 on Rt-561 at Sugarloaf Mt.Rd., N. of Minneola, 8-VI-1998 (33 ex.); S. Tavares, 1.3 mi. S. jct. Rt-19 on Rt-561, 29-V-1998 (15 ex.); same data except 24-26-V-1998 (48 ex.); same data except 8-VI-1998 (108 ex.). **Polk Co.:** N. Avon Park, 1.2mi. N. Highlands Co. line on US-27, 22-VII-1998 (20 ex.); Dundee, 0.5 mi. N. Rt-542 on US-27, 6-XII-1998 (5 ex); same data except 25-VII-1998 (10 ex.); E. Lake Wales, 7 mi. E. Rt-17 on Rt-60, 25-VII-1998 (68 ex.); N. Lake Wales, 1.8 mi. N. Rt-60 on US-27, 25-VII-1998 (38 ex.); N. Lake Wales; 1.3 mi. N. Rt-60 on US-27, 3-IV-2000 (8 ex.); SE. corner US-27 & Rt-192 at N. Co. line, 14-V-1998 (11 ex.);



Figures 18-19. *Geopsammodius* spp., habitus: 18) *G. hydropicus* (Horn); 19) *G. withlacoochee* n. sp.

1.2 mi. N. Highlands Co. line on US-27, 22-VII-1998 (7 ex.); NE. of Bartow airport, 0.7 mi. N. Bomber Rd. (CR559) on Rt-17, 21-II-2003 (2 ex.); Tiger Creek Preserve, 2.5 mi. SE. Babson Park, 18-19-V-2006, N27.82205° - W81.47859° (131 ex.); same data except N27.82614° - W81.47350° (67 ex.); same data except N27.82221° - W81.47534° (42 ex.); same data except N27.82146° - W81.47125° (131 ex.); Lake Marion Estates, NE. Lake Hamilton (nr. jct. Hibiscus & Cedar), 6-XII-1998 (38 ex.). Specimens to be deposited in the collections listed in the Materials and Methods.

Remarks. The specimens described as '*G. relictillus*' by Deyrup and Woodruff (1992) from Martin Co., at J. Dickinson State Park, are actually a new species, *G. fuscus*.

One collection record above (Polk Co., Lake Marion Estates, type locality of *G. morrissi*) was not expected. This locality is typical Florida sandhill-scrub, with pure white or yellowish sands. *Geopsammodius relictillus* naturally occupies areas close to the main central ridge where the sands are often

mixed with red clay. I suspect that a population of *G. relictillus* was transported to Lake Marion Estates with the red clay sands used to form the road base in the development.

***Geopsammodius rileyi* Skelley**

new species

Figs. 8, 11, 13

Diagnosis. This species is found primarily in the coastal dunes of Texas and southwestern Louisiana. It is easily identified by its small size, smooth transverse ridge on the pygidium, and the metatibia usually with a weak median transverse carina.

Description. Holotype, length 2.3 mm, width 1.3 mm. Body red brown. Head with granules extremely vague, visible only an anterior half of clypeus; dorsoventral diameter of eye half width of frontal lobe at base immediately adjacent to eye; facets not visible. Pronotum with punctures poorly defined, basically absent, indicated only where not close enough to be considered a groove, anterior

groove vague at middle, poorly developed laterally, stopping at level of eye; grooves on disc moderately defined; basal marginal line distinct but not sharply defined, about as wide as grooves on disc, complete across middle, not alutaceous within. Elytra with stria punctures weak; lateral epipleural edge of elytra near humerus rounded, not carinate, glossy between stria 10 and edge. Metatibia with ventral surface bearing 6-7 setigerous tubercles, arranged longitudinally then angled across middle, connected by a nearly complete carina. Pygidium with transverse dividing ridge poorly defined, glossy, lacking alutaceous band.

Variation. Length 2.3-2.6 mm, width 1.2-1.4 mm. The type series does not vary notably in length or width. Specimens from nearby populations vary a little. As with *G. unsidensis*, this species shows tremendous variation in many characters (see variation under *G. unsidensis*). However, all populations assigned to this species have the reduced pygidial transverse ridge and at least remnants of the transverse median carina on the metatibia.

Type material. Holotype (TAMU) and 4 paratypes: "TEXAS: Matagorda Co., Matagorda Beach at end of FM 2031, I-30-1999, B & B Raber, E. G. Riley, EGR-733, sifting sand from stabilized sand dune" (4 EGRC). Additional paratypes (31): TEXAS: Matagorda Co., Matagorda Beach, 15 Sept. 2001, R. Turnbow (1 PESC); TEXAS: Galveston Co., 3.5 mi. SW. Jamaica Beach, III-29-1997, E. G. Riley-437, Berlese of sifted sand (4 EGRC); TEXAS: Galveston Co., 7.5 mi. W. Jamaica Beach, X-16-2005, E. G. & C. M. Riley, in vegetated sand (6 EGRC); LOUISIANA: Cameron Co., Little Florida Beach, 8 July 2000, R. Turnbow (20 RHTC).

Other materials studied. A total of 67 specimens: TEXAS: Burleson Co., 2.2 mi. N. Caldwell, Feb. 5, 1995 (7 ex.); Cameron Co., Boca Chica, 29 Mar. 1981 (1 ex.); Kenedy Co., Kenedy Ranch, Jaboncillos Pasture, San Pedro Camp, 26°54'04"N, 97°39'22"W (11 ex.); Kleberg Co., public beach, 1 mi. S. Nueces Co. line, 15-V-1999 (5 ex.); Kleberg Co., N. Los Olmos Creek on Hwy. 77, 10-IV-2005 (4 ex.); Nueces Co., nr. Mustang Island St. Park, 28-II-1999 (7 ex.); San Patricio Co., Welder Wildlife Ref., nr. Big Lake, 16-V-1999 (22 ex.); San Patricio Co., Welder Wildlife Ref., 19/V/1993 (2 ex.); San Patricio Co., Welder Wildlife Ref., XI-5-1993 (4 ex.); San Patricio Co., Welder Wildlife Ref., 26.V.99 (6 ex.). Specimens deposited in EGRC, HAHC, MJPC, PESC, TAMU, WBG.

Etymology. Named after E. G. Riley, discoverer and collector of most of the known populations of *Geopsammadius* in Texas.

Geopsammadius sabinae Lavalette

Geopsammadius sabinae Lavalette 1999: 289

Diagnosis. Length 3.5 mm, width 1.8 mm. The apparent lack of pronotal grooves, with distinct pronotal punctures and presence of flight wings distinguish it from all other species in the genus.

Type material. Holotype male label data "Guyane Française, 10.iii.1996, Lavalette F. / Montjoyeux, Anse de Montabo / En Haut de Plage, sous un bois pourri, à vue / Holotype *Geopsammadius sabinae*, Lavalette 1999". It is reported to be deposited in the National Museum of Natural History, Paris. This species is presently known only from the holotype, which was not studied.

Remarks. Some aspects of the description and illustration presented by Lavalette (1999) are similar to that observed in *G. atlantida*. As with many others, additional materials are needed to further explore any relationships.

Geopsammadius subpedalis Skelley

new species

Figs. 10, 17

Diagnosis. This species is restricted to the coastal dunes occurring along the northern Gulf of Mexico, east of the Mississippi River. It is readily distinguished by its large size, reduced pronotal sculpturing, and the last tubercle on the medial metatibial surface being further from the apex than the last lateral tooth.

Description. Holotype, length 3.5 mm, width 2.0 mm. Body red brown. Head with granules present up to frontal suture, not sharply defined except near apex of clypeus; dorsoventral diameter of eye 3/4 width of frontal lobe at base immediately adjacent to eye; some facets visible. Pronotum with punctures and grooves very poorly defined, anterior groove weakly indicated at each side near eye, stopping well before level of eye; grooves on disc weak, scattered; basal marginal line indistinct most of length, nearly absent medially. Elytra with stria punctures absent; lateral epipleural edge of elytra near humerus rounded, not carinate, moderately alutaceous between stria 10 and edge. Metatibia with ventral surface bearing 3 setigerous tubercles, arranged longitudinally, last median tubercle placed further from apex than last lateral tooth. Pygidium with transverse dividing ridge defined, somewhat prominent at middle, followed by a narrow alutaceous band.

Variation. Length 2.9-3.5 mm; width 1.7-2.0 mm. Specimens vary from pale red brown to dark red brown, some possibly teneral. Pronotum varies tremendously in development of grooves, some individuals or populations (Horn Island, MS) have them absent. Some rare individuals have the last median metatibial tubercle positioned closer to the apex than is typical. Male genitalia in Fig. 17.

Type material. Holotype (FSCA) and 86 paratypes: "FLORIDA: Franklin Co., St. George Island St. Pk., 11-VII-1998, P. Skelley, sifting sand". Additional paratypes (5): FLORIDA: Franklin Co., St. George Island, eastern part, dunes, 1 March 1991, W. Steiner & J. Hill (USNM). Paratypes deposited in the collections listed in the Materials and Methods.

Other materials studied. A total of 285 specimens: ALABAMA: Baldwin Co., 7-6-17 (1 ex.); Baldwin Co., East of Fort Morgan, 28-II-2000 (51 ex.); Baldwin Co., nr. gate of Fort Morgan, 30-I-1993 (3 ex.); Baldwin Co. Fort Morgan, 30 Jan. 1993 (9 ex.); Baldwin Co., E. Gulf Shore Park, Perdido Beach, 12-III-1991 (15 ex.); Baldwin Co., Bon Secour NWR (7 ex.). FLORIDA: Bay Co., Laguna Beach (8 ex.); Bay Co., St. Andrews St. Park, 8-III-1980 (5 ex.); Escambia Co., Navarre Beach, 10-IV-1991 (35 ex.); Escambia Co., Santa Rosa Island, 5 mi. W. Navarre Beach, 15-IV-1989 (87 ex.); Franklin Co., Alligator Point, beach & small dunes, 1 March 1991 (5 ex.); Gulf Co., St. Joseph Peninsula S. P., 23-IV-1998 (1 ex.); Okaloosa Co., 3.5 mi. W. of county line, 19-VII-1979 (1 ex.); Okaloosa Co., Destin, 6-III-1980 (1 ex.); Okaloosa Co., Henderson Beach St. Rec. Area, 27 May 1985 (13 ex.); Okaloosa Co., Ft. Walton Beach, 6-IX-2002 (2 ex.); Santa Rosa Co., Navarre Beach, Santa Rosa Island, 15-IV-1989 (11 ex.); Walton Co., Grayton Beach, 21-XI-1998 (11 ex.). MISSISSIPPI: Jackson Co., Horn Island, nr. ranger station, 28 Feb. 2004 (1 ex.); same data except 27 May 2004 (18 ex.). Specimens deposited in FSCA, MJPC, PESC, PKLC, RHTC, USNM, WBWC

Etymology. Named for where all *Geopsammadius* are to be found, under your feet.

***Geopsammadius unsidensis* Skelley**
new species
 Figs. 12, 14

Diagnosis. This species occurs in scattered, primarily inland, localities of Texas. It is most easily distinguished by its small size, reduced pronotal sculpturing, rounded elytral margin near humerus, distinct transverse ridge on the pygidium.

Description. Holotype, length 2.6 mm, width 1.3 mm. Body red brown. Head with granules large, very indistinct, not sharply defined, present up to frontal suture; dorsoventral diameter of eye half width of frontal lobe at base immediately adjacent to eye; facets not visible. Pronotum with punctures poorly defined, indicated only where not close enough to be considered a groove, anterior groove vague at middle, distinct laterally, stopping at level of eye; grooves on disc moderately defined; basal marginal line distinct but not sharply defined, about as wide as grooves on disc, complete across middle, not alutaceous within. Elytra with stria punctures absent; lateral epipleural edge of elytra near humerus rounded, not carinate, glossy between stria 10 and edge. Metatibia with ventral surface bearing 6 setigerous tubercles, arranged in an angle longitudinally then across middle. Pygidium with transverse dividing ridge sharply defined at middle, weaker laterally, followed by a narrow alutaceous band.

Variation. Length 2.4-2.7 mm; width 1.3-1.5 mm. Across the range, *G. unsidensis* show tremendous variation in the development of the transverse pygidial ridge, the number and placement of the metatibial teeth, the general shape of the metatibia, the distinctness and extent of pronotal grooves, etc. It is strongly felt that some cryptic species are present and further material and analysis may bring them to light.

Type material. Holotype (TAMU) and 122 paratypes: "TEXAS: Milam Co., 4 mi. N. Gause, nr. Sugarloaf Mt., V-8-1993, Godwin, Riley, Warner & Wolfe, sifted from surface sand & debris". One additional paratype: TEXAS: Milam Co., 4 mi. N. Gause, nr. Sugarloaf Mt., III-25-IV-18-1993, pit-fall trap, sandy area. Paratype deposited in EGRC, FSCA, HAHC, PESC TAMU, WBGC, WBWC.

Other materials studied. A total of 34 specimens: TEXAS: Cameron, Co., Boca Chica Beach, III-17-1995 (12 ex.); Leon Co., ca. 6 mi. E. Buffalo, III-27-1994 (11 ex.); Leon Co., 5 mi. N. Flynn, V-27-1994 (1 ex.); Refugio Co., ca. 0.5 mi. W. Refugio, IV-28-1994 (10 ex.). Specimens deposited in EGRC, TAMU.

Etymology. The name is a combination of Latin roots, *uni-sideris-ensis*, meaning from the Lone Star State.

***Geopsammadius withlacochee* Skelley**
new species
 Fig. 3, 19

Diagnosis. This species is found on the southern Brooksville Ridge in the western peninsula of Florida.

It is most easily identified by its distinct, narrow pronotal basal margin, and dark coloration.

Description. Holotype, length 2.4 mm, width 1.6 mm. Body dark red brown, lighter around the edges. Head with granules distinct, not sharply defined, present up to vertex; dorsoventral diameter of eye 3/4 width of frontal lobe at base immediately adjacent to eye; with vague facets visible. Pronotum with anterior row of punctures in a deep groove laterally, groove absent on disc, row of punctures broken at midline, groove extending laterally slightly past level of eye; punctures of disc smaller than granules of head, grooves on disc not defined; basal marginal line distinct, nearly as wide as pronotal punctures, not alutaceous within. Elytra with striae distinctly punctate; lateral epipleural edge of elytra near humerus sharp, carinate, distinctly alutaceous between stria 10 and edge. Metatibia with ventral surface bearing 3 setigerous tubercles arranged longitudinally. Pygidium with transverse dividing ridge developed, half of pygidium behind ridge alutaceous.

Variation. Length 2.3-2.8 mm; width 1.3-1.5 mm. Although there is some variation in body color, none is nearly black. In many, the basal pronotal line is not as prominent as on the holotype (Fig. 19).

Type material. Holotype (FSCA) and 317 paratypes: "FLORIDA: Citrus Co., E. Chassahowitzka, 1.1 mi. SE. jct US-19 on US-98, 24-XI-2002, P. Skelley & D. Almquist, sand on roadside". Additional paratypes (345): FLORIDA: Hernando Co., Weeki Wachee, 0.2 mi. S. jct. St-50 on US-19; 24-XI-2002, P. Skelley & D. Almquist, sifting sand near oak scrub. Paratypes deposited in collections cited in the Materials and Methods.

Etymology. Named for the Withlacoochee State Forest, near where the species has been found. It is hoped this species is preserved in some of the habitat maintained in the forest.

Acknowledgments

I thank the following individuals for assistance collecting and for allowing me to borrow specimens from their institutions: W. B. Godwin, Steven F. Austin State University, Nacogdoches, TX; P. J. Harpootlian, Simpsonville, SC; H. F. Howden, Ottawa, Ontario, Canada; P. K. Lago, University of Mississippi, University, MS; R. F. Morris, Lakeland FL; M. J. Paulsen, Lincoln, NE; E. G. Riley, Texas A&M University, College Station, TX; T. R. Smith

and M. C. Thomas, Florida State Collection of Arthropods, Gainesville, FL; W. E. Steiner, U. S. National Museum of Natural History, Smithsonian Institution, Washington, DC; R. H. Turnbow, Fort Rucker, AL; J. E. Wappes, San Antonio, TX; W. B. Warner, Chandler, AZ. I thank E. G. Riley, W. B. Warner and M. J. Paulsen for reviews of the manuscript.

This project was supported, in part, through an NSF/PEET grant (DEB-0118669) to M. L. Jameson and B. C. Ratcliffe. This is Florida Department of Agriculture and Consumer Services, Entomology Contribution No. 1044.

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