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Description of a New Genus and Species of Stygobiontic Diving Beetle, *Psychopomporus felipi* Jean, Telles, and Miller (Coleoptera: Dytiscidae: Hydroporinae), from the Edwards-Trinity Aquifer System of Texas, USA

April Jean
Department of Earth and Planetary Sciences, University of New Mexico
Albuquerque, NM 87131-0001, U.S.A.
ajtafoya@unm.edu

Nicole D. Telles
Department of Biology and Museum of Southwestern Biology, University of New Mexico
Albuquerque, NM 87131-0001, U.S.A.
nikitay@unm.edu

J. Randy Gibson
National Fish Hatchery and Technology Center, U. S. Fish and Wildlife Service
500 East McCarty Lane, San Marcos, TX 78666, U.S.A.
Randy_Gibson@fws.gov

Dan Foley
Department of Biology, Sul Ross State University, Rio Grande College
205 Wildcat Drive, Del Rio, TX 78840, U.S.A.
dfoley@sulross.edu

and

Kelly B. Miller
Department of Biology and Museum of Southwestern Biology, University of New Mexico
Albuquerque, NM 87131-0001, U.S.A.
kbmiller@unm.edu

Abstract

Psychopomporus felipi Jean, Telles, and Miller, **new genus** and **new species** (Coleoptera: Dytiscidae), is described from San Felipe Springs, Val Verde County, Texas, USA, which emerges from the Edwards-Trinity aquifer system. *Psychopomporus felipi* shows several features typical of subterranean diving beetles, such as depigmentation, compound eyes reduced, elytra fused, and flight wings absent. *Psychopomporus* differs from other hydroporine genera in having a broad elytral epipleuron, the prosternal process small and with a medial, strongly produced prominence, and the meso- and (to a lesser extent) protibia apically broadly expanded and medially distinctly curved. This is the fourth stygobiontic diving beetle described from the Edwards-Trinity aquifer system in south-central Texas, USA.

Key Words: taxonomy, stygofauna, groundwater, karst, subterranean

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Increasing numbers of stygobiontic arthropod species are being discovered from springs and artesian wells within the Edwards-Trinity aquifer system in Texas, USA. The federally endangered *Stygobromus pecki* Holsinger (Peck's cave amphipod) is known from Comal and Hueco Springs in Comal County (Holsinger 1967) and *Stygoparnus comalensis* Barr and Spangler (Comal Springs dryopid beetle) is also endangered and known from Comal Springs in Comal County and Fern Bank Spring in Hays County (Barr and Spangler 1992). In addition, three subterranean diving beetles (Coleoptera: Dytiscidae) have been discovered: *Comaldessus stygius* Spangler and Barr at Comal Spring in Comal County (Spangler and Barr 1995), *Haideoporus texanus* Young and Longley from an artesian well located at the Texas State University Aquatic Station in Hays County and Comal Springs in Comal County (Bowles and Stanford 1997; Young and Longley 1976), and *Ereboporus naturaconservata* Miller, Gibson, and Alarie known only from Caroline Springs in Terrell County (Miller *et al.* 2009).

Collection efforts from San Felipe Springs in Val Verde County recently produced additional new stygobiont specimens of diving beetles which represent an undescribed genus and species. This newest, undescribed stygobiont species of Dytiscidae is the fourth species to be collected from the Edward-Trinity Aquifer system and the fifth to be described from North America (Miller *et al*. 2009). In the Yilgarn region of western Australia, the recently discovered subterranean dytiscid fauna includes over 100 species (Leys *et al*. 2003; Watts and Humphreys 2004, 2006, 2009; Watts *et al*. 2007). In addition, several new species have also been reported from eastern, southern, and central Australia in the alluvial aquifers of Hunter Valley and Peel River, New South Wales, the semiarid Flinders Range, and the Ngalia Basin, respectively (Balke *et al*. 2004; Watts and Humphreys 2006; Leys *et al*. 2010). This, along with the growing number of stygobiontic dytiscid species being found in North America, suggests that subterranean diving beetles may be considerably more diverse and widespread than previously thought (Miller *et al*. 2009).

Material and Methods

Species description was based on two specimens and three large fragments of additional specimens collected from two springs that discharge into the western side of San Felipe Creek in Del Rio, Val Verde County, Texas, USA (29.37234°N, 100.88602°W). The holotype, paratype, and fragments are deposited in the Division of Arthropods, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico, USA (MSBA, K. B. Miller, curator).

Measurements of the holotype were made using a Lasico digital micrometer. Measurements include: TL = total length; HL = length of head along midline; HW = greatest width of head; PL = length of pronotum along midline; PW = greatest width of pronotum; EL = length of elytron along midline; GW = greatest width across both elytra; FL = greatest length of metafemur; RL = greatest length of metatrochanter. Ratios are also provided to give an indication of shape or proportion.

Psychopomporus Jean, Telles, and Miller, new genus

(Figs. 1–4, 6–7)

Type Species. *Psychopomporus felipi* new species.

Diagnosis. Adults of *Psychopomporus* are distinct among Hydroporinae based on the combination of the following character states: 1) adaptations to subterranean environment including light pigmentation, fused elytra, and metathoracic wings and compound eyes reduced (Fig. 1); 2) prosternal process strongly declivous, apically reaching the anteriomedial projection of the metasternum (Figs. 2, 3) and with a prominent projection anteriorly (Fig. 3); 3) mesotibia apically expanded and strongly arcuate medially (Fig. 2); and 4) elytral epipleuron broad and flat anteriorly (Fig. 2). The general body form and obvious cave adaptations are similar to other stygobiontic members of Dytiscidae, suggestive of convergent adaption to the subterranean environment. Many stygobiontic diving beetles have a shortened prosternal process that does not reach the anterior margin of the metasternum and a distinct habitus with the pronotum cordate and a strong discontinuity in the curvature between the pronotum and elytron. These features are not present in *Psychopomporus* (Figs. 1–3).

Etymology. The genus is named *Psychopomporus* (masculine), from the Greek *psychopompos*, meaning "guide of souls" and *–porus*, a common root for genus names in the subfamily Hydroporinae.

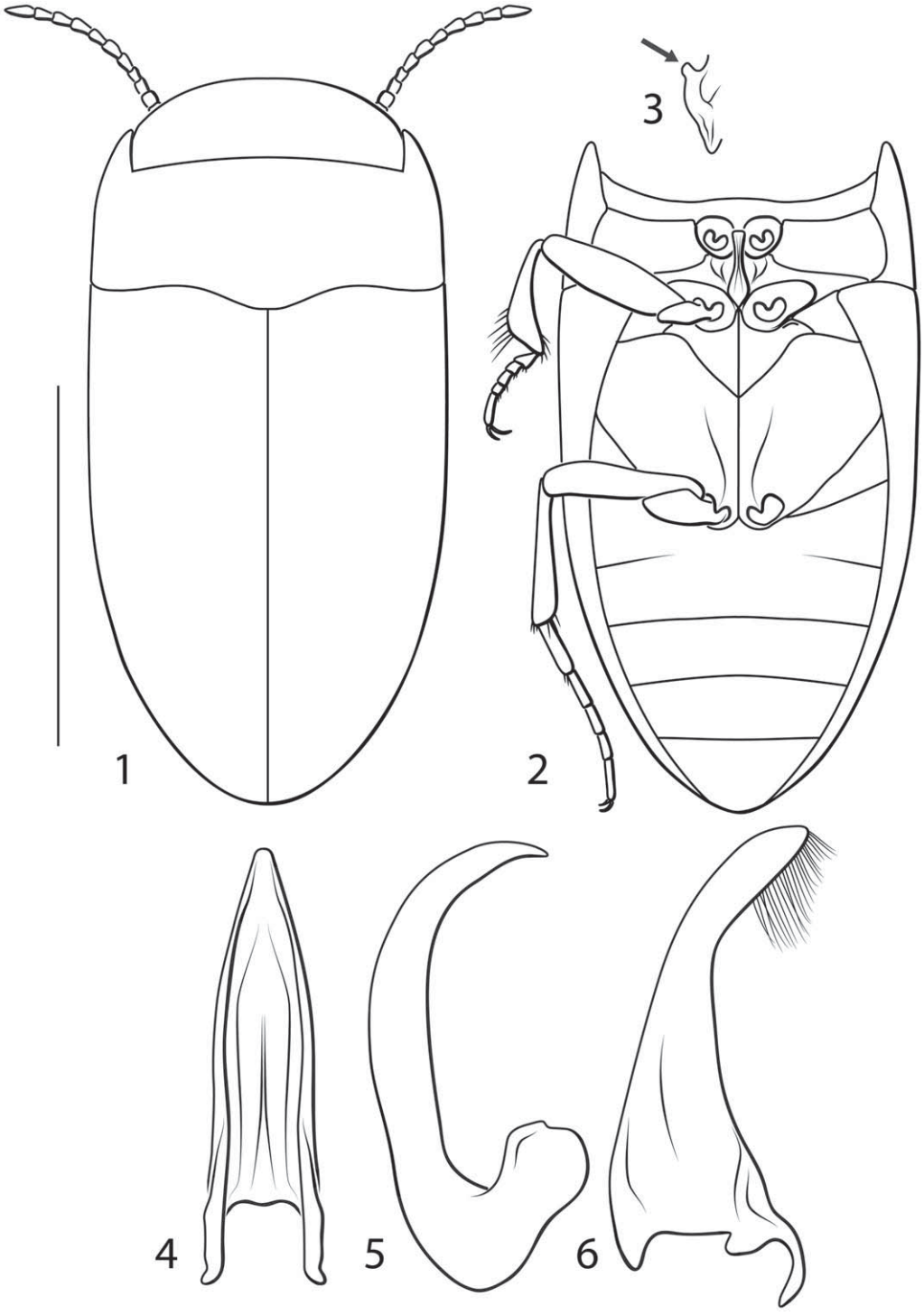
Distribution. Specimens of the single species in this genus were recovered in the flow from two springs discharging into the western side of San Felipe Creek (29.37234°N, 100.88602°W) in Del Rio, Val Verde County, Texas, USA (Fig. 7). These springs discharge from the Edwards-Trinity aquifer system. The distribution of *P. felipi* throughout this aquifer, as well as possible occurrence in other aquifers, is unknown.

Discussion. *Psychopomporus* belongs within the tribe Hydroporini (Hydroporinae) based on the following characters: 1) pronotum lacking bilateral basal plicae (Fig. 1); 2) scutellum not externally visible (Fig. 1); 3) pro- and mesotarsi moderately pseudotetramerous, though not strongly so (Fig. 2); 4) prosternal process strongly declivous (Figs. 2, 3); 5) apices of elytra evenly rounded (Figs. 1, 2); 6) posterior margin of metacoxal processes in similar plane as abdominal sternum (Fig. 2); 7) metacoxal process with lobes small but distinct, covering the base of the metatrochanter (Fig. 2); 8) metatarsal claws of equal length (Fig. 2); 9) male genitalia bilaterally symmetrical (Fig. 4); and 10) male lateral lobe with a single segment (Fig. 6). Based on morphology alone, relationships of *Psychopomporus* to other Hydroporini (and relationships among Hydroporini taxa in general) are not clear and a comprehensive analysis of this group using morphology and molecular data are needed for placing this unusual taxon. Such an analysis is currently under way with preliminary results suggesting that *Psychopomporus* is, indeed, a valid genus (K. Miller, personal observation).

Psychopomporus felipi Jean, Telles, and Miller, new species

(Figs. 1–7)

Type Locality. USA, Texas, Val Verde County, Del Rio, San Felipe Springs (29.37234°N 100.88602°W).



Figs. 1–6. *Psychopomporus felipi*. **1)** Dorsal habitus; **2)** Ventral habitus; **3)** Prosternal process, left lateral aspect, arrow points at medial prosternal prominences; **4)** Male median lobe, ventral aspect; **5)** Male median lobe, right lateral aspect; **6)** Male right lateral lobe, right lateral aspect. Scale bar = 1 mm for Figs. 1–3 only.

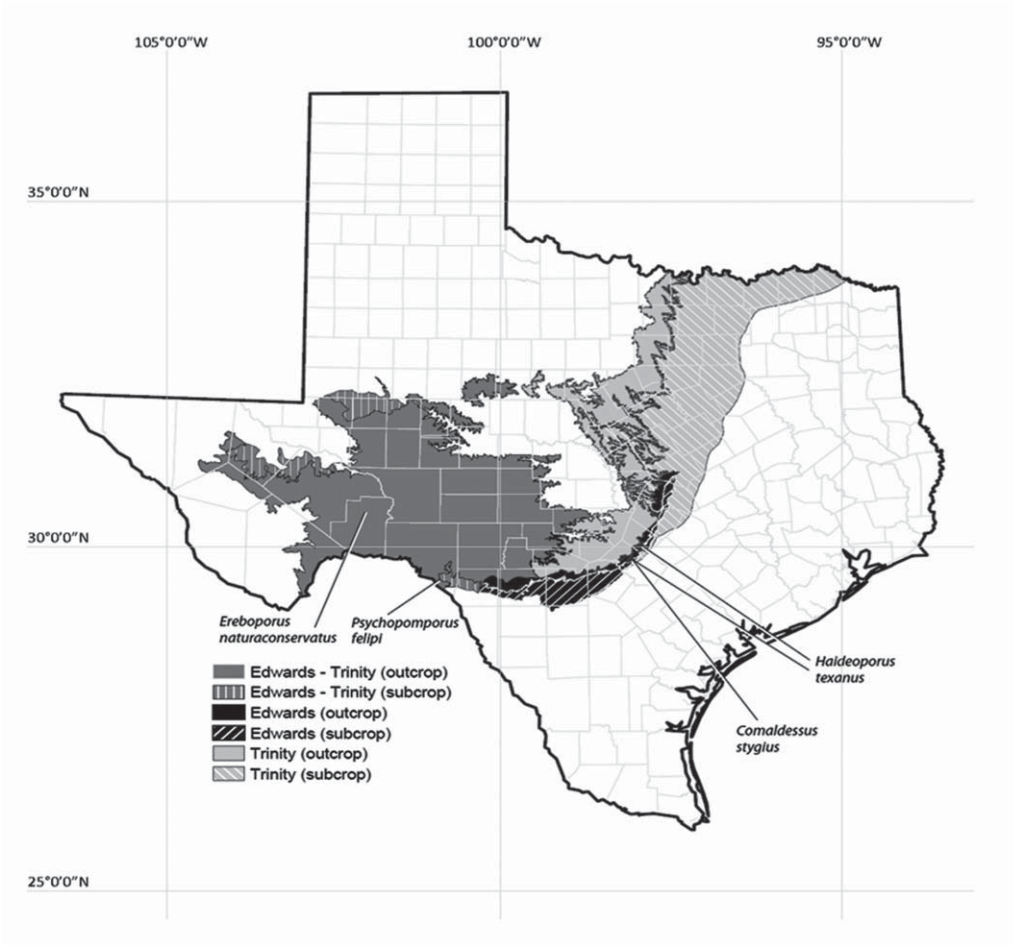


Fig. 7. Distribution of *Psychopomporus felipi* and other Texas subterranean diving beetles, showing extent of Edwards-Trinity Aquifer.

Diagnosis. This is the only species in the genus and is diagnosed by the character combination for the genus (see above).

Description. Measurements: TL = 2.03 mm; HL = 0.22 mm; HW = 0.75 mm; PL = 0.42 mm; PW = 0.97 mm; EL = 1.39 mm; GW = 0.99 mm; FL = 0.45 mm; RL = 0.24 mm; TL/GW = 2.05; HL/HW = 0.29; PL/PW = 0.43; EL/GW = 1.40; FL/RL = 1.88. **Habitus**: Body outline continuous in dorsal aspect, elongate and parallel-sided (TL/GW = 2.05; Fig. 1); body width greatest at pronotum; dorso-ventral width relatively uniform in lateral view, tapering posteriorly and dorso-ventrally somewhat compressed. Head relatively small compared with rest of body (HL/HW = 0.29; Fig. 1). **Color**: Dorsal and ventral surface uniformly reddish-brown, darker brown where cuticle is thicker. **Sculpture and structure**: Surface of head, pronotum, and elytron with fine, irregular reticulation; finely and sparsely punctate. Head with eyes absent, but with indistinct, oblique line along lateral margin, near normal position of each eye; anterior margin of clypeus broad and slightly concave. Pronotum with fine, distinct lateral bead, slightly expanded posteriorly; with areas of fine, rugulose surface sculpturing laterally; basal margin sinuous, concave laterally and convex medially; anterolateral angle extending anteriorly along lateral surface of head; postereolateral angle distinct and approximately right-angled; pronotum broadest medially (PL/PW = 0.43; Fig. 1). Elytron with epipleuron distinctively broad anteriorly at humeral angle, gradually tapering posteriorly (Fig. 2). Prosternum shortened with prosternal process short, distinctly impressed posteriorly and apically pointed, extending posteriorly between pro- and mesocoxae to anteromedial angle

of mesosternum; prosternal process between procoxae with prominent, anteriorly directed prominence (Fig. 3). Metacoxal plate large, anterior and posterior margins at prominent angle with respect to longitudinal axis (Fig. 2); metacoxal lines distinct, diverging anteriorly; interlinear space slightly but distinctly raised; metacoxal process with small but distinct lobes obscuring basal portion of metatrochanter (Fig. 2). Legs elongate, spinous, with numerous natatory setae; meso- and (to a lesser degree) protibia apically expanded and medially strongly and distinctly curved; metatibia moderately large with respect to metafemur (FL/RL = 1.88); metatarsal claws similar in length (Fig. 2). **Male genitalia**: Median lobe in ventral aspect broad, elongate, tapered to narrowly rounded apex (Fig. 4); in lateral aspect, elongate, of similar width throughout apical portion, strongly curved, slightly tapered to narrowly pointed apex (Fig. 5); lateral lobe in lateral aspect broadly triangular in basal half, apical portion slightly angled dorsally, apex broadly rounded, apex with dorsal margin with series of fine setae (Fig. 6).

The female and other life stages are unknown.

Distribution and Habitat. Same as for genus (Fig. 7, see above).

Etymology. The species name, *felipi*, is a genitive noun based on the type locality, San Felipe Springs in Del Rio, Val Verde County, Texas, USA.

Material Examined. Holotype: ♂ labeled, "U.S.A.: Texas, Val Verde Co., San Felipe Springs, 24.3 km S Sheffield, 30101, 19 May 2007, J.R. Gibson and D. Foley, colrs./ HOLOTYPE: *Psychopomporus felipi* Jean, Telles and Miller, 2011 [red label with double black line border]." Paratype: 1 labeled same as holotype except "…/PARATYPE: *Psychopomporus felipi* Jean, Telles and Miller, 2011 [blue label with black line border]."

Acknowledgments

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