



<http://dx.doi.org/10.11646/zootaxa.3887.1.3>

<http://zoobank.org/urn:lsid:zoobank.org:pub:F4BB8139-3A94-4E5E-8C0C-5974BB4E6C84>

Spelaeogammarus titan, a new troglobitic amphipod from Brazil (Amphipoda: Bogidielloidea: Artesiidae)

ANDRÉ R. SENNA¹, LUIZ F. ANDRADE², LUCAS P. CASTELO-BRANCO³ & RODRIGO L. FERREIRA⁴

¹Universidade Federal da Bahia (UFBA), Instituto de Biologia, Laboratório de Invertebrados Marinhos, Crustacea, Cnidaria & Fauna Associada (LABIMAR). Rua Barão de Jeremoabo, 147, Ondina, Salvador, BA, CEP 40170-290, Brasil.

E-mail: senna.carcinologia@gmail.com

²Universidade Federal Rural do Rio de Janeiro, Programa de Pós-graduação em Biologia Animal. Decanato de Pesquisa e Pós-Graduação, UFRRJ, Rod. BR 465, Km 7, Seropédica, RJ, CEP 23890-000, Brasil. E-mail: lzfjp.andrade@hotmail.com

³Centro Universitário de Volta Redonda (UniFOA), Curso de Ciências Biológicas. Av. Paulo Erlei Alves Abrantes, 1.325, Prédio 1, Três Poços, Volta Redonda, RJ, CEP 27240-560, Brasil. E-mail: lucas.cbranco@hotmail.com

⁴Universidade Federal de Lavras (UFLA), Centro de Estudos em Biologia Subterrânea, Departamento de Biologia. Lavras, MG, Brasil. E-mail: drops@dbi.ufla.br

Abstract

A new troglobitic species of the amphipod family Artesiidae Holsinger, 1980 is described from a cave in the municipality of Santa Maria da Vitória, in the Brazilian state of Bahia, northeastern Brazil. *Spelaeogammarus titan* sp. nov. differs from the others in the genus by its body length, rising up to 18.3 mm, the antenna 1 with accessory flagellum 6-articulate, propodus of the first gnathopod 1.8 X longer than basis, the largest in the genus, coxa 5 with posterior lobe slightly concave, inner ramus of pleopods with 10 to 13 setae, outer ramus of uropod 3 with 22 simple setae, and telson with 1 apical plus 3 subapical stout setae in each lobe. With this study, the knowledge of *Spelaeogammarus* is improved to 5 species, all of them exclusive to caves in the northeastern Brazilian state of Bahia. A comparative table with the diagnostic characters of the species of *Spelaeogammarus* is provided.

Key words: Taxonomy, Biodiversity, cave fauna, Urucuia formation, Santa Maria da Vitória, Bahia

Introduction

Holsinger (1980) established the family Artesiidae in the superfamily Bogidielloidea Hertzog, 1936, positioning there the genus *Spelaeogammarus* Da Silva Brum, 1975. However, Botosaneanu & Stock (1989) did not accept Artesiidae and Bogidiellidae as distinct families and suggest that the name Artesiidae would be leaved and its genera included into Bogidiellidae, based in the description of *Aequigidiella* Botosaneanu & Stock, 1989, from two caves in Thailand. This genus bears some characters that seems to be a bridge between the two families (Holsinger 1992).

Koenemann & Holsinger (2000) accept *Spelaeogammarus* positioned in Bogidiellidae, stating that the taxon most closely related to *Spelaeogammarus*, described until now, could be *Bogidiella gammarijormis* Sket (1985), found in a cave from Ecuador.

Lowry & Myers (2013) establish a new suborder Senticaudata, grouping 95 families anteriorly in Gammaridea. Six infraorders were recognized: Carangoliopsida Bousfield, 1977, Talitrida Rafinesque, 1815, Hadziida S. Karaman, 1932, Corophiida Leach, 1814, Bogidiellida Hertzog, 1936 and Gammarida Latreille, 1802. The infraorder Bogidiellida include just one Parvorder, Bogidiellidira, with a single superfamily, Bogidielloidea, which includes three families, Artesiidae Holsinger, 1980, Bogidiellidae Hertzog, 1936, and Salentinellidae Bousfield, 1977. According to the authors, the genera *Artesia* Holsinger, 1980 and *Spelaeogammarus* are grouped in Artesiidae.

Recent studies in caves from the Northeastern Brazil are bringing up a rich fauna, with descriptions of many new species, including Palpigradi (Souza & Ferreira 2011a, b), Opilioacarida (Bernardi *et al.* 2012), Schizomida

(Santos *et al.* 2013), Hemiptera (Hoch & Ferreira 2013) and Amphipoda (Fiser *et al.* 2013), besides a large amount of taxa that are still undescribed (Ferreira *et al.* 2010). Among the new discoveries in this region, one deserves attention: a new stygobitic Amphipoda of the genus *Spelaeogammarus* Da Silva Brum, 1975 that will be the object of this study. Currently, *Spelaeogammarus* includes four species, all of them recorded exclusively from caves in the Brazilian state of Bahia: *S. bahiensis* Da Silva Brum, 1975 (type-species), *S. spinilacertus* Koenemann & Holsinger, 2000; *S. trajanoae* Koenemann & Holsinger, 2000; and *S. santanensis* Koenemann & Holsinger, 2000.

The genus *Spelaeogammarus* is characterized by presenting the following characters: anoftalmy; body smooth and depigmented; coxae 1 and 2 small, wider than long; coxae 3 to 6 longer than wide, overlapping; maxilla 1, inner plate with 3 plumose setae, outer plate with 6 or 7 multi-cuspidate stout setae; maxilliped, inner plate with stout setae apically bifid; gnathopod 1, propodus stronger than in gnathopod 2; uropod 1, peduncle with 3 or 4 basofacial stout setae; uropod 3, rami subequal in length, 1-segmented; telson longer than wide, with shallow apical excavation, bearing apical and subapical stout setae.

Recently, a new species of *Spelaeogammarus* was found in a cave in the municipality of Santa Maria da Vitória, in the Brazilian state of Bahia. It presents all the diagnostic characters of the genus and it is closely related to the species *S. santanensis* Koenemann & Holsinger, 2000, presenting, despite this, distinctive characters, which will be presented and discussed later. One characteristic that deserves attention in the new taxa described here is its length; some specimens can have more than 18 mm of body length, a size considerably larger than all other species in the genus.

Material and methods

The material examined was collected in a cave PEA-445 (13° 05' 4.18"S; 44° 41' 58.88"W) located in the municipality of Santa Maria da Vitória, West of the Brazilian state of Bahia (Fig 1), in May 6th, 2013. All specimens were captured with a hand net and placed in vials containing 70% ethanol. The material examined is housed at the Crustacea Collection of *Museu de Zoologia da Universidade Federal da Bahia* (UFBA) and in the Collection of Subterranean Invertebrates of *Universidade Federal de Lavras* (ISLA). Appendages and mouthparts were dissected and mounted on glass slides with glycerol gelatin (Reid, 2000). Drawings were made under an optic microscopy (Motic BA-310) with *camera lucida*, and digitally prepared with CorelDraw X6, following a protocol based on Coleman (2003). Drawings were made based on the holotype, UFBA 1606 and one paratype, UFBA 1607. The setal/spine classification adopted in this paper follows Watling (1989). Nomenclature of gnathopod palm is based on Poore & Lowry (1997).

The following abbreviations were used on the figures: Hb, habitus; Hd, head; A1–2, antennae 1–2; Md, mandible; Mx1–2, maxillae 1–2; UL, upper lip; LL, lower lip; Mp, maxilliped; Gn1–2, gnathopods 1–2; P3–7, pereopods 3–7; Ep1–3, epimeral plates 1–3; Pl1–3, pleopods 1–3; U1–3, uropods 1–3; T, telson; R, right; L, left.

Results

Order Amphipoda Latreille, 1816

Suborder Senticaudata Lowry & Myers, 2013

Superfamily Bogidielloidea Hertzog, 1936

Family Artesiidae Holsinger, 1980

Genus *Spelaeogammarus* Da Silva Brum, 1975

Spelaeogammarus titan sp. nov.

(Figs 2–7)

Etymology. The specific epithet is related to the enlarged size of specimens of this species, greatly larger than the others in the genus.

Material examined. Holotype, female, dissected and drawn, 10.1 mm, 6 May 2013, cave PEA-445 (13° 05' 4.18"S; 44° 41' 58.88"W), municipality of Santa Maria da Vitória, Bahia state, Brazil, UFBA 1606. Paratypes: 1 female, habitus drawn, 18.3 mm, 6 May 2013, cave PEA-445 (13° 05' 4.18"S; 44° 41' 58.88"W), municipality of Santa Maria da Vitória, Bahia state, Brazil, UFBA 1607; 18 females, 6 May 2013, cave PEA-445 (13° 05' 4.18"S; 44° 41' 58.88"W), municipality of Santa Maria da Vitória, Bahia state, Brazil, UFBA 1608; 41 females, 6 May 2013, cave PEA-445 (13° 05' 4.18"S; 44° 41' 58.88"W), municipality of Santa Maria da Vitória, Bahia state, Brazil, ISLA 5142.

Diagnosis. Antenna 1, accessory flagellum 6-articulate. Antenna 2, flagellum 10-articulate. Maxilla 1, outer lobe, apical margin with 6 multi-cuspidate stout setae and 1 plumose seta. Maxilliped, inner plate, apical margin with 2 Y-shaped stout setae, 2 plumose setae, and 2 slender setae; palp article 3, apical margin bearing a row of small, blunt and plumose nodular setae. Gnathopod 1, basis, anterior margin with 7 small setae, posterior margin with 20 long setae; propodus stout, about 1.8X longer than basis. Gnathopod 2, basis, posterior margin with 23 setae. Coxa 5 with 1 stout setae and 14 slender setae, posterior lobe slightly concave. Coxa 6 with 1 stout seta. Pleopods, inner ramus with 10 to 13 setae. Uropod 3, outer ramus bearing 22 simple stout setae. Telson bearing 1 apical and 3 subapical stout setae in each lobe. Largest specimen: female, 18.3 mm.

Description. Body slender. Head without eyes, slightly deeper than long, about as long as pereonites 1 and 2 combined; rostrum weakly produced, subacute, lateral cephalic lobe rounded, anteroventral corner subquadrate, without setae. Antenna 1, about half the body length, peduncle slightly shorter than flagellum, article 1 0.7 X as long as articles 2 and 3 combined, ratio of peduncular articles 1–3 = 1.7:1.4:1; flagellum 26-articulate; accessory flagellum 6-articulate, article 6 reduced, total length of accessory flagellum as long as articles 1 to 6 of flagellum combined. Antenna 2, about 0.7 X the length of antenna 1, peduncle 2.7 X as long as flagellum, article 2 cone gland rising up to the distal margin of article 3, article 5 slightly shorter than article 4; flagellum 10-articulate.

Maxilla 1, inner plate subrectangular, bearing 3 stout plumose setae on apical margin, about 0.7 X as long as of outer plate; outer plate subrectangular, bearing 6 multi-cuspidate setae on apical margin, and 1 stout plumose seta at the innerdistal corner; palp 2-articulate, article 2 tapering distally, with a row of setae downwards from the apex to the inner margin. Maxilla 2, short, inner plate about 1.8 X wider than outer plate, apical margin bearing a fringe of plumose setae; outer plate slightly longer than inner plate, apical margin bearing a fringe of slender setae. Left mandible, molar broad, semi-tritulative, subcircular, bearing a long slender plumose seta; accessory setal row consisting of 5 curved plumose setae, one of them longer and stronger than the others; *lacinia mobilis* present, well developed, broad and apically multi-cuspidate; incisor multi-cuspidate; palp 3-articulate, article 1 about twice longer than wide, article 2 slightly robust, about 3.9 X longer than wide, and about 1.3 X longer than article 3, ventral margin bearing 7 slender setae, article 3 tapering distally, with 2 apical long setae and 4 small slender setae on the ventral margin. Right mandible subequal to left mandible, accessory setal row consisting of 4 curved plumose setae, 2 of them longer and stronger than the others. Upper lip rounded and smooth, apically setulose. Lower lip, inner lobe apically rounded and setulose; outer lobe well developed, broadly rounded, inner distal margin setulose. Maxilliped, inner and outer plates short; inner plate suboval, apical margin with 2 Y-shaped stout setae, 2 plumose setae, and 2 slender setae; outer plate slightly elongate, suboval, bearing 6 stout setae on the inner distal margin; palp 4-articulate, article 1 about 1.4 X longer than wide, article 2, the largest, about 3 X longer than wide and 1.6 X longer than article 3, inner margin with a fringe of plumose setae, article 3 with distal submarginal field of setules, apical margin bearing a row of small, blunt and plumose nodular setae, inner margin with a fringe of plumose setae, article 4 tapering distally, inner margin concave and setose, a small claw present.

Gnathopod 1, coxa subquadrate; basis stout, about 1.8X longer than wide, anterior margin with 7 small setae, posterior margin bearing 20 long setae; isquium subquadrate, distoventral corner with 1 slender seta; merus, ventral margin setose; carpus subtriangular, posterodistal corner produced, with comb-scales, posterodistal margin with a fringe of plumose setae; propodus stout, suboval, sinuous, about 1.8X longer than basis, palm acute, about 2.7 X longer than posterior margin, covered by a dense fringe of small setae, bearing 13 stout setae; dactylus long, curved, naked, not reaching the palmar corner. Gnathopod 2, basis subrectangular, about 2.9 X longer than wide, posterior margin with 23 setae; isquium slightly longer than wide, posterior margin with 2 small slender setae; merus subrectangular, about 1.6 X longer than wide; carpus subtrapezoidal, about 1.5 longer than wide, posterior margin setose; propodus suboval, slightly elongate, about twice longer than wide, anterior and posterior margins setose, palm acute, about 0.75 X as long as posterior margin, covered by a dense fringe of small setae, bearing 8 stout setae, dactylus long, curved, naked, reaching beyond the palmar corner. Pereopod 3, coxa suboval, about 1.7

X longer than wide, ventral margin with 7 setae; basis suboval, slightly elongate, anterior and posterior margins without setae, posterodistal corner with 1 seta; merus, about 3.3 X longer than wide, slightly shorter than carpus, anterior margin with 2 stout setae, anterodistal corner with 2 stout setae, posterior margin with 8 setae; carpus elongate, about 5.5 X longer than wide, slightly longer than merus, anterior margin with 4 stout setae, posterior margin with 8 stout setae; propodus, slightly elongate, about 9 X longer than wide, slightly longer than carpus, anterior margin with 4 slender setae, posterior margin with 12 stout setae; dactylus slightly curved, apical nail present. Pereopod 4 subequal to pereopod 3, oostegite long and slender, naked or setae missing. Pereopod 5, coxa bilobate, anterior lobe well developed, about 1.6 X longer than wide, with 14 slender setae, posterior lobe small, posterior margin slightly concave, bearing 1 stout; basis suboval, about 2.3 X longer than wide, anterior and posterior margins bearing several marginal and submarginal stout and slender setae; merus about 3.8 X longer than wide, anterior margin with 8 slender setae and 1 proximal stout seta, posterior margin naked; carpus slightly elongate, 6.5 X longer than wide, about 1.2 X longer than merus, anterior margin with a dense fringe of slender setae, anterodistal corner with a set of long slender setae, posterior margin with 6 sparse slender setae; propodus slightly elongate, about 10 X longer than wide, about 0.9 X as long as carpus, bearing 13 lateral sets of stout setae (1-2-2-2-1-1-2-2-1-2-1-1-1), anterior margin with a dense fringe of small slender setae, anterodistal corner with 1 stout seta, posterior margin naked, posterodistal corner with 1 stout seta; dactylus slightly curved, apical nail present. Pereopod 6 slightly longer than pereopod 5, coxa bilobate, anterior lobe well developed, ventral margin naked, posterior margin with 1 stout seta; basis suboval, about twice longer than wide, anterior and posterior margins bearing several stout setae, merus slightly elongate, about 4.4 X longer than wide, anterior and posterior margins slightly setose; carpus slightly elongate, 6.9 X longer than wide, about 1.2 X longer than merus, anterior margin with a dense fringe of slender setae, distal setae longer than the proximal, anterodistal corner with 3 stout setae, posterior margin with 5 sparse slender setae, posterodistal corner with 1 stout seta; propodus slightly elongate, about 10.4 X longer than wide, about 0.9 X as long as carpus, bearing 14 lateral sets of stout setae (2-1-2-1-2-2-1-2-2-1-1-2-1-2), anterior margin with a dense fringe of small slender setae, distal setae longer than the proximal, anterodistal corner with 1 stout seta, posterior margin naked; dactylus slightly curved, apical nail present. Pereopod 7 slightly longer than pereopod 6, coxa subtriangular, about 1.7 X wider than long, with 1 posterior stout seta; basis suboval, about 1.7 X longer than wide, anterior and posterior margins with several stout setae; ischium slightly stout; merus about 3.3 X longer than wide, anterior and posterior margins with 4 stout setae each, anterodistal corner with 2 stout setae, posterodistal corner with 4 stout setae; carpus slightly elongate, about 7.8 X longer than wide, about 1.4 X longer than merus, anterior margin with 8 sets of stout setae (3-2-3-3-1-3-3), anterodistal corner with 3 stout setae, posterior margin with 5 sparse stout setae, posterodistal corner with 2 stout setae; propodus elongate, about 13.2 X longer than wide, about 1.2 X longer than carpus, anterior and posterior margins densely setose; dactylus slightly curved, apical nail present.

Epimeral plates 1 and 2 subequal, posteroventral corner subquadrate, bearing a small spine, ventral and posterior margins naked. Epimeral plate 3, posteroventral corner subacute, weakly produced in a small spine, ventral and posterior margins naked. Pleopod 1, peduncle subrectangular, about 3.2 X longer than wide, naked; inner ramus 1-articulate, bearing 10 plumose slender setae; outer ramus 3-articulate, subequal in length to inner ramus, article 1, inner margin with 7 plumose setae, outer margin with 13 plumose setae, article 2 with 2 plumose setae, article 3, smallest, with 2 apical plumose setae. Pleopod 2, peduncle subrectangular, about 4.6 X longer than wide, naked; inner ramus 1-articulate, bearing 11 plumose slender setae; outer ramus 3-articulate, slightly longer than inner ramus, article 1, inner margin with 10 plumose setae, outer margin with 19 plumose setae, article 2 with 1 plumose seta, article 3, smallest, with 3 apical plumose setae. Pleopod 3, peduncle subrectangular, about 5.3 X longer than wide, naked; inner ramus 1-articulate, bearing 13 plumose slender setae; outer ramus 3-articulate, slightly longer than inner ramus, article 1, inner margin with 8 plumose setae, outer margin with 20 plumose setae, article 2 with 2 plumose seta, article 3, smallest, with 2 apical plumose setae. Uropod 1, peduncle short, about 1.6 X longer than wide, bearing 1 distolateral stout seta; rami subequal in length, lanceolate; inner ramus about 2.6 X longer than peduncle, bearing 9 dorsal, 1 ventrodiscal, and 2 apical setae; outer ramus bearing 21 dorsal, 7 ventral, and 3 apical setae. Uropod 2, peduncle slightly elongate, about 2.4 X longer than wide, bearing 2 dorsal and 1 distolateral stout setae; rami subequal in length, slightly longer than peduncle; inner ramus bearing 2 dorsal, 1 ventrodiscal, and 4 apical stout setae; outer ramus bearing 3 dorsal, 2 ventral, and 4 apical stout setae. Uropod 3, peduncle short, about 1.4 X longer than wide, bearing 2 dorsal and 1 distolateral stout setae; rami slightly elongate,

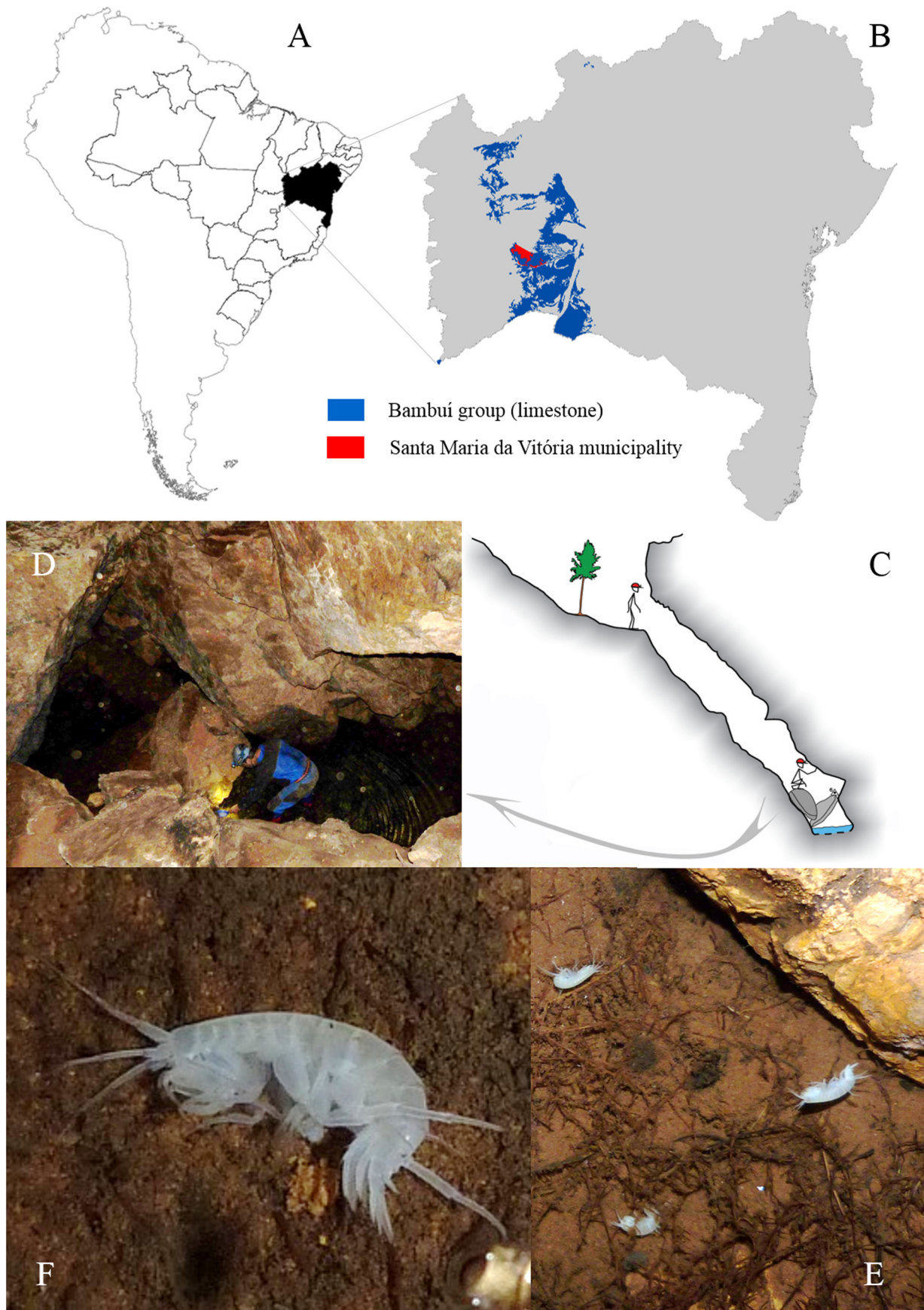


FIGURE 1. *Spelaeogammarus titan* sp. nov. (A) Brazil (Bahia state: black); (B) Bahia state (Bambuí group: Blue; Santa Maria da Vitória: Red); (C) Cave chamber; (D) Lake inside the cave chamber; (E) Specimens on decomposing roots in the bottom of the lake; (F) A specimen on decaying organic matter in the bottom of the lake.



FIGURE 2. *Spelaeogammarus titan* sp. nov. Cave PEA-445 (13° 05' 4.18"S; 44° 41' 58.88"W), municipality of Santa Maria da Vitória, Bahia state, Brazil. Photography by R. L. Ferreira.

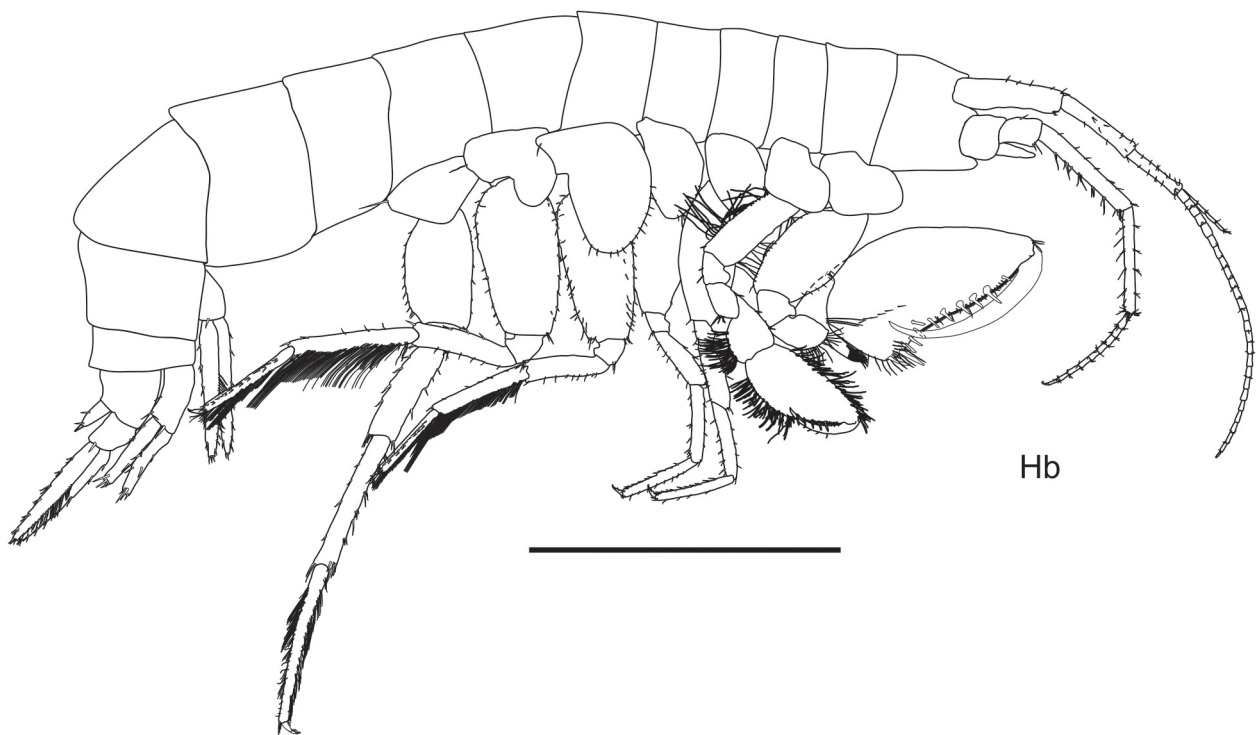


FIGURE 3. *Spelaeogammarus titan* sp. nov. Paratype, female, 18.3 mm, UFBA 1607. Cave PEA-445 (13° 05' 4.18"S; 44° 41' 58.88"W), municipality of Santa Maria da Vitória, Bahia state, Brazil. Scale bar: 5.0 mm.

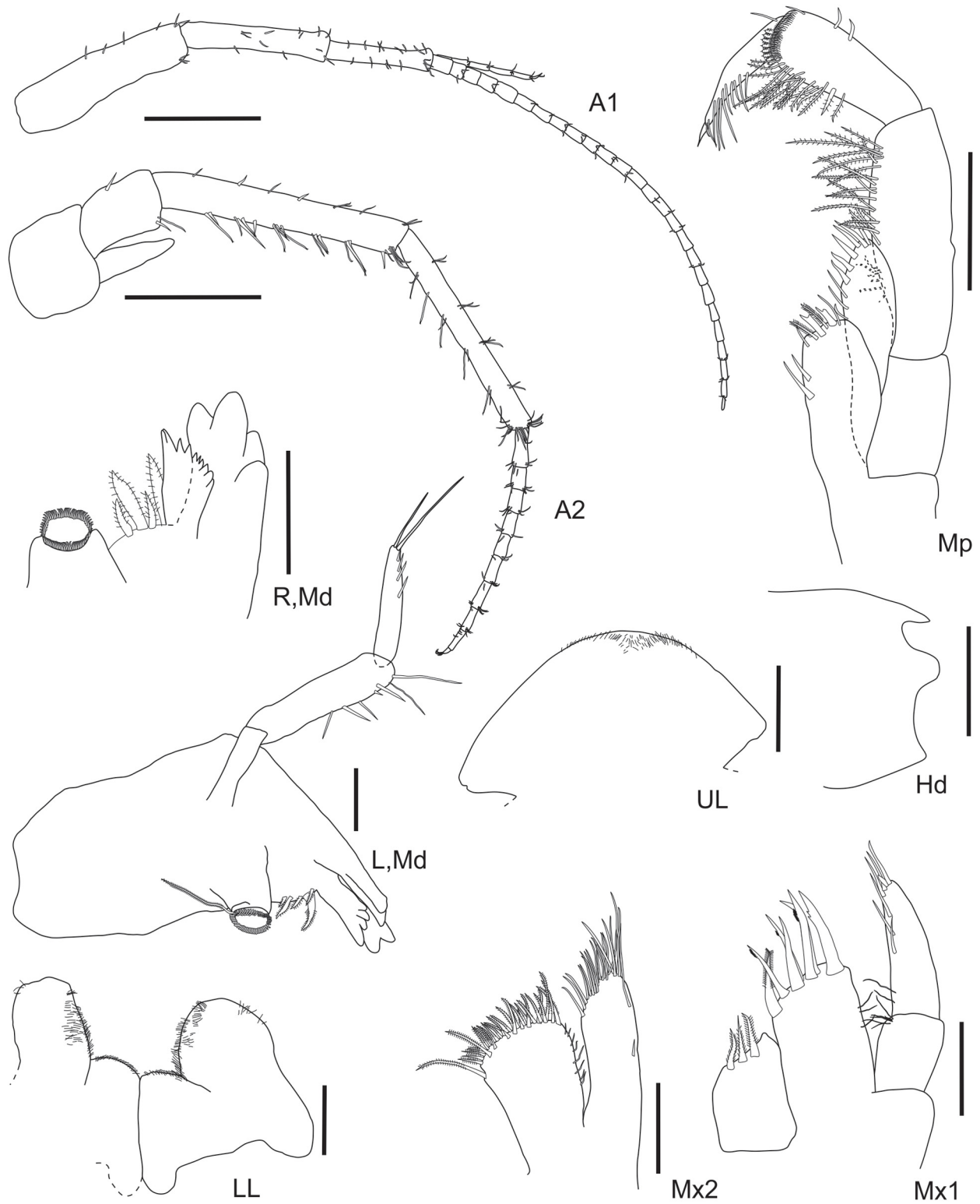


FIGURE 4. *Spelaeogammarus titan* sp. nov. Holotype, female, 10.1 mm, UFBA 1606. Cave PEA-445 (13° 05' 4.18"S; 44° 41' 58.88"W), municipality of Santa Maria da Vitória, Bahia state, Brazil. Scale bars: 1.0 mm for A1–2 and Hd; 0.5 mm for Mp; 0.2 mm for the remainder.

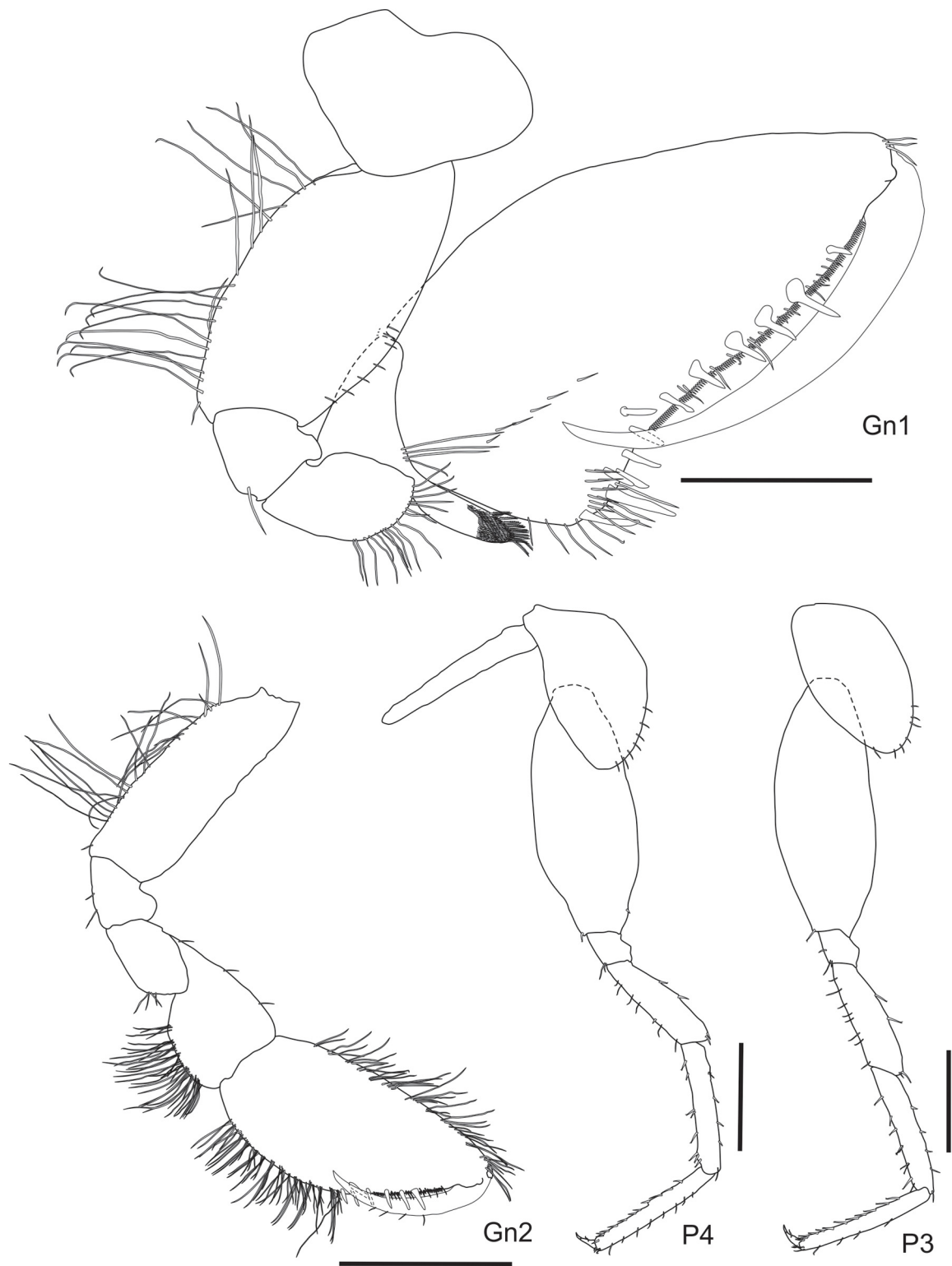


FIGURE 5. *Spelaeogammarus titan* sp. nov. Holotype, female, 10.1 mm, UFBA 1606. Cave PEA-445 (13° 05' 4.18"S; 44° 41' 58.88"W), municipality of Santa Maria da Vitória, Bahia state, Brazil. Scale bars: 1.0 mm.

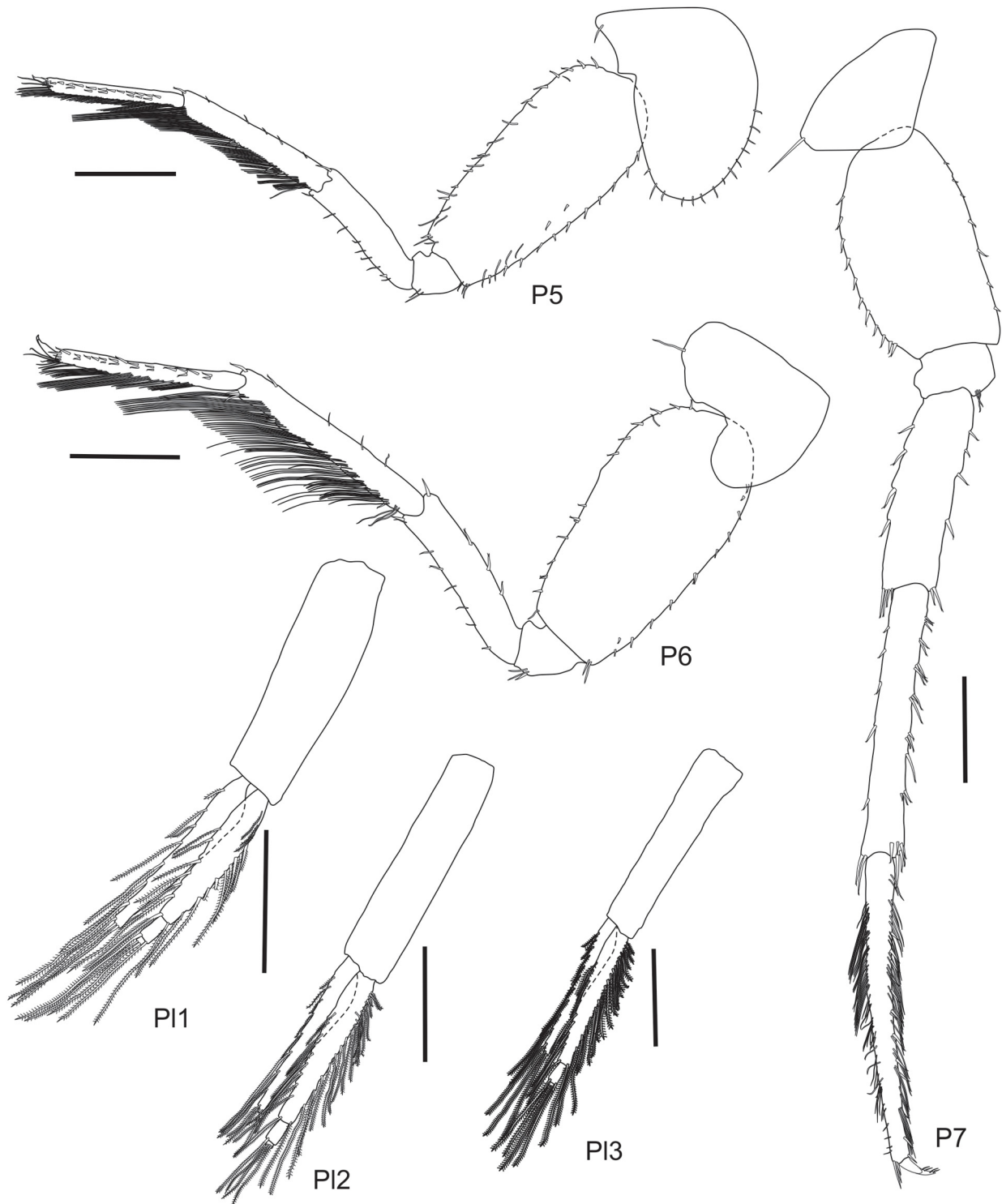


FIGURE 6. *Spelaeogammarus titan* sp. nov. Holotype, female, 10.1 mm, UFBA 1606. Cave PEA-445 (13° 05' 4.18"S; 44° 41' 58.88"W), municipality of Santa Maria da Vitória, Bahia state, Brazil. Scale bars: 1.0 mm.

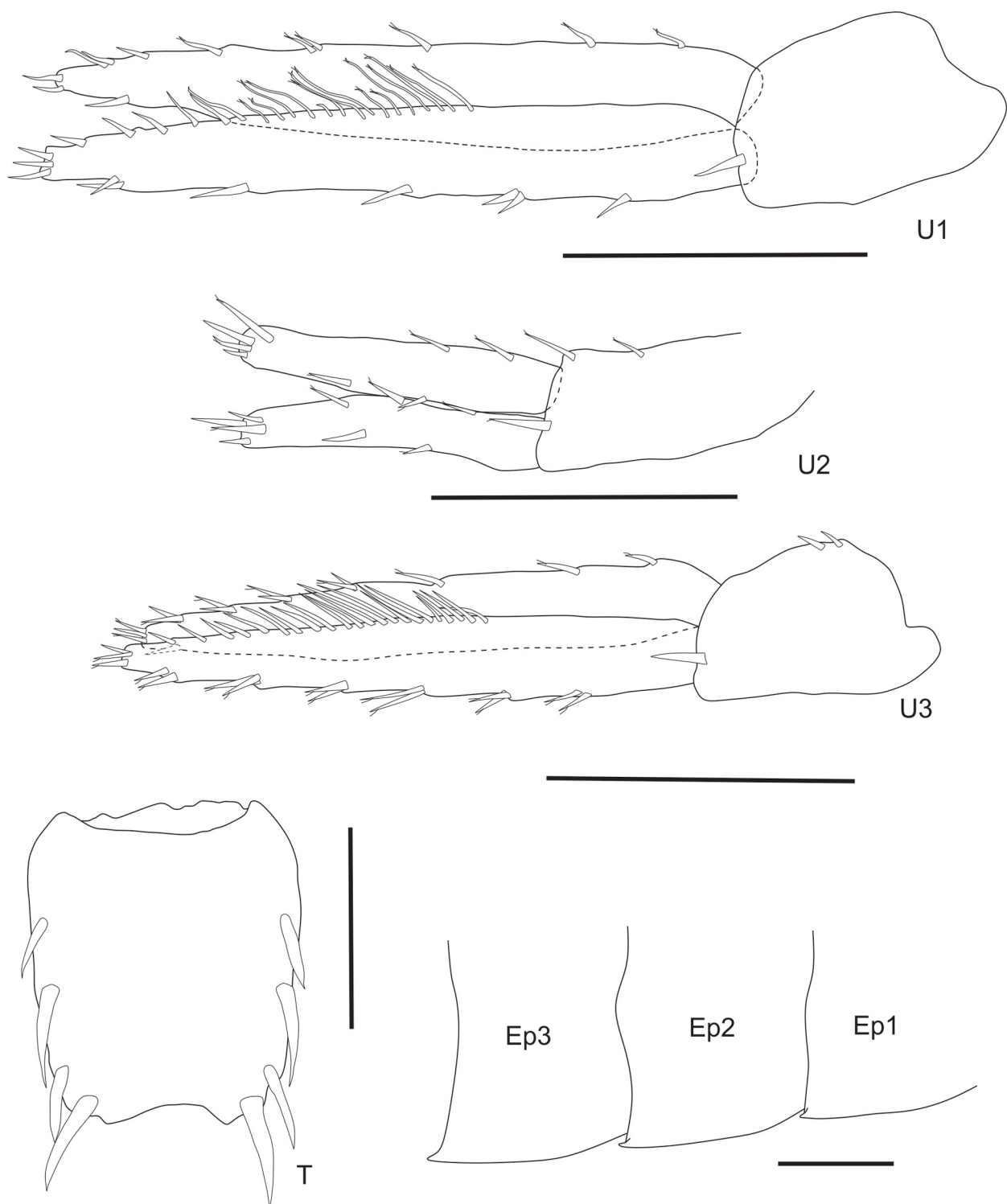


FIGURE 7. *Spelaeogammarus titan* sp. nov. Holotype, female, 10.1 mm, UFBA 1606. Cave PEA-445 (13° 05' 4.18"S; 44° 41' 58.88"W), municipality of Santa Maria da Vitória, Bahia state, Brazil. Scale bars: 0.5 mm for Ep1–3 and T; 1.0 mm for the remainder.

TABLE 1. Diagnostic characters of the species in *Spelaeogammarus*.

Characters	<i>S. spinilacertus</i>	<i>S. irajanoae</i>	<i>S. santamensis</i>	<i>S. bahiensis</i>	<i>S. titan sp. nov.</i>
Accessory flagellum	4-articulate	4-articulate	5-articulate	4-articulate	6-articulate
Antenna 2, flagellum	7-articulate	7-articulate	8 to 10-articulate	7-articulate	10-articulate
Maxilla 1, outer plate, apical margin	6 multi-cuspidate stout setae + 1 plumose seta	6 multi-cuspidate stout setae + 1 plumose seta	7 multi-cuspidate stout setae	7 multi-cuspidate stout setae	6 multi-cuspidate stout setae + 1 plumose seta
Maxilliped, inner plate, apical margin	4 plumose setae	4 plumose setae	2 plumose setae	Without plumose setae	2 plumose setae
Gnathopod 1, basis, anterior margin	2–4 stout setae + 1 small seta	5–9 small setae	4 small setae	3–5 small setae	7 small setae
Gnathopod 1, basis, posterior margin	6–8 setae (some bifid)	9–10 simple setae	20 simple setae	7–9 simple setae	20 setae
Gnathopod 1, propodus length	Slightly longer than basis	Slightly longer than basis	About 1.5X longer than basis	Slightly longer than basis	About 1.8X longer than basis
Gnathopod 2, basis, posterior margin	9–10 setae	8–9 setae	20–23 setae	9 setae	23 setae
Coxa 5	1 stout seta + 9 setae	1 stout seta + 17–18 setae	1 stout seta + 12 slender setae	1 stout seta + 20–21 slender setae	1 stout seta + 14 slender setae
Coxa 5, posterior lobe	Round	Round	Round	Round	Slightly concave
Coxa 6	1 stout seta	1 stout seta	1 stout seta + 1 slender seta	1 stout seta + 20–21 slender setae	1 stout seta
Pleopods, inner ramus	4–5 setae	5–7 setae	7–8 setae	7 setae	10–13 setae
Uropod 3, outer ramus, dorsal margin	20 bifid setae	20 bifid setae	8 bifid setae	Unknown	22 simple setae
Telson, stout setae per lobe	2 apical + 3–4 subapical	3 apical + 2–3 subapical	1 apical + 3 subapical	2 apical + 3–4 subapical	1 apical + 3 subapical

lanceolate; inner ramus about 2.7 X longer than peduncle, bearing 11 dorsal, 1 ventrodorsal, and 3 apical stout setae; outer ramus slightly longer than inner ramus, bearing 22 dorsal simple stout setae, 6 ventral pairs of bifid stout setae, and 3 apical stout setae. Telson slightly longer than wide, apical margin with shallow U-shaped excavation, bearing 1 apical and 3 subapical stout setae in each lobe.

Remarks. *Speleogammarus titan* sp. nov. is most closely related to *S. santanensis* than the others in the genus, by presenting antenna 2 flagellum 10-articulate, the maxilliped inner lobe with 2 plumose setae in the apical margin, the gnathopod 1 basis posterior margin with 20 setae and propodus much larger than basis (1.8X), the gnathopod 2 basis with 23 setae, the uropod 3 outer ramus with 8 bifid stout setae, and telson with 1 apical and 3 subapical setae in each lobe. However, the propodus of gnathopod 1 of *S. titan* sp. nov. is relatively larger than propodus in *S. santanensis* (1.5X), and the 8 bifid stout setae in the outer ramus of uropod 3 are placed in pairs with other 7 simple stout setae. *Speleogammarus titan* sp. nov. shares with other two species, *S. spinilacertus* and *S. trajanoae*, the maxilla 1 apical margin of outer lobe with 6 multi-cuspidate stout setae and 1 plumose seta. The new species presents as exclusive characteristics in the genus: the 6-articulate accessory flagellum, which modifies the diagnosis of the genus that was ranging from 4 to 5-articulate until now; the coxa 5 with posterior lobe slightly concave; the inner ramus of pleopods bears 10 to 13 plumose setae, while in all other species this number is much less, from 4 to 8; the dorsal margin of the outer ramus of uropod 3 with 22 simple stout setae, while the others species present 8 or 20 bifid setae; and the unique pattern of setation on the telson, bearing 1 apical and 3 subapical stout setae in each lobe.

Natural history and threats. The cave PEA-445 (13° 05' 4.18"S; 44° 41' 58.88"W) is located in Santa Maria da Vitória municipality, southeastern Bahia state, Brazil (Fig 1A–B). The cave is inserted in sandstones from the Urucuia formation, and is placed in an altitude of 625 meters. The cave entrance is located at the bottom of a semi-circular sinkhole, with around 10 meters of diameter. Such entrance is fragmented in two distinct irregular spans with around 2x3 meters each. The entrance was certainly originated by a subsidence of the roof of the underground chamber. The cave is inserted in a silicified sandstone, densely fractured in a possible fault zone, in contrast to other caves in which other species of *Speleogammarus* are found, all inserted in limestones. However, it is important to stand out that under such sandstones may occur limestones from the Bambuí group, and the collapse of this subjacent limestone could have led to the collapse of the associated sandstones coverings, originating the cave. The cave comprises a chamber steeply sloping (slope -50%—Fig 1C) which follows the sinkhole slope, until intercepting a “lake” about 15 meters deep from the surface (Fig 1D). The cave chamber has an irregular contour, with approximately 15 meters of linear development and 7.5 meters of depth (from the entrance until the lake). The “lake” in the bottom of the cave comprises the phreatic level of the area (Fig 1D). In this “lake”, root tufts from the external vegetation were observed in profusion. Amid the roots, hundreds of individuals of *S. titan* were observed (Fig 1F), apparently feeding on decaying organic matter, brought down to the bottom of the cave by floods, or on exudates from the decomposing roots (Fig 1E). The lake’s hydrochemistry was determined during one of the visits to the cave: turbidity 0; temperature 27°C; pH 7.77; electrical conductivity 195 µS/cm; total dissolved solids 97 mg/L; alkalinity 81.6 mg/L CaCO₃.

Although the cave is located near a road and also near some residences, it apparently does not receive any visitors, due to the difficulty of access. Thus, its inner portion is quite preserved. However, it is worrying the advanced state of deforestation of the immediate epigeal area surrounding the cave. The cave entrance is located in the middle portion of a narrow strip of vegetation (approximately 580 meters long by 37 meters wide) surrounded by areas of bare soil or with monocultures. Although one small border of this vegetated area is connected to an extensive preserved area, the cave is situated nearly 300 meters from this connection, being subject to changes resulting from external deforestation, which implies in alterations on the processes of input of organic resources from the external environments.

Acknowledgments

We thank Edvard Magalhães for discovering the new species, entrusting it to us and for sending information about the cave. We also thank Marconi Souza Silva for his help in collecting material. RLF is also grateful to the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq grant nr. 301061/2011–4). The authors are grateful to Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) by financial support and fellowships.

References

- Bernardi, L.F.O., Pellegrini, T.G. & Ferreira, R.L. (2012) New species of *Neoteneriffiola* (Acari: Trombidiformes: Teneriffiidae) from Brazilian caves: geographical distribution and ecological traits. *International Journal of Acarology*, 38, 410–419.
<http://dx.doi.org/10.1080/01647954.2012.662246>
- Botosaneanu, L. & Stock, J.H. (1989) A remarkable new genus of cavernicolous Bogidiellidae (Crustacea, Amphipoda) from Thailand. Studies in honour of Dr. Pieter Wagenaar Hummelinck. *Foundation for Scientific Research in Surinam and the Netherlands Antilles*, 123, 171–184.
- Coleman, C.O. (2003) “Digital inking”: How to make perfect line drawings on computers. *Organisms, Diversity and Evolution*, 3 (14), 1–14.
- Da Silva Brum, I.N. (1975) *Spelaeogammarus bahiensis* g. n. sp. n. de anfípodo cavernícola do Brasil (Amphipoda-Bogidiellidae). *Atlas da Sociedade de Biologia do Rio de Janeiro*, 17, 125–128.
- Ferreira, R.L., Prous, X., Bernardi, L.F.O. & Silva, M.S. (2010) Fauna subterrânea do Estado do Rio Grande do Norte: caracterização e impactos. *Revista Brasileira de Espeleologia*, 1, 25–51.
- Fiser, C., Zagmajster, M. & Ferreira, R.L. (2013) Two new Amphipod families recorded in South America shed light on an old biogeographical enigma. *Systematics and Biodiversity*, 11, 1–23.
<http://dx.doi.org/10.1080/14772000.2013.788579>
- Hoch, H. & Ferreira, R.L. (2013) *Potiguara troglobia* gen. n., sp. n. first record of a troglobitic Kinnaridae from Brazil (Hemiptera: Fulgoromorpha). *Deutsche Entomologische Zeitschrift*, 60, 33–40.
- Holsinger, J.R. (1980) Artesiididae Holsinger, new family. In: Holsinger, J.R. & Longley, G. (Eds.), The subterranean amphipod crustacean fauna of an artesian well in Texas. *Smithsonian Contributions to Zoology*, 308, 1–62.
<http://dx.doi.org/10.5479/si.00810282.308>
- Holsinger, J.R. (1992) Four new species of subterranean amphipod crustaceans (Artesiidae, Hadziidae, Sebidae) from Texas, with comments on their phylogenetic and biogeographic relationships. *Texas Memorial Museum, Speleological Monographs*, 3, 1–22.
- Koenemann, S. & Holsinger, J.R. (2000) Revision of the subterranean amphipod genus *Spelaeogammarus* (Bogidiellidae) from Brazil, including descriptions of three new species and considerations of their phylogeny and biogeography. *Proceedings of the Biological Society of Washington*, 113 (1), 104–123.
- Lowry, J.K. & Myers, A.A. (2013) A phylogeny and classification of the Senticaudata subord. nov. (Crustacea: Amphipoda). *Zootaxa*, 3610 (1), 1–80.
<http://dx.doi.org/10.11646/zootaxa.3610.1.1>
- Poore, A.G.B. & Lowry, J.K. (1997) New amphithoid amphipods from Port Jackson, New South Wales, Australia (Crustacea: Amphipoda: Ampithoidae). *Invertebrate Taxonomy*, 11, 897–941.
<http://dx.doi.org/10.1071/IT95045>
- Reid, J.W. (2000) *The World of Copepods: Workshop on Taxonomic Techniques for Copepods*. Available from: <http://invertebrates.si.edu/copepod/techniques.htm> (Accessed on 2 Jun. 2014)
- Santos, A.J., Ferreira, R.L. & Buzatto, B.A. (2013) Two new cave-dwellings of the short-tailed whipscorpion genus *Rowlandius* (Arachnida: Schizomida: Hubbardiidae) from Northeastern Brazil, with comments on male dimorphism. *PLoS ONE*, 8 (5), e63616.
<http://dx.doi.org/10.1371/journal.pone.0063616>
- Souza, M.F.V.R. & Ferreira, R.L. (2011a) A new species of *Eukoenenia* (Palpigradi: Eukoeneniidae) from Brazilian iron caves. *Zootaxa*, 2886, 31–38.
- Souza, M.F.V.R. & Ferreira, R.L. (2011b) A new troglobitic *Eukoenenia* (Palpigradi: Eukoeneniidae) from Brazil. *The Journal of Arachnology*, 39, 185–188.
<http://dx.doi.org/10.1636/Ha10-43.1>
- Watling, L. (1989) A classification of crustacean setae based on the homology concept. In: Felgenhauer, B.E., Thistle, A.B. & Watling, L. (Eds.), *Functional Morphology of Feeding and Grooming in Crustacea. Vol. 6. Crustacean Issues*. CRC Press, New York, pp. 15–26.