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Brasileirinidae, a new isopod family (Crustacea: Isopoda) from the cave in Bahia (Brazil) with a discussion on its taxonomic position

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Abstract

The aquatic troglobiont *Brasileirinho cavaticus* (Crustacea: Isopoda: Calabozoidea), new genus and species is described from the karst cave of the State of Bahia, Brazil. Based on its unique pleonal features i.e. the total absence of female pleopods I–II, uniramous male pleopods I–II, minute, uniramous respiratory pleopods III–V in both sexes and pleotelson not exceeding 45% of the pleon length, a new family, Brasileirinidae, is created. Some biological, ecological and behavioral data for the species are provided together with the nature conservation issues. Additionally, an assignment of the new species to the suborder Calabozoidea is discussed through comparison with the other two calabozoid species, *Calabozoa pellucida* and *Pongycarcinia xiphidiourus*. For the latter species, some previously missing morphological details, as well as a new locality record, are provided. According to the updated morphological evidence, the previously assumed relationships of Calabozoidea are discussed and, consequently, the diagnostic characters of some taxa emended.

Key words: *Brasileirinho cavaticus* sp. nov., gen. nov., fam. nov., morphology, biology, Calabozoidea, nature conservation, troglobiont

Introduction

Recently, the first aquatic troglobiotic isopod was found within a ca. 191.300 km² large Brazilian karst region. The new isopod from the State of Bahia (Messana *et al.* 2002) supplemented the species list of aquatic troglobiotic crustaceans comprising only seven amphipods, two spelaeogriphaceans and three decapods (*Aegla* spp.; Trajano & Bichuete 2009).

Together with the erection of the new genus *Pongycarcinia* for the Bahian isopod, Messana *et al.* (2002) suggested a slight modification of Van Lieshout (1983) diagnosis of the suborder Calabozoidea. They used *Pongycarcinia xiphidiourus* Messana, Baratti & Benvenuti, 2002 to discuss two main hypotheses about the suborder's position, as the phylogenetic position of Calabozoidea had been controversial, based exclusively on the morphological traits of the Venezuelan *Calabozoa pellucida* Van Lieshout, 1983. Since both genera are presently monotypic, we are using the genera names further in the text.

Van Lieshout (1983) suggested possible affinities of *Calabozoa* to both the Asellota and Oniscidea, but she laid greater stress upon the reduction of the first two pleonites and the presumed origin of the respective male pleopods, acknowledging a closer relationship between Calabozoidea and Asellota. Wägele (1989; p. 58, fig. 30) treated latter suborders as sister-groups on the basis of: 1) the reduced telsonic part, terminal anus and subterminally inserted uropods, 2) very small endopodite of male first pleopod, 3) male pleopod II without appendix masculina, with endopodite formed as small gonopodium without swimming setae, 4) female pleopod I smaller than pleopod III and 5) female pleopod II with endopodite smaller than exopodite. He also stated that "...the Oniscidea have a large number of autapomorphies that are absent in *C. pellucida*". Brusca and Wilson (1991) on the other hand, argued that *Calabozoa* appears to possess no asellotan synapomorphies either; antennal peduncle is not 6-articulate and has no scale, pleonites III–V are free, not fused with the pleotelson, male pleopod II doesn't have endopod transformed into an elongate geniculate gonopod and exopod modified to work with the latter in sperm transfer as

possibly the unique asellotan spermathecal duct. They reexamined specimens of *Calabozoa* and found Van Lieshout's illustrations and description misleading, emphasizing the taxonomical importance of the pleon and pleopod morphology. The latter was also emphasized by Tabacaru and Danielopol (1999), as well as by Messina *et al.* (2002). They used the synapomorphies manifested in *Pongycarcinia* (especially the free, well developed pleonites III–V) to support the theory of a phylogenetic closeness between Calabozoidea and Oniscidea. Finally, despite his initial disagreement with the proposed calabozoid-oniscidean relationship (Wägele 1989, 1991), in the latest reconstruction of the isopod phylogeny also Wägele (Dreyer & Wägele 2002) placed *Calabozoa* conditionally to the newly introduced taxon Scutocoxifera, i.e. together with all isopod suborders with lateral coxal plates in contrast to Asellota and Phreatoicoidea with the ring-shaped coxae.

Discovery of a further troglobiotic species in Bahia fulfilled predictions of Messina *et al.* (2002) that a more detailed search may bring about a finding of further interesting isopods in the region. Here we describe an aberrant, tiny troglobiotic isopod whose taxonomic relationships are not yet clear. We compare it with *Calabozoa* and *Pongycarcinia*. For the latter, we provide some morphological details that are missing in the original description, as well as a new locality record, extending its distribution range. We also discuss previously assumed relationships of Calabozoidea considering new morphological evidence.

Material and methods

Specimens used for the description of the new taxon were mounted either in Hoyer's medium or in glycerol-gelatine on slides and photographed with a Sony DXC-390P digital camera mounted on a stereomicroscope (Olympus ZZX 9). Body and appendage proportions were then measured on photographs with the Cell^B 2.8 Imaging program. For drawing of selected morphological details, 3 females and 2 males were dissected, mouth appendages were mounted in glycerol-gelatine on slides while pereopods and bodies were first kept in heated KOH solution at ~70°C for 2 hours and stained with Trypan blue afterwards (e.g. Prevorčnik *et al.* 2004). Due to the rigid crustacean exoskeleton, the procedure had no observable influence on the reliability of measurements. Meristic characters were counted directly under the microscope (Opton). The male holotype was temporarily mounted in glycerol without a prior dissection, photographed and measured as described above, but handled with utmost care to avoid damaging. One male specimen was glued on an aluminum foil using a double-sided adhesive carbon tape and then secured to an aluminum support stub. The specimen was sputter-coated with gold (Baltec SCD 050), and examined in a LEO EVO 40 XVP scanning electron microscope (Leo Electron Microscopy). The SEM preparation technique caused deformation in pleopod III–V but no artifacts seem to be present on pleopod I–II. The type material is deposited in the Carcinology collection of the Museu Nacional, Rio De Janeiro, Brazil (MNRJ), in the collection of subterranean invertebrates of the Universidade Federal de Lavras (ISLA/UFLA) and in the Zoological collection of the Slovenian Univerza v Ljubljani, Biotehniška fakulteta, Oddelek za biologijo (OBBFUL). One male and one female of *Pongycarcinia xiphidiourus* from the type locality were partly dissected and mounted in glycerol-gelatine on slides for measuring and drawing, as described above. Other specimens were temporarily mounted in glycerol without prior dissection, photographed and measured as described above. The material is deposited in the collection of subterranean invertebrates of the Universidade Federal de Lavras (ISLA/UFLA) and in the Zoological collection of the Slovenian Univerza v Ljubljani, Biotehniška fakulteta, Oddelek za biologijo (OBBFUL).

Taxonomy

Brasileirinidae fam. nov.

Diagnosis. Body dorsoventrally depressed, pleon slightly concave. Pleonites I and II small, but not reduced to sternal parts. Pleotelson of pleonite VI and telson, reaching only about 1/5 of body and less than 45% of pleon length. Pleopods I and II absent in females, uniramous and apparently modified for copulatory purpose in males. Respiratory pleopods III–V present in both sexes, mutually similar, ramus small, tumescent, with transverse suture in the middle; other ramus absent or highly reduced (pleopods apparently uniramous).

***Brasileirinho* gen. nov.**

Diagnosis. With characters of Brasileirinidae fam. nov. Antenna II flagellum of less than 10 articles. Long styliform uropods, inserted laterally, their tips slightly surpassing pleotelson apex.

Type species. *Brasileirinho cavaticus* sp. nov.

***Brasileirinho cavaticus* sp. nov.**

(Figs 1–5, 6A–D)

Material examined. Holotype. Male, 1.7 mm, MNRJ 22765, phreatic pond in Baixa Funda cave, Paripiranga, Bahia State, Brazil, lat: 10°42' 24.8"S, long: 37°55' 54.4"W, 400 m a.s.l., water depth 0.2 m, water temperature 26.5°C, pH 7.4, conductivity 0.21 S/m, dissolved oxygen 3.3 mg/l, leg. R.L. Ferreira, 10.01.2009. Preserved in 70% ethanol. **Paratypes.** Male, 1.8 mm, prepared for SEM inspection, ISLA 1452; 6 specimens (2–2.7 mm, presumably females) mounted with Hoyer's medium on 3 slides, ISLA 1453–1455; 15 specimens (no male or ovigerous female) preserved in 70% ethanol, ISLA 1456; 3 specimens (2.3–2.5 mm, presumably females) dissected and mounted in glycerol-gelatine on slides, OBBFUL I0001–I0003; 10 specimens (no male or ovigerous female) preserved in 70% ethanol, OBBFUL I0004–I0013, all specimens same collection data as holotype. Other material. Two males, 1.9 mm and 1.6 mm, dissected and mounted in glycerol-gelatine on two slides OBBFUL I0014–I0015, locality as holotype, leg. R. L. Ferreira, May 2010; 16 males, preserved in 96% ethanol, ISLA 1507; 131 presumable females (no ovigerous), preserved in 96% ethanol, ISLA 1508–1520, locality as holotype, leg. R. L. Ferreira, May 2010.

Diagnosis. *Brasileirinho* species with oblong-oval body, dorsoventrally depressed, transparent-whitish (Fig. 6B–D). Head shield semicircular, approximately as long as pleotelson, eyes absent. Body length about 3 times body width; pleonites I–II much smaller than pereonites in length and width, visible dorsally, pleonites III–V as long as pereonites, pleotelson length not exceeding 1/5 of body length. Male pleopods I–II uniramous and biarticulate, distal articles almost twice as long as proximal. In pleopod I, distal article, flat and bicuspidate distally; in pleopod II, distal article elongated conical. Female pleopods I–II absent. Pleopods III–V half of length of pleonites, uniramous, circular, with longitudinal suture. Styliform uniramous uropods nearly reaching telson's tip.

Description. Holotype and male paratype (values given in parentheses) description.

Body 1.7 mm (1.6–1.9 mm) long, 2.8 (3.0–3.2) times as long as wide (Fig. 1Bm); dorsoventrally depressed, with almost flat dorsum, pleon even slightly concave (Fig. 6B–D), transparent-whitish, surface seemingly smooth, but cephalon and pereonites I–VI dorsally with 4 short setae and pereonite VII and pleonites I–II with two short setae each. *Head* shield subtriangular, 1.7 (1.8–2.2) times as wide as long; with a short but distinct clypeus. No eye structures visible, neither on the surface, nor within tissue. *Pereonites* subtrapezoidal, with rounded epimeral angles, pereonite V widest. Lateral and posterolateral margins of pereonites with 4 delicate setae each. *Pleon* length only 38% (39%) of body length; pleonites I–II visible dorsally, length of each about 50% of pereonite VII length and with one seta posterolaterally; pleonite III–V length each of about pereonite VII length and with two setae posterolaterally; pleotelson length 17% (up to 20%) of body length, with one shorter and one longer seta submarginally on anterolateral ventral surface and 3 setae at posterolateral telsonic angle, longest seta length 140% (100–140%) of pleotelson length. *Male genital papilla* (Fig. 4Plm, Fig. 4Pe-Plm, Fig. 5) placed medially on the articulating membrane between pereonite VII and pleonite I, protected ventrally by sclerotized shield.

Antenna I (antennula)(Fig. 1AI) length about 23% of body length, length relations of peduncular articles 1–3 (from first to third) 1: 1.8 (1.7–1.8): 1.8 (1.7–1.8); flagellum of single article, 1.4 (from 1.2) times as long as first peduncle article, with one aesthetasc apically, aesthetasc length 90% (85–90%) of flagellum length.

Antenna II (antenna; Fig. 1AII) length about 47% of body length, relations of peduncular articles 1–5 (from first to fifth) 1: 1 (0.9): 1.7 (2): 5.2 (5.4): 6.4 (6); flagellum of 6 articles, its length about 134% (130–134%) of peduncular length.

Mandibles without palp and molar process (pars molaris). Right mandible (Fig. 2Mdm(R)) incisor (pars incisiva) with 4 sclerotized cusps, lacinoid spine sclerotized and bifurcate, spine row reduced to a single pappose (with dense setules loosely arranged about the shaft in a seemingly random manner) robust seta. Left mandible (Fig. 2Mdm(L)) similar, lacinia mobilis 4-cuspidate.

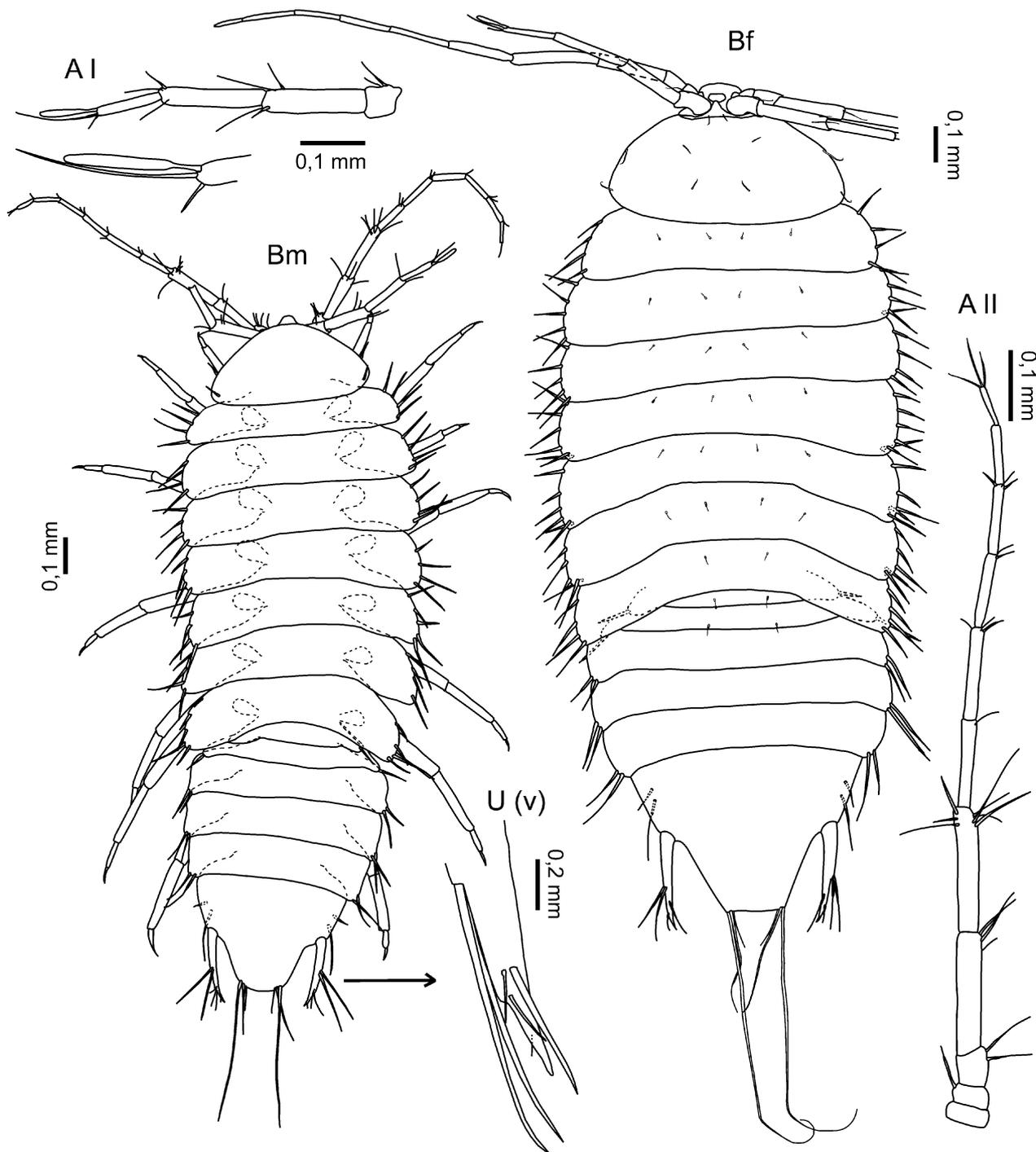


FIGURE 1. *Brasileirinho cavaticus* n. sp., n. gen., n. fam., Baixa Funda cave, Paripiranga, Bahia, Brazil, holotype, 1.7 mm: Bm, body, dorsal view; U (v), uropod, distal part, ventral view; female, 2.4 mm: A I, II, antennae I–II; Bf, body, dorsal view.

Maxilla I (maxillula; Fig. 2MxI) lateral lobe from lateral to medial with 4 (4–5) simple robust setae, 4 (4–5) dentate robust setae and 1 simple robust seta with one median denticule on outer side, at the inner basis of the setal row also 2 stocky simple setae, inner margin with 2 simple setae; mesial lobe distally with 1 short and 1 longer pappose robust seta and 1 sclerotized biserrate seta.

Maxilla II (maxilla; Fig. 2MxII) lateral and middle lobe with 6 curved pectinate robust setae each, mesial lobe from lateral to medial with 2 long sclerotized plumose setae and 6 shorter biserrate setae with 2 simple setae at the base of the row, outer margin distally with pseudochaetae.

Maxilliped (Fig. 2Mxlp) with complex endite of two lobes, smaller inner lobe apically with 6 (6–8) simple setae, inner margin and submarginal surface with numerous pseudochaetae, larger outer lobe on inner margin with

3 sclerotised biserrate setae and numerous short simple setae, two pappose robust setae on apex and 5 long plumose setae on outer margin; palp of 5 articles, first article fused with maxilliped body, articles 2–3 with long simple setae at distal medial angles, article 5 smallest, with tuft of setae distally.

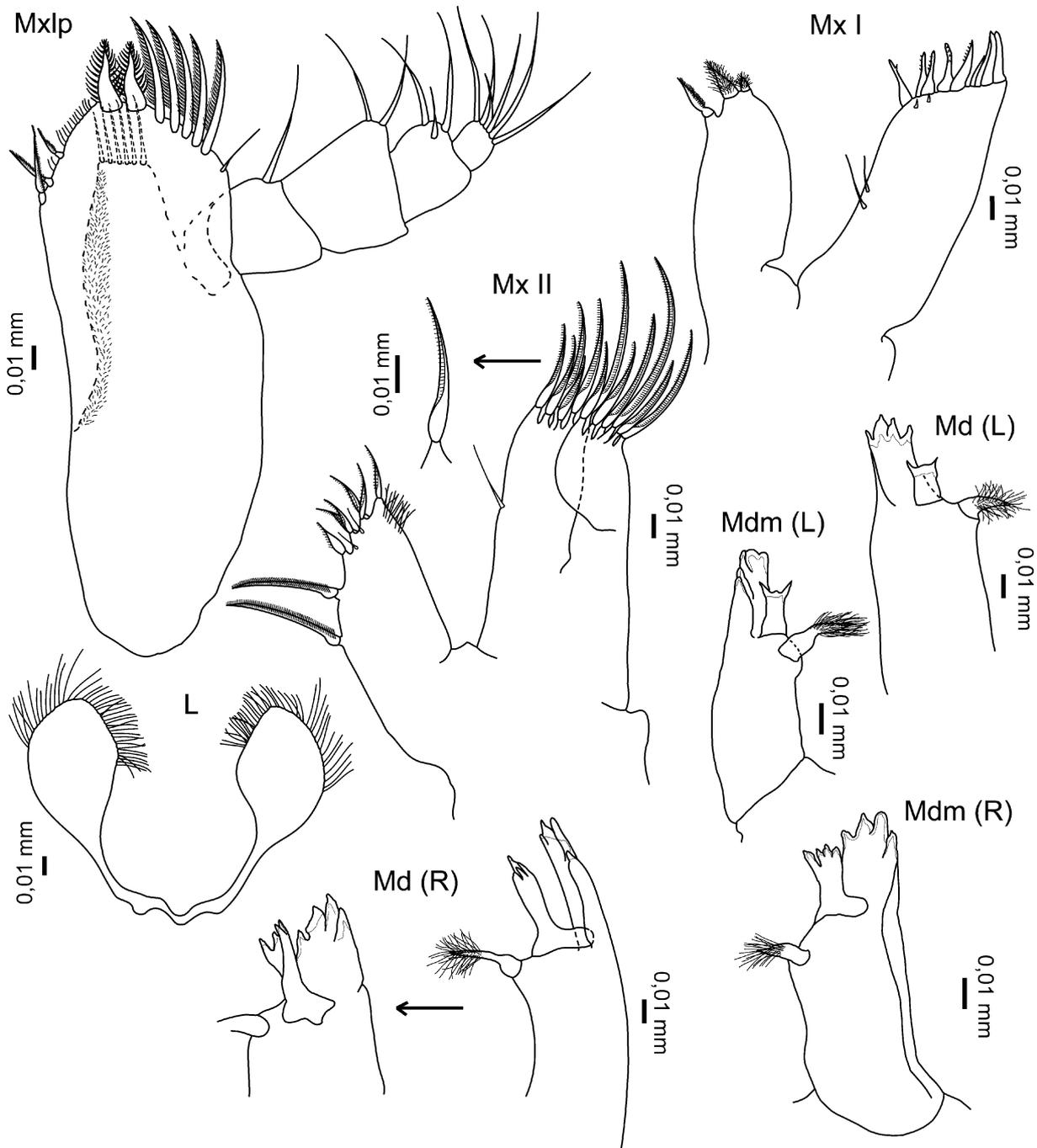


FIGURE 2. *Brasileirinho cavaticus* paratype male, 1.9 mm: Mdm (L), left mandible with lacinoid spine, dorsal view; Mdm (R), right mandible with *lacinia mobilis*, dorsal view; female, 2.4 mm: L, lower lip; Md(L) and Md(R), mandibles s in males; Mx I, II, left maxillae I–II, ventral view; Mxlp, left maxilliped, ventral view.

Pereopods do not display serial gradation of orientation: pereopods I–IV oriented forward, pereopods V–VII oriented backward. Pereopod I (Fig. 3PeI) ambulatory, but reminiscent of subchelae due to extremely short carpus (article 5) and somewhat widened propodus (article 6); lateral coxal plate large, completely fused with pereonite I; pereopod length 31% (28–31%) of body length, length relations of articles from basis (article 2) to dactylus (article 7) 1: 0.22 (0.22–0.24): 0.39 (0.38): 0.22 (0.21–0.22): 0.67 (0.65–0.67): 0.33 (0.32–0.36), unguis length 50% (50–57%) of dactylus length; superior distal angle of merus (article 4) with 2 long setae with hairy apical transverse

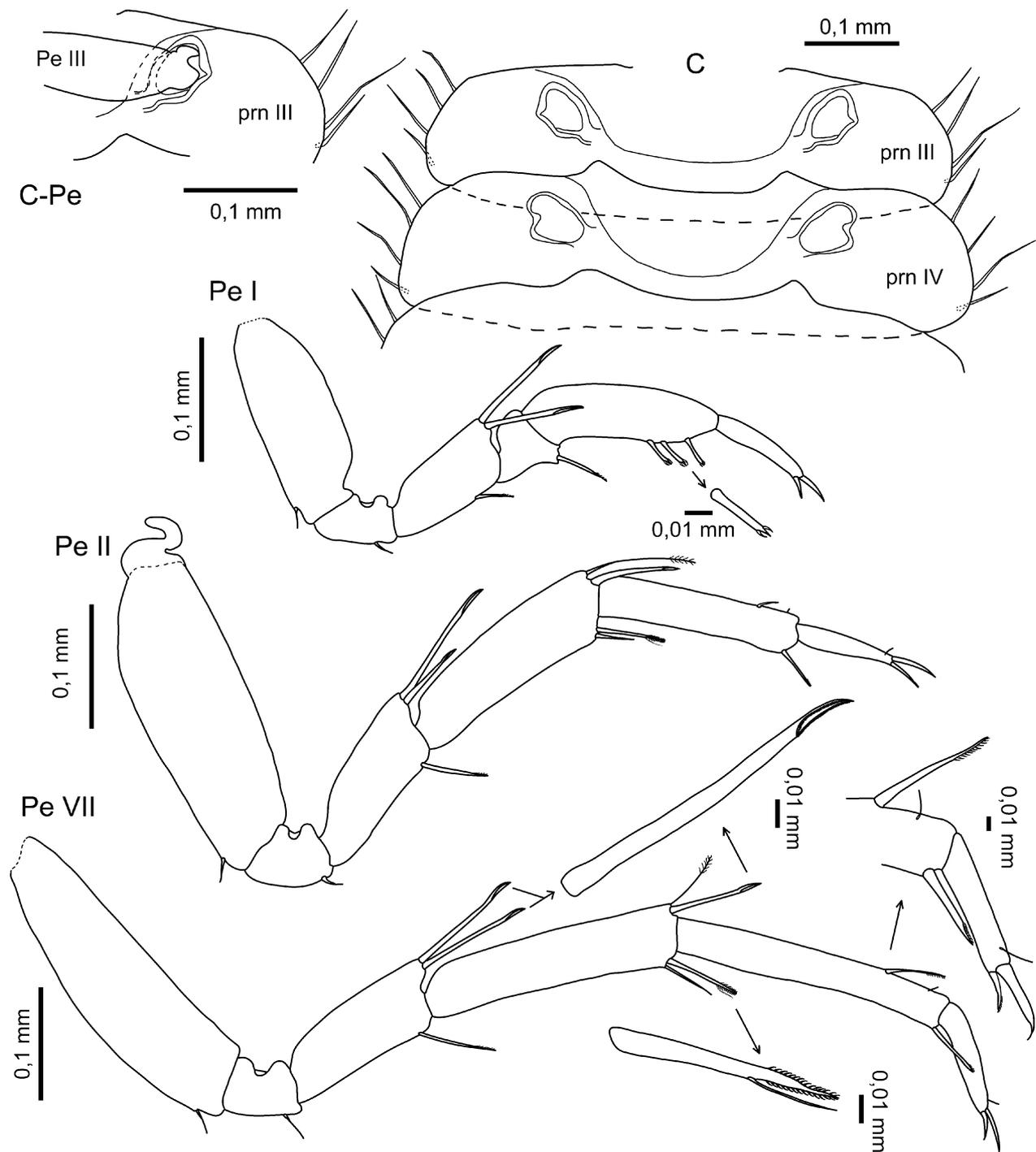


FIGURE 3. *Brasileirinho cavaticus* female, 2.4 mm: C, pereonites (prn) III–IV with coxae, ventral view; C-Pe, pereopod III insertion on the pereonite III (prn III); Pe I, II, VII, pereopods I, II and VII.

cutting (*sensu* Messana *et al.* 2002), inferior margins of basis, ischium (article 3) and merus with one finely serrate seta each, inferodistal angle of carpus with one apically plumose seta with whip-shaped median hair, inferior margin of propodus with 3 biserrate setae, secondary unguis finely serrate. Pereopods II–VII (Fig. 3PeII, Fig. 3PeVII) ambulatory, mutually similar in shape and setation, increasing in length; coxae (Fig. 3C, Fig. 3C-Pe) expanded laterally into flattened lateral coxal plates (completely fused dorsally with their respective pereonites) and inwardly over sternum, as sternal coxal plates; inferior margins of articles from basis to propodus with one finely serrate seta, on carpus additionally one longer apically plumose seta with whip-shaped median hair, superior distal angles of merus and carpus with two long setae with hairy apical transverse cutting and with one long seta with hairy apical transverse cutting and one long penicillate seta, respectively, superior margin of propodus with

longer finely serrate seta and shorter simple seta, superior margin of dactylus with short simple seta; unguis and secondary unguis with acute apices, latter finely serrate. Pereopod II length 41% (38–41%) of body length, length relations of articles from basis (article 2) to dactylus (article 7) 1 : 0.14 : 0.48 : 0.67 : 0.62 : 0.29 and 1 : 0.14–0.15 : 0.46–0.49 : 0.65–0.70 : 0.61–0.65 : 0.27–0.29 in holotype and other males, respectively, unguis length 67% (66–68%) of dactylus length. Pereopod VII length 50% (48–52%) of body length, length relations of articles from basis (article 2) to dactylus (article 7) 1 : 0.23 : 0.50 : 0.86 : 0.82 : 0.36 and 1 : 0.22–0.26 : 0.51–0.52 : 0.83–0.86 : 0.81–0.84 : 0.34–0.37 in holotype and male paratypes, respectively, unguis length 63% (60–64%) of dactylus length.

Pleopods I–II uniramous, unipartite, modified for copulatory purposes, with identical ventral and dorsal (Fig. 4PlpI(d), Fig. 4PlpII(d)) sides. Pleopod I (Fig. 4Plm, Fig. 5B) protopodite subrectangular, its width about 78% of its length, subrectangular ramus (supposedly exopodite) length about 130% of protopodite length, thick lamellar, vaulted, with acute lateroapical and obtuse medioapical angles. Pleopod II (Fig. 4Plm, Fig. 5B) protopodite obtusely subtrapezoidal, ramus (supposedly endopodite) about twice as long as protopodite, elongated conical and slightly spindle shaped.

Pleopods III–V (Fig. 4Plm, Fig. 4Plf, Fig. 4PlpIII, Fig. 5A) not sexually dimorphic, mutually similar, presumably without or with extremely reduced exopodites, endopodites ellipsoid, tumescent, about 1.25 times as long as wide, with a longitudinal suture. The origin of the subtriangular structures (“scales”) at the basis of each pleopod remains unclear due to the indistinguishable protopodite, hidden in the »vault« formed underneath the distal border of the pleonite. As articulations between structures are vague it is only presumed that structures in question could be exceptionally reduced exopodites.

Uropods (Fig. 1Bm, Fig. 1U(v)) inserted laterally, slightly surpassing pleotelson apex, uniramous, with no visible suture lines, styliform, with acute apex, their length about 50% of pleotelson length; lateral margin with 2 setae, their length about 80% of uropod length, ventral and dorsal surfaces distally with 3 and 5 (4 and 5) shorter setae, respectively.

Description of female. Almost identical to males, except mainly larger, up to 2.7 mm long. *Body* 3–3.5 times as long as wide (Fig. 1Bf), pleotelson (Fig. 4Pltf) with almost straight posterolateral and posterior margins, its length 16–19% of body length, longer submarginal seta length 60–150% of pleotelson length.

Antenna I length 19–21% of body length, length relations of peduncular articles 1–3 (from first to third) 1: 1.7–2: 1.8–2; flagellum 1.2–1.4 times as long as first peduncle article, aesthetasc length only 64–76% of flagellum length. *Antenna II* length 39–42% of body length, relations of peduncular articles 1–5 (from first to fifth) 1: 1–1.1: 1.7–2: 5.7–6: 6–6.2; flagellum of 5–6 articles, its length 130–140% of antenna length.

Mouthparts (mandibles: Fig. 2Md(L), Fig. 2Md(R)) as in males.

Pereopods somewhat shorter than in males, pereopod I, II and VII lengths 24–29%, 32–36% and 42–46% of body length, respectively; length relations of articles from basis to dactylus, as in males.

Pleopods I and II absent (Fig. 4Plf), pleopods III–V as in males.

Uropods (Fig. 1Bf, Fig. 4Pltf) as in males.

Etymology. *Brasileirinho* is a small Brazilian in Portuguese. The animal is less than 3 mm long. Latin word 'cavaticus' meaning living in a cave, refers to its troglobiotic status.

Habitat, ecology and behavior. The Baixa Funda cave is located in the municipal district of Paripiranga, NE of Bahia. A single, 50 m long rectilinear conduit descends gently from the entrance towards a small pond at the cave's far end. In January 2010, the length and the width of the pond were about 5 and 1.5 m, respectively. However, water level variation of more than a meter could be inferred from the “tide marks” on the conduit walls. In May 2010, the level of the pond was about 30 cm lower, and water parameters were: temperature, 26.5°C; pH, 7.4; conductivity, 0.21 S/m; dissolved oxygen, 3.3 mg/l.

While some specimens were assembled on a submerged guano patch (Fig. 6A), countless specimens were walking around in the observable area of the pond. On both occasions, the population consisted of few thousands of individuals. During the first collection the majority of specimens were observed assembling on the bottom of the pond. Nevertheless, due to the extremely fine sediments which would be easily disturbed the sampling and observing were confined to the pond margin. The deepest part of the pond remained uninspected.

The individuals were roaming the bottom, stopping randomly. At times they entered small cracks present in the substrate, but they were not observed to bury themselves into the fine sediment. No specimen was caught swimming. Moreover, individuals that accidentally fell off the brush during collection were passively sinking down to the bottom, demonstrating clearly their swimming inability.

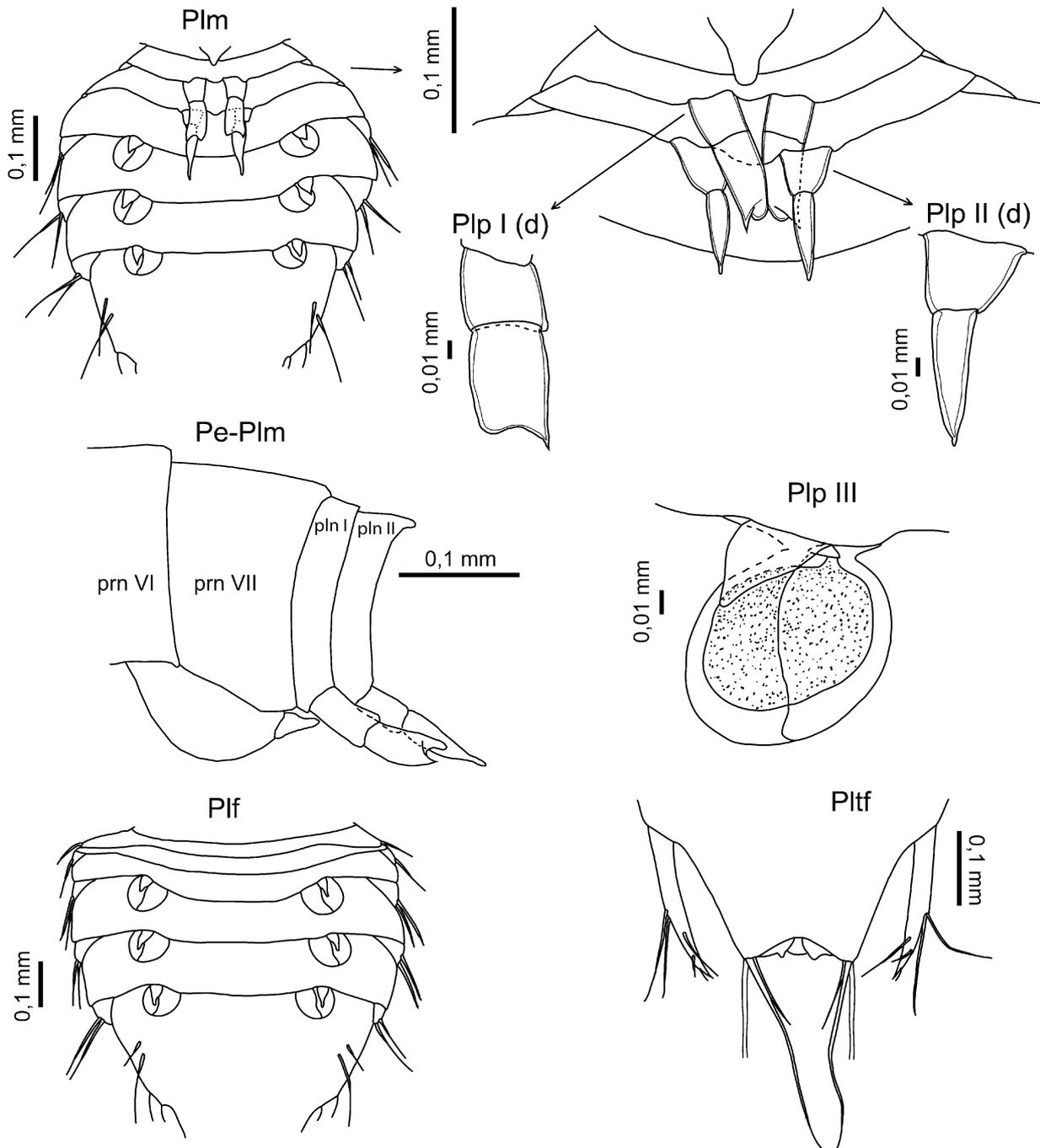


FIGURE 4. *Brasileirinho cavaticus* holotype: Plm, pleon with pleopods, ventral view; Plp I (d), II (d), pleopods I–II, dorsal view; Pe-Plm, last two pereonites (prn) and first two pleonites (pln) with pleopods, lateral view; female, 2.4 mm: Plf, pleon with pleopods, ventral view; Plp III, pleopod III, Pltf, distal part of pleotelson, ventral view.

No agonistic behavior was observed. As the population density was high, specimens were found to bump into each other frequently, changing their direction consequently. Some smaller individuals (maybe immature) were observed to walk over larger individuals. Specimens were exhibiting no phototactic behavior, neither positive, nor the negative.

The observed sex ratio was highly biased in *Brasileirinho*; in the January sample we've only got 2 males (4%) for 49 females while in the May sample, 16 males (12%) for 131 females have been found. There were no signs of gravidity in the females: neither visible eggs within the body nor developed oostegites in any of 180 sampled female specimens.

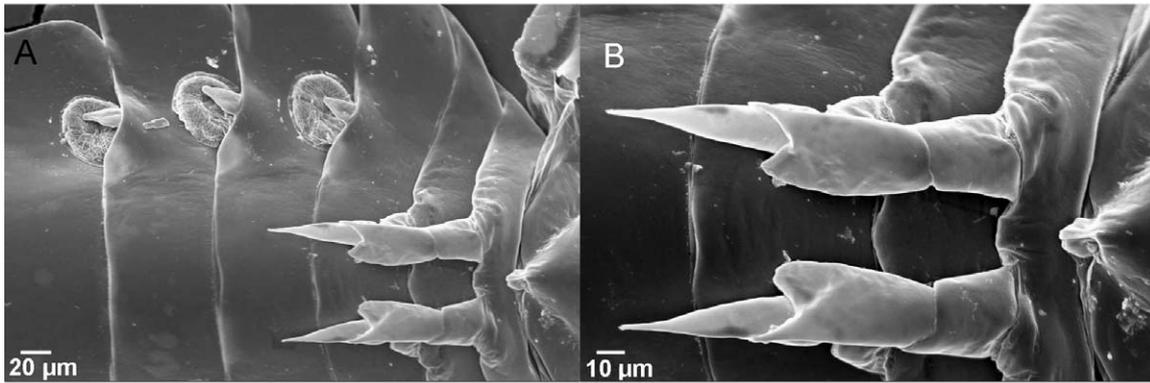


FIGURE 5. *Brasileirinho cavaticus* paratype male, 1.8 mm: SEM photo of A, pleon (ventral view) with pleopods I–V; B, pleopods I–II.

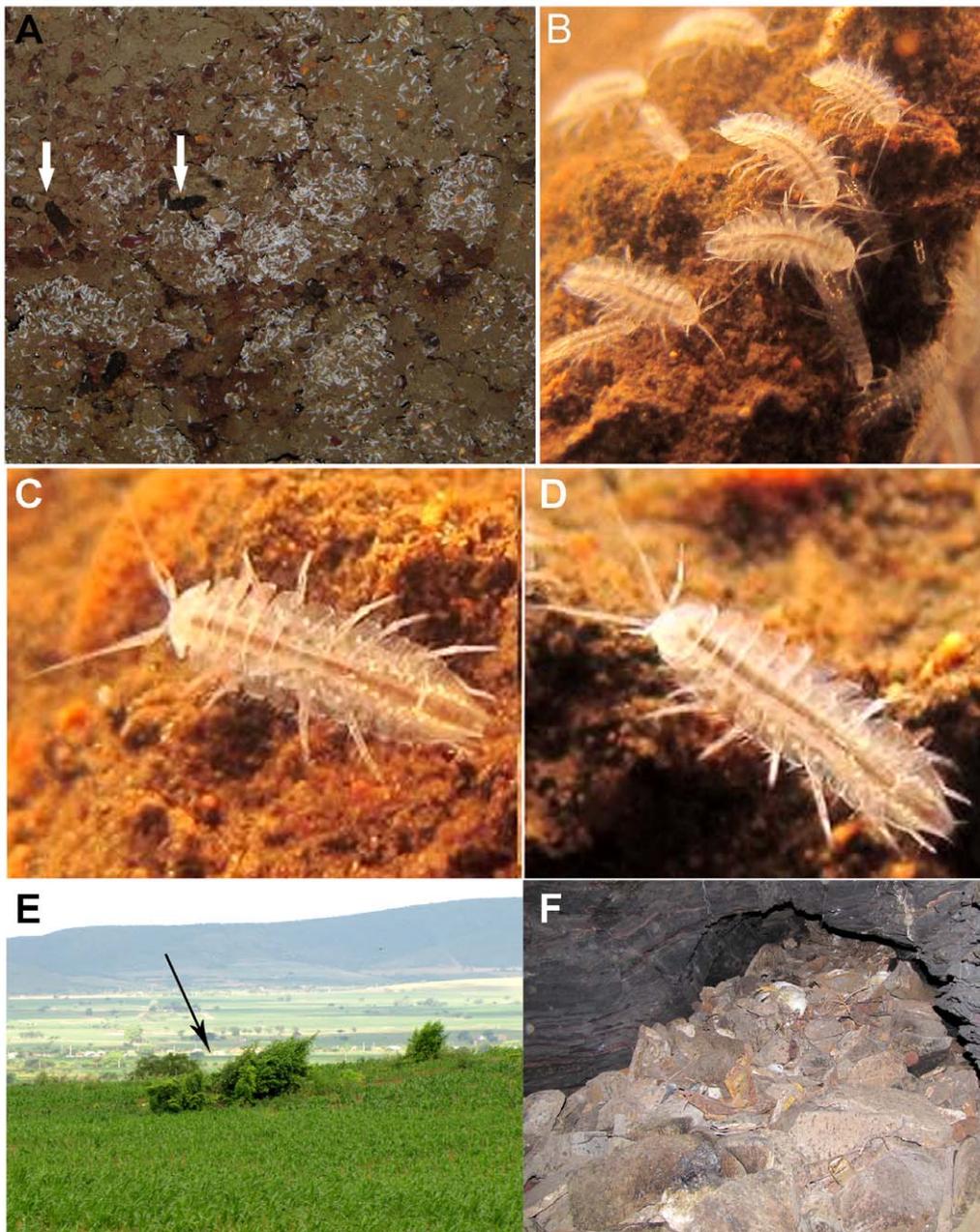


FIGURE 6. A, *Brasileirinho cavaticus* assembled on the bottom of the pond in the Baixa Funda cave, arrows denote guano particles; B–D, specimens (magnified) at the same locality; E, the Baixa Funda cave surroundings with denoted cave entrance; F, cave entrance filled with the household waste.

There were no apparent predators in the pond, which could explain high population density, as well as the absence of agonistic or cryptobiotic behavior in *Brasileirinho*. The only cohabitants in the pond seem to be oligochaetes, copepods and bathynellaceans. The only visible food resource present at the bottom of the lake was guano and *brasileirinhos* apparently fed on it. Almost all specimens had their intestine filled with a dark-colored content.

Calabozoidae Van Lieshout, 1983

Type species. *Pongycarcinia xiphidiourus* Messana, Baratti & Benvenuti, 2002

Material examined. Juvenile male, 2.8 mm, OBBFUL I0016 and mature female, 3 mm, OBBFUL I0017, both Toca do Gonçalves, Campo Formoso, Bahia State, Brazil, lat: 10°30'41"S, long: 40°53'39.8"W, 546 m a.s.l., leg. R. L. Ferreira, 28.12.2010, partially dissected and mounted on glycerol-gelatine on two slides; 2 juvenile males, ISLA 1505 and 1 mature female, ISLA 1506 all in 96% ethanol; 6 mature females, OBBFUL I0016, Toca da Jurema, Várzea Nova, Bahia State, Brazil, lat: 11,0563567S, long: 41,092988W, leg. R. L. Ferreira, 20.07.2008.

Male and female supplementary description (Figs 7 and 8)

Mandibles without palp and molar process (pars molaris). Right mandible with bipartite incisor (pars incisiva), each part with 4 sclerotized cusps, lacinia mobilis short, with 3 indistinct cusps and spine row reduced to a single pappose robust seta. Left mandible similar but with one-part incisor and sclerotized lacinoid spine with densely serrated bifid apex.

Pleopods in males and females biramous, only pleopods II show strong sexual dimorphism. Juvenile male pleopod I as female pleopod I, protopodite obtusely subtrapezoidal, endopodite narrow ellipsoidal, elongate, about 1.7 times as long as protopodite, with apical plumose seta about 1.7 times as long as endopodite, exopodite lamellar, subtriangular, about 2.6 times as long as endopodite, with 4 plumose setae along distal margin. Juvenile male pleopod II exopodite lamellar, ellipsoid, about half as long as wide, with 7–8 plumose setae on internal and distal margins, both endopodites elongated, blade-like, but left endopodite with obtuse instead of pointed apex, its length about 85% of right endopodite length. Female pleopod II endopodite elongated oval, with apical plumose seta, lamellar exopodite ellipsoid, about 2 times as wide as long and about 2 times as long as endopodite, with 3 long plumose setae on internal and 5 shorter plumose setae on apical margin.

Uropods long styliform, greatly surpassing the pleotelson apex.

Habitat. The Toca do Gonçalves cave is one of the most affected caves in the Brazilian Caatinga formation, due to the impact of human utilization. It is located in a small village, representing its only water source. For decades, people are extracting water from the cave using a diesel-water pump which releases smoke into the cave atmosphere and oil into phreatic waters. But the pump is used only once a week, for a short period that allows refilling of the external water reservoirs. That was a compromise between cave conservation principles and socio-economic issues accepted due to the extreme poverty of villagers. However, in 2010 an additional electric water pump was installed inside the cave, by a farmer from another village. He had turned the pump on early each morning and kept pumping water throughout the day for the purpose of irrigation. This pump caused a severe decrease in the phreatic level of more than 1 m. After our visit to the cave in December 2010, we've informed the Brazilian Agency of the Environment about the situation. The Agency negotiated with the Municipal Council to promote the installation of an artesian well outside the cave and enable the removal of both water pumps.

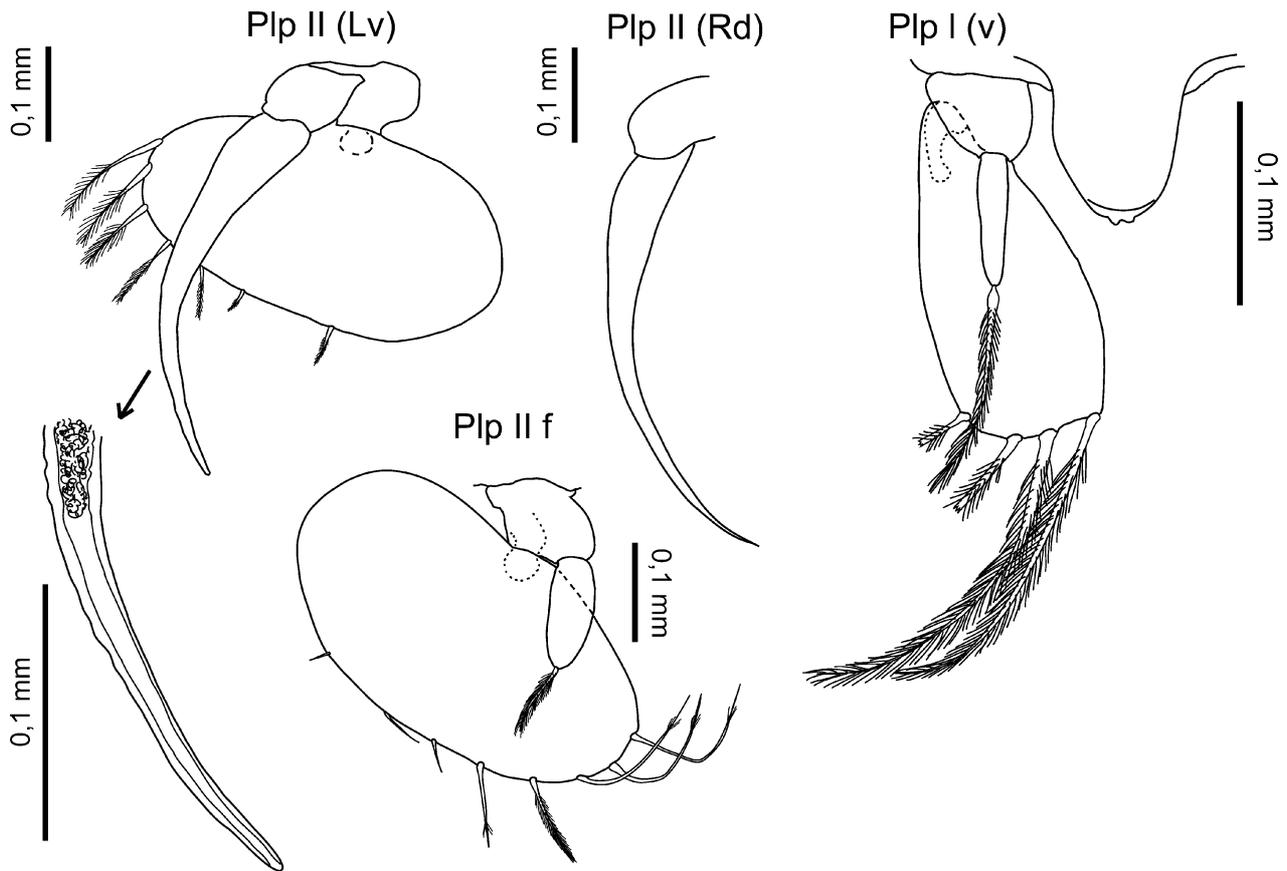


FIGURE 7. *Pongycarcinia xiphidiourus*, Toca do Gonçalves, Campo Formoso, Bahia State, Brazil, supposedly juvenile male, 2.8 mm: Plp I (v), pleopod I, ventral view; Plp II (Lv), left pleopod II, ventral view; Plp II (Rd), endopodite of pleopod II, dorsal view; female, 3 mm: Plp II f, pleopod II.



FIGURE 8. *Pongycarcinia xiphidiourus*, Toca da Jurema, Várzea Nova, Bahia State, Brazil.

More than a decade ago, the pH of water was 6.99, temperature 26.38 °C, dissolved oxygen 1.06–2.49 mg l⁻¹ and conductivity 1.47 μScm⁻¹ (Messana *et al.* 2002). In mid-June 2012 the water parameters were: pH 7.63, temperature 26.5 °C, dissolved oxygen 2.04 mg l⁻¹ and conductivity 1.63 μScm⁻¹. Despite the fact that the first measurements were taken with the water pump still operating and the latter were taken after its removal, the values of measured parameters did not change significantly. This could eventually indicate that a “buffer effect” of the phreatic water circulation had protected the aquatic cave fauna from the long lasting human effects.

Discussion

Comparative morphology of the new species. The overall habitus of the newly discovered species generally corresponds to the habitus of the other two calabozoids (Table 1), differing mainly by its small pleotelson, well developed pleonites III–V and laterally inserted long uropods that only slightly surpass the apex of pleotelson. The similarities and differences among the three species, as well as a comparison with other isopod orders (see Table 2: for comparison with Oniscidea and Asellota) are provided below.

All three species have similar architecture of the mouth appendages and both pairs of antennae. Though we are aware that no thorough understanding of pattern and homology among mandibular structures (molar process, spine row, lacinia mobilis) has been achieved, we believe that treating the molar as absent (like in Messana *et al.* 2002) is adequate. Namely, no mesially directed mandibular process was detected in our specimens. Furthermore, considering also Van Lieshaut's (1983) figures of *Calabozoa* (p. 168, fig. 2E) and mandibular descriptions given in several isopod references (Wägele 1989, Schmalzfuss 1974, Serov & Wilson 1999), the homology between the calabozoid pappose seta and the spine row of other isopods, seems more plausible than the presence of highly derived pointed (i.e. pappose) and articulated molar without grinding surface. Although there are several taxa without the molar process within Isopoda (listed in Brusca & Wilson 1991) and losses are considered to be “weak” (i.e. less reliable) characters while they occur more easily than gains, negative characters might “contain phylogenetically useful information on restricted parts of the phylogenetic tree” (Strauch 1984). So together with the unique pappose seta and a bifurcate sclerotized lacinoid spine (*sensu* Bruce 1994; in Limnoriidae) on the left mandible, the loss of the molar represents a shared derived character of all three calabozoids. In contrast, the lack of a mandibular palp in calabozoids and oniscids might be treated as a character of the groundpattern of both taxa. We agree with Wägele (1994) that as it is not possible to distinguish between homologies and convergencies without further knowledge about their genetic background, this loss should not be used as a synapomorphy (as proposed by Brusca & Wilson 1991) of both suborders. Also individual species or genera within other crustacean families display this particular reductive trait.

A shared derived character of all three calabozoids is also the 1-articulate flagellum of antenna I with one apical aesthetasc. Except for the fact that such extreme flagellar reduction is neither due to the exploitation of parasitic nor interstitial habitats, two of the most common conditions in which the reductions occur in isopods, we can provide no adequate explanation for it. Various and presumably non-homologous reductions of the antennae I are present in at least some species of each isopod suborder, omitting the reliability of the character at the suborder level. The position of the antennae I, on the other hand, reveals that calabozoids lack one of the unique oniscidean apomorphies, i.e. antennae I inserting between antennae II. Brusca and Wilson (1991) scored this character (char. 22) as undecided (?) instead of plesiomorphic (0)—i.e. antennae I inserting dorso-medially to (above) antennae II, in calabozoids. On the other hand both, calabozoids and oniscideans share a derived antenna II peduncle (5-articulate and without an antennal scale) in contrast to the asellotan 6-articulate peduncle with an antennal scale.

Pereopods of *Brasileirinho* superficially resemble those in the other two calabozoid species i.e. all 7 pairs are ambulatory, but they are not monomorphic. Based on the shape of pereopod I, particularly in *Pongycarcinia* (Messana *et al.* 2002, p. 248, fig. 4a) with its greatly shortened carpus and widened propodus (articles 5–6), we believe that pereopod I of calabozoids represents a subchela in regression. Although in most asellotes a prehensile subchela of pereopod I is strongly developed a similarly shaped (i.e. “regressed”) subchela may be found in some of the smallest members of the asellote genus *Proasellus*, in taxa of the aggregate *Proasellus deminutus* (Sket 1959). Although *Brasileirinho* and *P. deminutus* are both of the same size, the described character is apparently not strongly linked to their smallness as the equally sized *P. parvulus* (Sket 1960) has well developed subchelae (Sket 1965). On the contrary, one of the unique apomorphies of oniscids should be non-subchelate pereopod I (Wägele 1989, p. 232). However, in a rhithral oniscidean genus *Macedonethes* Buturović, 1955, even 4 anterior pereopod pairs are subchelate (Karaman 2003, p. 10, fig. 4a–d).

Pereopodal coxal lateral and sternal plates developed in *Brasileirinho*, *Pongycarcinia* (both pers. obs.) and *Calabozoa* (Van Lieshaut 1983), classify calabozoids within Scutocoxifera (Wägele 2002) contrary to asellotes with the ring-like coxae. In contrast to other Scutocoxifera, however, not only the first but all lateral coxal plates are completely fused to their respective pereonites (Van Lieshaut 1983, Brusca & Wilson 1991, pers. obs.) in calabozoids. Coalescent plates were considered as apomorphies by Racovitza (1912). So the total coalescence of all lateral and sternal coxal plates can be regarded as convincing autapomorphy of the Calabozoidea.

TABLE 1. Morphological characters of *Brasileirinho cavaticus* n. sp. in comparison with *Calabozoa pellucida* and *Pongycarcinia xiphidourus*.
 *--observation of Brusca & Wilson (emended original description); "--our emended description; #--sensu Bruce (1994; in Limnoriidae)

	<i>Brasileirinho cavaticus</i> n. sp.	<i>Pongycarcinia xiphidourus</i>	<i>Calabozoa pellucida</i>
Antenna I	uniramous, without scale peduncle of 3, flagellum of 1 article, with 1 aesthetasc inserted dorso-medially to (above) antenna	as in <i>Brasileirinho</i>	as in <i>Brasileirinho</i>
Antenna II	uniramous; peduncle of 5 articles flagellum of 5–6 articles	as in <i>Brasileirinho</i> flagellum of >10 articles	as in <i>Brasileirinho</i> flagellum of 26–32 articles
Mandible	palp and <i>pars molaris</i> absent spine row replaced by 1 pappose seta <i>lacinia mobilis</i> present on right mandible bifurcate hitinized lacinoid spine [#] present on left mandible right <i>pars incisiva</i> unipartite	as in <i>Brasileirinho</i>	as in <i>Brasileirinho</i>
Maxilla I	palp absent mesial lobe with 2 pappose setae and 1 sclerotized biserrate seta	right <i>pars incisiva</i> bipartite as in <i>Brasileirinho</i>	right <i>pars incisiva</i> bipartite as in <i>Brasileirinho</i>
Maxilla II	with three endites bearing setae	mesial lobe with 2 pappose setae and 2 glabrous bottle- shaped setae	mesial lobe with 2 pappose setae and 2 sclerotized biserrate setae
Maxilliped	no coxal sclerite and epipodite palp reduced relative to basis (shorter than basis) basal endite without retinacula on inner margin	as in <i>Brasileirinho</i>	as in <i>Brasileirinho</i>
Pereopods	pereopods II–VII monomorphic, ambulatory pereopod I with short carpus and widened propodus, reminiscent of subchelae, ambulatory	as in <i>Brasileirinho</i>	as in <i>Brasileirinho</i>
Coxae	forming lateral and sternal coxal plates, fused completely to their respective pereonites	as in <i>Brasileirinho</i>	as in <i>Brasileirinho</i>
Pleonites	pleonites I–II short, but visible dorsally pleonites I–V free	as in <i>Brasileirinho</i>	pleonites I–II reduced to sternal plates as in <i>Brasileirinho</i>
Pleotelson	of pleonite VI and telson its length about 18% of body and 45% of pleon length	as in <i>Brasileirinho</i> its length about 30% of body and 75% of pleon length	as in <i>Brasileirinho</i> its length about 30% of body and 75% of pleon length
Telsonic part	its length about 50% of pleotelson length	its length about 15% of pleotelson length	its length about 18% of pleotelson length

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TABLE 1. (continued)

	<i>Brasileirinho cavaticus</i> n. sp.	<i>Pongycarcinia xiphidourus</i>	<i>Catbozoa pellucida</i>
Male pleopod I	uniramous (juvenile?) presumable exopodite lamellar, subrectangular, vaulted	in juvenile ⁴ ; biramous, identical to female pleopod I endopodite narrow ellipsoid, small exopodite unipartite, lamellar, subovoid, large	biramous endopodite tiny (at the border of both exopodite parts*) exopodite bipartite, pediform, large
Male pleopod II	uniramous (juvenile?) presumable endopodite elongate conical, spindle-shaped exopodite reduced	in juvenile ⁴ ; biramous endopodite bipartite, strongly elongated, narrow, sickle-shaped, large exopodite unipartite, lamellar, ellipsoid, large	biramous endopodite unipartite (bipartite ⁶), strongly elongated, plump proximally, sickle-shaped distally, large exopodite unipartite (bipartite ⁶), lamellar, subtriangular, small
Female pleopod I	absent (juvenile?)	biramous; as juvenile male pleopod I (above)	biramous; endopodite narrow conical, small exopodite lamellar, oval, large
Female pleopod II	absent (juvenile?)	biramous; endopodite ellipsoid, small ⁷ exopodite lamellar, ellipsoid, large ⁷	biramous; endopodite narrow oval, elongated, small exopodite lamellar, subovoid, large
Pleopods III–V	uniramous?, respiratory endopodite, thick, tumescent, with transverse suture exopodite absent (extremely reduced?)	biramous endopodite lamellar, with transverse suture, small, respiratory exopodite lamellar, ovoid–rounded oval, large, natatory	biramous endopodite lamellar, with transverse suture, small, respiratory exopodite lamellar, ovoid–rounded oval, large, natatory
Genital papillae (male)	basally fused on articulating membrane between pleonite I and pereonite VII protective lamella on pereonite 7	as in <i>Brasileirinho</i>	as in <i>Brasileirinho</i>
Uropods	uniramous, without visible suture lines long, styliform inserted laterally, uropod tip slightly surpassing pleotelson apex	as in <i>Brasileirinho</i> inserted laterally, uropod greatly surpassing pleotelson apex	as in <i>Brasileirinho</i> short, tuberculate inserted laterally

TABLE 2. Morphological comparison of Calabozoidea, Oniscidea and Asellota.

	so. Calabozoidea	so. Oniscidea	so. Asellota
Antenna I	<p>peduncle and flagellum indistinguishable</p> <p>peduncle of 3, flagellum of 1 article</p> <p>inserted dorso-medially to (above) antennae II</p>	<p>uniramous, without scale</p> <p>peduncle and flagellum indistinguishable</p> <p>peduncle of 2, flagellum of 1 article</p> <p>inserted directly between antennae II</p>	<p>peduncle and flagellum distinct</p> <p>peduncle 3 articles, flagellum whip-like, of more than 1 article</p> <p>inserted dorso-medially to (above) antennae II</p>
Antenna II		uniramous	
Mandible	<p>without scale</p> <p>peduncle of 5 articles</p> <p>palp absent</p> <p>spine row replaced by 1 pappose seta, beside <i>lacinia mobilis</i></p> <p><i>pars molaris</i> absent</p>	<p>without scale</p> <p>peduncle of 5 articles</p> <p>palp absent</p> <p>tuft of setae divided, one part on the <i>lacinia mobilis</i></p> <p><i>pars molaris</i> present or absent</p>	<p>with scale</p> <p>peduncle of 6 articles</p> <p>palp present or absent</p> <p>tuft of setae not divided, beside <i>lacinia mobilis</i></p> <p><i>pars molaris</i> present</p>
Maxilla II	with 3 endites bearing "comb" setae	endites fused to each other and with basis, "comb" setae absent	with 3 endites bearing "comb" setae
Maxilliped	<p>no coxal sclerite</p> <p>palp articulation absent, palp reduced in length</p> <p>no retinacle</p>	<p>with coxal sclerite</p> <p>palp articulation absent, palp reduced in length</p> <p>no retinacle</p>	<p>with coxal sclerites</p> <p>palp articulation present, palp not reduced in length</p> <p>retinacles present</p>
Pereopods	<p>6 monomorphic ambulatory pairs (pereopod II–VII)</p> <p>pereopod I-reminiscent of subchela</p>	<p>6 or 7 ambulatory pairs, monomorphic</p> <p>pereopod I usually not subchelate, exceptionally reminiscent of subchela</p>	<p>6 or 7 pairs, differentiated</p> <p>pereopod I-usually subchelate, exceptionally reminiscent of subchela</p>
Coxae	<p>coxae forming lateral and sternal plates</p> <p>all lateral plates coalescent with their respective pereonites</p>	<p>coxae forming lateral and sternal plates</p> <p>only 1st lateral plate coalescent with its pereonite</p>	<p>coxae not forming lateral plates (ring-like coxal articles developed)</p>

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TABLE 2. (continued)

	so. Calabozoidea	so. Oniscidea	so. Asellota
Pleon	5 free somites (pleonites I–V)	6 or 5 free somites (pleonites I–V(VI))	1–2 free somites (pleonites I–II)
Pleotelson	pleonite VI fused with telson large	telsonic part small pleonite VI fused with telson minute	pleonites III–VI fused with telson large
Male pleopod I	uni- or biramous; one ramus modified for copulatory purpose	modified, non-respiratory biramous; both rami lamellar or endopodite styliform	uniramous; exopodite lamellar
Male pleopod II	uni- or biramous exopodite absent or lamellar, endopodite styliform	modified, non-respiratory biramous exopodite lamellar, endopodite styliform	biramous exopodite small non-lamellar, endopodite complex gonopod
Female pleopod I	modified; small biramous or absent	modified; endopodite often reduced or absent	absent
Female pleopod II	modified; small, biramous or absent	modified; endopodite often reduced or absent	uniramous; exopodite lamellar
Pleopods III–V	uni- or biramous; exopodites natatory or absent, endopodites respiratory, with transverse suture	biramous; exopodites broad opercular; endopodites thick, tumescent	biramous; pleopod III or II opercular, pleopods IV–V respiratory
Genital papilla	basally fused on the articulating membrane between pereon and pleon	basally fused on the articulating membrane between pereon and pleon	not fused on inner corner of pereopod VII coxae or pereonite VII sternite
Uropods	uniramous, without visible suture lines inserted laterally	biramous or uniramous inserted ventrolaterally, terminally or subterminally	biramous inserted terminally or subterminally

The pleonites I–II of *Brasileirinho* resemble the ones in *Pongycarcinia*, i.e. they are small but not reduced to their sternal parts as in *Calabozoa*. Both, the partial reduction as well as the diminished size of the first two pleonites represent apomorphic traits, together with an enlarged pleotelson. While the latter comprises about 1/3 of the body in *Calabozoa* and *Pongycarcinia*, it is less prominent in *Brasileirinho*, comprising only about 1/5 of the body. This can be attributed to different life style (swimming incapability) in connection with a radical reduction of the pleopods in *Brasileirinho* (see below). In the former two taxa swimming, as well as running, were observed by Van Lieshaut (1983) and Trajano and Bockmann (2000).

The unique pleopods are definitely the most contrasting feature of the new species. Absence of female pleopods I–II corresponds to the pattern seen in Microcerberidae and Atlantasellidae. Females of other two calabozoid species have mutually similar, biramous, small and modified first two pleopod pairs, treated as apomorphies by Van Lieshaut (1983). In spite of being a reductive trait we suggest the loss of female pleopods in *Brasileirinho* deserves to be treated as a unique apomorphy of the new family, as e.g. in Lynseidae (Poore 1987). First two pleopod pairs are developed in *Brasileirinho* males, but they differ considerably from pleopods of other two calabozoids: they are uniramous and less elaborate, at least in comparison with the adult *Calabozoa* males. Still, they are derived in comparison with the broad lamellar rami representing the groundpattern of isopods (according to Van Lieshaut 1983, p. 174, Wägele 1994, p. 100). Van Lieshaut (1983) stated that: "The only significance of these structures [i.e. first two pleopod pairs] in revealing a possible relationship on this level [i.e. among the suborders], is their origin. She presumed (op. cit., p. 176) the origin of the *Calabozoa* male pleopod I to be exopodal, while simultaneously establishing that: "...the shape ... and probably also its function, has more similarities with 1st male pleopod of the Armadillidiidae (Oniscidea)", in which the endopodite has evolved. Her presumption is based on a tiny outgrowth, "implanted halfway in the first part" of "pediform exopodite consisting of two parts" (op.cit., p. 169). Also in the emended figure of the first pleopod in Brusca & Wilson (1991, p. 176, fig. 10B) a tiny medial outgrowth can be seen "that due to its position must be the endopod" (Wägele 1992, p. 100). Together with the highly complex shape of the "exopodite", also the insertion point of the "tiny endopodite" is somewhat surprising. Namely, the outgrowth arises from the boundary between both parts of the bipartite "exopodite" instead from the protopodite. Unfortunately, we weren't able to obtain specimens of *Calabozoa* from the Zoologisch Museum of Amsterdam, to verify the position of the tiny structure ourselves. Also our attempt to clarify the situation through analyzing *Pongycarcinia* males instead, failed; pleopods I (missing in the holotype) in males from both locations were identical to female pleopods I. This suggests (Van Lieshaut 1983, Messana *et al.* 2002) that none of our males are sexually mature, in spite of their strongly developed genital papilla and complex pleopod II endopodite (i.e. not just elongated as reported for juvenile *Calabozoa* males) and strongly supports the findings of Van Lieshaut (1983), that "the mature male pleopods are developed only at the last moult". Considering pleopod features discussed above, three scenarios are possible for explanation of the characters in the examined *Brasileirinho* specimens:

All our specimens are juvenile. As we examined no less than 198 specimens: 180 without first two pleopod pairs being of a comparable size or even larger than 18 specimens with the developed first two pleopod pairs, and specimens were sampled in two seasons (summer, autumn), the lack of the first two pleopod pairs as an indicator of immaturity in females seems highly improbable. But as we found no ovigerous female in the whole sample, this supposition can't be ruled out completely either,

Only our males are immature. As their pleopod I superficially resembles a lamellar exopodite in juvenile

Calabozoa and *Pongycarcinia* (except for being setae-less, vaulted and with prominent latero-apical angles) and their pleopod II superficially resembles a conical endopodite (except for being less elongated and elaborate) in the same juveniles, this would be a legitimate supposition.

Our males are mature. In this case, their pleopod I seems to be of exopodal and their pleopod II of endopodal origins. Even though the former trait coincides in Calabozoida and Asellota, representing a synapomorphy of both suborders (according to Van Lieshaut 1983), being in conflict with several other asellotan autapomorphies, it suggests a convergent evolution of the male pleopod I. As both pleopods in *Brasileirinho* males are much less elaborate than in *Calabozoa* and a highly female-biased sex ratio is recorded in a population, even a possibility exists that the population is parthenogenetic, while the rare males are in fact dysfunctional.

Uniramous small, mutually similar *Brasileirinho* pleopods III–V resemble pleopod endopodites in other two calabozoids, considering their tumescence and possession of a longitudinal suture. Large and well-developed natatory exopodites, however, are either absent in *Brasileirinho* or perhaps the stiff flat scale at the pleopod base

represents their rudiment. The absence or strong reduction of exopodites corresponds to the observed swimming inability of the new species and supports the general rule manifested in the higher crustaceans (Lang 1960), that the exopodite reduces before the endopodite.

The shape and size of the uniramous styliiform uropods are most similar to those in *Pongycarcinia*, but the insertion point is shifted anteriorly in the former, so the tip of the uropod only slightly surpasses the pleotelson apex. The position of greatly reduced uropods in *Calabozoa* is similar as in *Pongycarcinia*. As the evolution of the tail fan is correlated with the evolution of swimming behaviour and pleopod structure (Wägele 1994), differences among calabozoids are not surprising. We agree with Wägele that the isopod tail fan is homologous with that of the Eumalacostraca and that from that common groundpattern, styliiform uropods evolved independently in phreatoicids and oniscids (1989, p. 162), most probably also in calabozoids.

Taxonomic implications. The above observations suggest that the diagnosis of the suborder, as well as the family, should be modified as suggested bellow. Such emendations are to be expected in any group consisting of only few known species, when the new species are found. We expect that the molecular analyses planned in the near future will support our suppositions.

Calabozoidea Van Lieshaut 1983

Emended diagnosis. Isopods with ambulatory pereopods II–VII, mutually similar in shape and setation. Pereopod I also ambulatory but with moderately or weakly developed subchela, i. e. with very short carpus (article 5) and somewhat widened propodus (article 6). The pereopodal coxal lateral and sternal plates present, completely fused (with no visible suture lines) to their respective pereonites. Mandibles without palp and *pars molaris*, the spine row replaced by 1 pappose seta. Antennae I inserting dorso-medially to (above) antennae II, antenna I flagellum 1-articulate with one apical aesthetasc. Pleonites I–II minute or reduced to sternal parts. Pleonites III–V free, pleonite VI fused with telson, composing large pleotelson. Male pleopods I–II present, modified for copulatory purpose. Pleopods III–V branchial. Uropods uniramous, without visible suture lines, styliiform or shortened (tuberculate), inserted laterally.

Calabozoidae Van Lieshaut 1983

Emended diagnosis. Body dorsoventrally depressed. Antenna II flagellum of more than 10 articles. Pleonites I–II small or reduced to sternal parts. Pleotelson of pleonite VI and telson, reaching about 1/3 of body length. Pleopods I–II in females present, endopodite narrow, elongate, exopodite lamellar. Pleopods I–II in mature males biramous, but no ramus large lamellar. Biramous, sexually monomorphic pleopods III–V mutually similar, each with large lamellar exopodite and small tumescent endopodite.

Nature conservation aspect. The cave is the only known habitat of the *Brasileirinho* so far. Furthermore, of 20 known caves in the municipal district, that is the only one with perennial water. The Baixa Funda cave, as well as its surroundings, was severely altered in the last ten years. The autochthonous surface vegetation was substituted by monocultures; at present with a corn monoculture (Fig. 5C). Local residents reported that the previous land owner started to fill the cave up by dumping huge amounts of different materials (especially stones) in order to drive away curious visitors. Fortunately, he did not succeed but even today local residents use the cave to discard their household waste (Fig. 5D). Due to the difficult access through the partially obstructed entrance, the end section of the cave remains relatively well protected from visitors. Nevertheless, there is still a major human threat to the type locality and its inhabitants; a lot of agricultural products were seen at the entrance, representing a potential source of chemical groundwater contamination. At the moment, there are no administrative acts available to protect this type locality.

Until 2008, all Brazilian caves were protected by law. With the legislation changes the caves lost their intangibility and are now exposed to different human activities, especially mining. In an attempt to define which caves can be destroyed and which should be preserved some categories defining the status of each cave were created, based on biological and geological parameters. So, to achieve an indubitable preservation of cave according to biological parameters, the presence of an endemic troglobiotic or rare species within the cave is

required. The description of *Brasileirinho cavaticus* therefore represents not only a contribution to the knowledge of isopod diversity, but is also a permanent assurance of the preservation of a cave and its surroundings.

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