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On the phylogeny of Ischyroceridae (Amphipoda, Senticaudata, Corophiida), with the description of a new genus and eight new species from deep-sea Brazilian waters

JESSER F. SOUZA-FILHO[1]* and CRISTIANA S. SEREJO[2]

[1]*Departamento de Oceanografia, Museu de Oceanografia Prof. Petrônio Alves Coelho. Laboratório de Carcinologia. Cidade Universitária, Rua da Arquitetura, Universidade Federal de Pernambuco, S/N, CEP 50670-901, Recife, Pernambuco, Brazil*

[2]*Departamento de Invertebrados. Quinta da Boa Vista, São Cristóvão. Museu Nacional/Universidade Federal do Rio de Janeiro. CEP 20940-040 Rio de Janeiro, Brazil*

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The family Ischyroceridae is analysed herein by cladistic methods based on morphological characters, using both PAUP 4.0b and TNT. The data matrix of 41 characters × 32 terminal taxa was constructed using DELTA. Based on the results, we comment on the phylogenetic relationships of certain genera and their synapomorphic characters, also discussing the phylogenetic position of ***Myersius* gen. nov.**, which appeared as the sister group of *Bathyphotis*. In addition, *Pseudischyrocerus crenatipes* is removed to *Bathyphotis*, for which a new diagnosis is provided. A taxonomic study with the Ischyroceridae collected on the continental slope (depth, 700–2000 m) in the Campos Basin (20.5–24°S, 40–41°W) was also performed. Samples were collected in November–December 2002 and July–August 2003 using a box core device. As a result, a new genus and eight new species are described: ***Bonnierella campensis* sp. nov.**, ***Bonnierella laurensi* sp. nov.**, ***Myersius denticaudatus* gen. et sp. nov.**, ***Notopoma lowryi* sp. nov.**, ***Notopoma teresae* sp. nov.**, ***Pseudericthonius bousfieldi* sp. nov.**, ***Pseudericthonius concavus* sp. nov.**, and ***Pseudischyrocerus caecus* sp. nov.** The genus *Bonnierella* is recorded for the first time from Brazilian waters, and the subspecies *Bonnierella linearis linearis* and *Bonnierella linearis californica* are elevated to species rank. Keys to the genera of Ischyroceridae used in the cladistic analysis and the world species of *Notopoma* are given.

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ADDITIONAL KEYWORDS: Campos Basin – cladistic analysis – Corophiidea – deep sea – Ischyroceridae – new species.

INTRODUCTION

The taxonomic and phylogenetic relationships among some groups of Corophioidea are controversial, and have been much discussed, including the position of this superfamily within the suborder Gammaridea. J.L. Barnard (1973) erected the superfamily Corophioidea including the families Ampithoidae, Cheluridae, Corophiidae, Ischyroceridae, and Podoceridae, all of which were well defined except for Corophiidae. In the same work, Barnard synonymized the families Photidae, Aoridae, and Isaeidae with Corophiidae, but recognized no subfamilies. Other authors have proposed a more restricted concept of the family Corophiidae. Bousfield (1978) recognized the superfamily Corophioidea including nine families, among which Aoridae, Corophiidae, Photidae, and Isaeidae were considered distinct families. Later on, Myers (1981) erected the family Neomegamphopidae, and retained a separate status for Aoridae and Corophiidae, whereas Photidae and Isaeidae were

*Corresponding author. E-mail: jesser_fidelis@yahoo.com.br

merged with Isaeidae. Just (1983) erected the subfamily Siphonoecetinae within Corophiidae (*sensu* Myers, 1981). Despite these proposals, J.L. Barnard & Karaman (1991) followed J.L. Barnard's (1973) classification and submerged Ischyroceridae and Neomegamphopidae within Corophiidae, but maintained the subfamily Siphonoecetinae. Nevertheless, Bousfield & Hoover (1997) continued giving separate recognition to Aoridae, Isaeidae, and Ischyroceridae within the superfamily Corophioidea, and considered the family Corophiidae to have two subfamilies, Corophiinae and Siphonoecetinae.

Currently, the family Ischyroceridae comprises 254 species distributed in 40 genera, with a worldwide distribution. This family is mainly characterized by the uropod 3 with the peduncle broad proximally and narrow distally, and its rami with tiny apical setae and the outer ramus with recurved apical spines; these spines are lost in siphonoecetids (Myers & Lowry, 2003). Studies dealing with the evolution of the Ischyroceridae include that of Lowry & Berents (1996), who presented a cladistic analysis for the *Ericthonius* group, which included the *Cerapus* clade, *Ericthonius*, *Pseudericthonius*, *Pseudischyrocerus*, and the Siphonocetid clade. Myers & Lowry (2003) proposed a new classification for the corophioideans based on a morphological cladistic analysis, where the suborder Corophiidea was erected. This suborder comprised two infraorders: the Corophiida, earlier placed within the suborder Gammaridea, and the Caprellida, previously treated as a separate suborder. This classification supported the previous hypothesis where the Caprellida share a common ancestor with podocerids (Laubitz, 1979). Myers & Lowry (2003) also used feeding strategies to separate these groups, where Corophiida were considered as derived from bottom-feeding detritivores, whereas members of the Caprellida were derived from ancestors that fed on material suspended in the water column. The work of Myers & Lowry (2003) clarified the relationship among most families of Corophioidea, and provided a restricted diagnosis of most of the families discussed above. For example, the *Ericthonius* group was found to be monophyletic, as observed by Lowry & Berents (1996), although it appeared as a Siphonoecetine within the Ischyroceridae. Also, Photidae and Isaeidae were found to be separate families. The relationships among genera of these families were not discussed, however. Recently, Lowry & Myers (2013) erected the suborder Senticaudata, defined as a monophyletic clade that shares robust setae on the apices of uropods 1 and 2. The Senticaudata included 95 families that were previously assigned to the suborder Gammaridea, and all members of the suborder Corophiidea, which is now considered as the infraorder Corophiida.

The first Brazilian deep-sea amphipod, *Parandania boecki*, was recorded by Stebbing (1888; as *Andania boecki*), and was collected by the 'Challenger Expedition – 1873' at a depth of 1234 m off the state of Pernambuco. More than a century later, new deep-sea amphipod records off the Brazilian coast began to be reported. Fifteen studies have recorded a total of 35 amphipod species from off the Brazilian coast in waters below 200 m (Table 1). Despite these efforts, the Brazilian deep-sea amphipod fauna is still little known, and many more species await description.

In recent decades, deep-water drilling exploration activities off the Brazilian coast intensified with the discovery of giant oil reserves, such as the Albacora, Marlin, and Barracuda banks in the Campos Basin. Consequently, in order to maintain sustainable deep-water exploration, the Petrobras Research Center or Cenpes/Petrobras (Petróleo do Brasil SA) initiated the Campos Basin Deep Sea Environmental Project (OCEANPROF). The main objective of this project was to characterize the oceanic region of the Campos Basin according to the physical, chemical, and biological properties of the water and the bottom between the depths of 700 and 2000 m (Lavrado *et al*., 2010). As a result of this project, two books were published in which 144 crustaceans were listed (Serejo *et al*., 2010). Several taxonomic studies with Decapoda, Isopoda, and Tanaidacea from the OCEANPROF have been published (e.g. Cardoso & Serejo, 2007; Albuquerque & Costa, 2008; Larsen, Silva & Coelho, 2009).

Among the amphipods collected by the OCEANPROF project, the corophiideans were one of the most important groups. The family Ischyroceridae Stebbing, 1899 was represented by five genera and eight species, distributed in two subfamilies: Bonnierellinae Myers & Lowry, 2003 and Ischyrocerinae Stebbing, 1899. Currently, 11 ischyrocerids are known from Brazilian waters (Wakabara & Serejo, 1998; Valério-Berardo, 2001; Valério-Berardo, Souza & Rodrigues, 2008), but the present study raised this number to 19. Taking this material into account, we performed a cladistic analysis based on morphological characters, to better understand the phylogenetic relationships among certain genera of the family Ischyroceridae, including the position of *Myersius* gen. nov. described herein. Based on this analysis, some minor taxonomic changes within the family are also proposed.

MATERIAL AND METHODS

Phylogenetic analysis

In order to classify the material observed from the Campos Basin, we decided to run a cladistic analysis

Table 1. List of deep-sea species of the order Amphipoda recorded in Brazilian waters

Species	Locality and depth	Reference
Amathillopsis atlantica Chevreux, 1908	23°54′S, 42°10′W, 830 m	Wakabara & Serejo (1999)
Ampelisca anae Valério-Berardo, 2008	22°27′31.62″S, 40°09′23.19″W, 750 m	Valério-Berardo (2008)
Ampelisca campensis Valério-Berardo, 2008	22°41′10.8″S, 40°2′20.3″W, 1650 m	Valério-Berardo (2008)
Ampelisca minuta Valério-Berardo, 2008	22°31′12.47″S, 40°15′11.08″W, 750 m	Valério-Berardo (2008)
Ampelisca wakabarae Valério-Berardo, 2008	22°04′33.9″–22°27′31.62″S, 39°52′05.1″–40°09′23.19″W, 750–1050 m	Valério-Berardo (2008)
Bathybirubius margaretae Senna, 2010	22°02′31″S, 39°52′14″W, 1050 m	Senna (2010)
Byblis bjornbergae Valério-Berardo, 2008	22°10′43.278″S, 39°54′46.036″W, 750–1050 m	Valério-Berardo (2008)
Caprella ungulina Mayer, 1903	14°36.579′S, 038°49.544′W 1067 m	Sittrop & Serejo (2009)
Coxophoxus alonso Senna, 2010	22°02′31″S, 39°52′13″W, 1050–1350 m	Senna (2010)
Epimeria bathyalis Wakabara & Serejo, 1999	19°01′S, 37°47′W, 1500–1575 m	Wakabara & Serejo (1999)
Epimeria rotunda Wakabara & Serejo, 1999	21°36′S, 39°58′W, 1190–1205 m	Wakabara & Serejo (1999)
Epimeria ultraspinosa Wakabara & Serejo, 1999	23°54′S, 42°10′W, 830 m	Wakabara & Serejo (1999)
Eurythenes gryllus (Lichtenstein in Mandt, 1822)	13° 19′.944″S, 38 19′.654″W and 20° 26′.850″S, 39 41′.636″W, 1089–1730 m	Serejo *et al*. (2007)
Eurythenes obesus (Chevreux, 1905)	22°15.49′S, 39°47.450′W, 1300–1608 m	Senna & Serejo (2008)
Haploops meloi Valério-Berardo, 2008	22°02′50.811″S, 39°52′24.1″W, 1050 m	Valério-Berardo (2008)
Lepechinella campensis Sittrop & Serejo, 2009	22°10′54.4″S, 39°52′19.4″W, 1050 m	Sittrop & Serejo (2009)
Lepechinella hirsuta Sittrop & Serejo, 2009	21°52′50.5″S, 39°51′42.6″W, 1050 m	Sittrop & Serejo (2009)
Lepechinella laurensi Sittrop & Serejo, 2009	21°57′26.8″S, 39°40′34.0″W, 1950 m	Sittrop & Serejo (2009)
Leptophoxoides marina Senna, 2010	21°52′36″S, 39°55′18″W, 750–1950 m	Senna (2010)
Liljeborgia quinquedentata Schellenberg, 1931	19°02′S, 33°47′W, 790 m	Wakabara *et al*. (1991)
Liropus nelsonae Guerra-García, 2003	7°50′–7°58′S, 34°17′W, 943–1007 m	Guerra-García (2003)
Megamphopus robustisetae Souza-Filho & Senna, 2012	22°41.928′S, 40°16.506′W, 1045–1350 m	Souza-Filho & Senna (2012)
Notopoma fluminense Valério-Berardo, Souza & Rodrigues, 2008	22°41′S, 40°20′W, 730 m	Valério-Berardo *et al*. (2008)
Parandania boecki (Stebbing, 1888)	off Pernambuco State, 1234 m	Stebbing (1888)
Parvipalpus colemani Guerra-García, 2003	7°50′–7°58′S, 34°17′W, 943–1007 m	Guerra-García (2003)
Pseudharpinia berardo Senna, 2010	22°35′25″S, 40°15′31″W, 900 m	Senna (2010)
Pseudharpinia ovata Senna, 2010	22°02′31″–22°41′08″S, 39°52′13″–40°14′06″W, 1050–1100 m	Senna (2010)
Stephonyx uncinatus Senna & Serejo, 2007	14°27′654″S, 38°51′130″W, 730–739 m	Senna & Serejo (2007)
Tectovalopsis ruffoi (Serejo & Wakabara, 2003)	19°01′S, 37°47′W, 1500–1575 m	Serejo & Wakabara (2003)
Trischizostoma costai Freire & Serejo, 2004	21°12.293′S, 40°00.884′W, 1364 m,	Freire & Serejo (2004)
Trischizostoma denticulatum Ledoyer, 1978	21°07.780′S, 39°49.106′W to 21°04.783′S, 39°48.698′W, 1642 m	Freire & Serejo (2004)
Trischizostoma longirostrum Chevreux, 1919	15°47.725′–19°58.936′S, 38°24.839′–39°38.657′W, 1002–2076 m	Freire & Serejo (2004)
Trischizostoma raschi Boeck, 1861	15°08.595′–19°59.936′S, 38°40.638′–39°38.657′W, 922–1026 m	Freire & Serejo (2004)
Trischizostoma richeri Lowry & Stoddart, 1994	15°48.503′S, 38°36.265′W, 599 m	Freire & Serejo (2004)
Valettiopsis macrodactyla Chevreux, 1909	21°36′S, 39°58′W, 1190–1295 m	Serejo & Wakabara (2003)

of the family Ischyroceridae, including the genera *Bathyphotis*, *Bathypoma*, *Bonnierella*, *Cerapus*, *Ericthonius*, *Notopoma*, *Paracerapus*, *Pseudischyrocerus*, *Pseudericthonius*, and *Runanga*, plus *Myersius* gen. nov. and the *Siphonoecetes* clade (*Australoecetes*, *Borneoecetes*, *Bubocorophium*, *Cariboecetes*, *Concholestes*, *Corocubanus*, *Rhinoecetes*, and *Siphonoecetes*).

Considering that we did not include all genera of Ischyroceridae, the monophyly of the family was based on the cladistic analysis proposed by Myers & Lowry (2003). The family Photidae is considered as a sister clade of Ischyroceridae within the superfamily Photoidea (*sensu* Myers & Lowry, 2003). Thus, two species of this family, *Gammaropsis* sp. and *Photis* sp., were chosen as out-groups.

The in-group was composed of 32 terminal taxa of the family Ischyroceridae (Table 2). Within the subfamily Bonnierellinae, the genus *Bogenfelsia* J.L. Barnard, 1962 was briefly described based only on *Bogenfelsia incisa* J.L. Barnard, 1962. Taking this into account, and considering that this taxon would have many gaps in the character matrix, it was not included in the analysis.

The data matrix of 41 characters × 32 terminal taxa (Tables 3 and 4) was constructed using DELTA (Dallwitz, 2005). Some character states (Figs 1–6) were scored according to Lowry & Berents (1996) and Myers & Lowry (2003), but most of them have been verified by personal observation by the authors, including photomicrographs in SEM for character 33 (Fig. 6). Also, other characters not previously considered by Lowry & Berents (1996) were included or re-defined based on new personal observations. Continuous characters, such as the number of articles on the accessory flagellum of antenna 1 and the size of the inner ramus of the uropods, were not included. Myers (1981) pointed out that these characters have doubtful phylogenetic significance in Amphipoda. The gradual reduction of a biramous appendage to a uniramous condition and the reduction of the accessory flagellum are phenomena that are repeated again and again throughout the Crustacea, and therefore there is no reason to assume that they are a synapomorphy in Amphipoda (Myers, 1981, 1986).

A total of 40 unordered characters were used in the analysis (listed below), of which 39 were parsimony informative and one defined the out-group (Figs 1–6; Table 3). When appropriate, characters were combined into multistate groupings to avoid overly dependent characters. This resulted in 28 binary characters and 12 multistate characters. The data matrix was analysed using the parsimony criterion available in PAUP* 4.0b-10 (Swofford, 2002) and TNT 1.1 (Goloboff *et al*., 2008). Heuristic searches (additional sequence) with 1000 replications, with one tree held in PAUP and ten trees held in TNT at each step during stepwise addition, were performed on the data matrix. The branch-swapping algorithm used was tree, bisection and reconnection (TBR). The characters were analysed as unweighted; multistate taxa were treated as polymorphisms. Bremer support (Bremer, 1994) was evaluated with TNT using a 20-step suboptimal tree search, and the values are given in absolute numbers.

Taxonomic study

The study area included the Campos Basin, which extends from the states of Espírito Santo to Rio de Janeiro (20.5–24°S, 40–41°W) on the south-eastern Brazilian coast. The Campos Basin measures some 100 000 km^2 and has enormous economic importance, as it currently accounts for nearly 80% of Brazil's oil production and is the largest oil reserve in Brazilian waters (Lavrado *et al*., 2010).

The samples analysed herein were collected on board the N/RB *Astro Garoupa*, on the continental slope (depth 700–2000 m) of the Campos Basin in cruises carried out in November–December 2002 (OCEANPROF I) and July–August 2003 (OCEANPROF II). These samples were collected according to the framework of the Campos Basin Deep Sea Environmental Project (OCEANPROF) coordinated by CENPES/PETROBRAS (Leopoldo Américo Miguez de Mello Center for Research and Development/Petróleo Brasileiro SA). All samples were obtained using a box corer (50 cm^3) and the sediment was sieved in a 0.5-mm net. An overview of the Campos Basin area, together with a map, the sampling methodology, and the general results for the macrobenthic fauna resulting from the OCEANPROF I–II project can be found in Lavrado *et al*. (2010). Additional material of the species *Pseudischyrocerus caecus* sp. nov. was collected by a remotely operated vehicle (ROV) as part of the project ECOPROF-Deep-Sea Ecosystems in the Campos Basin (21–23°S), also coordinated by CENPES/PETROBRAS.

Type material of *Bonnierella linearis* J.L. Barnard, 1964 from the American Museum of Natural History, New Your, USA (AMNH) was redescribed for comparison with local species. The observations on *Bonnierella linearis californica* J.L. Barnard, 1966 and *Bathyphotis crenatipes* comb. nov. (Bellan-Santini & Ledoyer, 1986) were based on the literature, as attempts to borrow the original material of the two species were unsuccessful.

Treatment of specimens

Specimens were preserved in 70% ethanol. Appendages and mouthparts of dissected specimens were

Table 2. List of 32 taxa used in the cladistic analysis with reference information used for each species, and catalogue number when the material was available for study

Taxon	Reference	Collection number
Gammaropsis sp.		MNRJ 21546
Photis sp.		MNRJ 21573
Bonnierella linearis J.L. Barnard, 1964	J.L. Barnard (1964)	AMNH 12348
***Bonnierella campensis* sp. nov.**	Present study	MNRJ 21218
***Bonnierella laurensi* sp. nov.**	Present study	MNRJ 21231
***Myersius denticaudatus* gen. et sp. nov.**	Present study	MNRJ 21424
Bathyphotis tridentata Stephensen, 1944	Stephensen (1944); Griffiths (1977)	
Bathyphotis crenatipes (Bellan-Santini & Ledoyer, 1986)	Bellan-Santini & Ledoyer (1986)	
Pseudischyrocerus besnardi Valério-Berardo, 2001	Valério-Berardo (2001)	
***Pseudischyrocerus caecus* sp. nov.**	Present study	
Pseudischyrocerus denticauda Schellenberg, 1931	Schellenberg (1931)	
***Pseudericthonius concavus* sp. nov.**	Present study	
Pseudericthonius hesperidesi Rauschert, 1997	Rauschert (1997)	
Pseudericthonius gaussi (Schellenberg, 1926)	Schellenberg (1926); Bellan-Santini & Ledoyer (1986)	
Ericthonius brasiliensis (Dana, 1853)	Present study	MNRJ 6117
Ericthonius pugnax (Dana, 1853)	Myers (1995)	
Paracerapus polutovi (Gurjanova, 1951)	Lowry & Berents (1996)	
Cerapus tubularis Say, 1817	Lowry & Berents (1996)	
Cerapus jonsoni Valério-Berardo, Souza & Rodrigues, 2008	Valério-Berardo *et al.* (2008)	
Runanga coxalis J.L. Barnard, 1962	J.L. Barnard (1962)	
Bathypoma enigma Lowry & Berents, 1996	Lowry & Berents (1996)	
***Notopoma teresae* sp. nov.**	Present study	MNRJ 21239
Notopoma stoddartae Lowry & Berents, 1996	Lowry & Berents (1996)	
***Notopoma lowryi* sp. nov.**	Present study	
Notopoma cidaridis Berge, Vader & Lockhart, 2004	Berge *et al.* (2004)	
Australoecetes australis (Stebbing, 1910)	Just (1985)	
Borneoecetes wongi Barnard & Thomas, 1984	J.L. Barnard & Thomas (1984)	
Bubocorophium macropalpus Just, 2004	Just (2004)	
Caribboecetes barbadensis Just, 1983	Just (1983)	
Concholestes dentalii Giles, 1888	Just (1984)	
Rhinoecetes robustus Just, 1983	Just (1983)	
Siphonoecetes (Siphonoecetes) arabicus Barnard & Thomas, 1984	J.L. Barnard & Thomas (1984)	

Table 3. Morphological characters used in the analyses

Characters

1. Head anteroventral margin: (1) moderately recessed; (2) strongly recessed.
2. Antenna 1, length in relation to antenna 2: (1) subequal to antenna 2; (2) shorter than antenna 2.
3. Antenna 1, peduncular article 1: (1) long and rectangular; (2) produced anterodistally and medially.
4. Antenna 1, peduncular article 3: (1) subequal or shorter than article 2; (2) longer than article 2.
5. Antennae 1, article 1 posterior margin: (1) without swelling; (2) with swelling.
6. Mandibular palp: (1) well developed, 3-articulate; (2) reduced, 2-articulate; (3) very reduced, 1-articulate.
7. Maxilla 1, outer margin of inner plate: (1) with a row of setae; (2) without a row of setae.
8. Gnathopod 1, carpus: (1) shorter than propodus; (2) longer than propodus.
9. Gnathopod 2 male: (1) subchelate; (2) carpochelate; (3) simple.
10. Gnathopod 2 male, carpus: (1) shorter than propodus; (2) longer than propodus; (3) subequal to propodus.
11. Gnathopod 2 female, carpus: (1) shorter than propodus; (2) longer than propodus; (3) subequal to propodus.
12. Coxae 1–7, relative lengths: (1) coxae 1–5 longer than wide and coxae 6 and 7 wider than long; (2) coxae 1–7 wider than long; (3) coxae 1–4 longer than wide and coxae 5–7 wider than long.
13. Coxa 4, margin: (1) smooth; (2) serrate.
14. Coxa 4, posterior margin: (1) not excavated; (2) excavated.
15. Coxa 5: (1) with posterodorsal lobe; (2) without posterodorsal lobe.
16. Pereopods 3–7 basis: (1) ovate; (2) rectilinear.
17. Pereopod 4, merus: (1) equal to merus of pereopod 3; (2) longer than merus of pereopod 3.
18. Pereopod 5, carpus: (1) subrectangular; (2) lunate or reniform.
19. Pereopods 5, shape: (1) pereopod 5 similar to pereopods 6 and 7; (2) pereopod 5 dissimilar to pereopods 6 and 7; (3) pereopod 5 similar to pereopod 6 and dissimilar to pereopod 7.
20. Pereopods 5–7, dactylus: (1) without accessory spines; (2) with accessory spines.
21. Pereopod 5, carpus: (1) without denticles or robust setae on posteroventral margin; (2) with denticles on posteroventral margin; (3) with denticles and short robust setae on posteroventral margin.
22. Pereopod 5: (1) distal part (at least the propodus and dactylus) directed anteriorly; (2) distal part directed posteriorly.
23. Pereopod 6: (1) distal part (at least the propodus and dactylus) directed anteriorly; (2) distal part directed posteriorly.
24. Pereopod 7: (1) distal part (at least the propodus and dactylus) directed anteriorly; (2) distal part directed posteriorly.
25. Pleosomite: (1) without lateral ridges; (2) with lateral ridges.
26. Pleopods peduncle: (1) slender, not expanded; (2) broad, expanded.
27. Pleopod 2, inner ramus: (1) present, as long as outer ramus; (2) reduced or absent.
28. Urosomite 1: (1) without dorsal spines; (2) with dorsal spines.
29. Uropod 1, peduncle: (1) with interamal process; (2) with distoventral corona; (3) without distoventral corona or process.
30. Uropod 1, outer margin of outer ramus: (1) smooth; (2) dentate.
31. Uropod 2: (1) biramous; (2) uniramous; (3) rami absent.
32. Uropod 2, outer margin of rami: (1) smooth and with robust setae; (2) dentate and without robust setae.
33. Uropod 3, tip of outer ramus: (1) without spines; (2) with spines; (3) with plate bearing spines.
34. Uropod 3, peduncle: (1) parallel sided; (2) broad proximally and narrow distally.
35. Uropod 3: (1) biramous; (2) uniramous; (3) absent.
36. Uropod 3, rami or ramus: (1) longer than peduncle; (2) shorter than peduncle.
37. Uropod 3, outer ramus: (1) 2-articulate, second one rudimentary; (2) 1-articulate.
38. Telson: (1) longer than wide; (2) wider than long.
39. Telson: (1) entire; (2) cleft.
40. Telson, dorsal margin: (1) without recurved spines; (2) with recurved spines in patches; (3) with recurved spines in rows.
41. Telson, tip: (1) without distolateral spines; (2) with 2 distolateral spines.

mounted on glass slides and sealed with CMC-10 or glycerol gelatin. For photomicrography in a scanning electron microscope (SEM; JEOL 6390 series) the specimens were treated according to Felgenhauer's (1987) method. In order to minimize the modification of structures, a smooth alcohol gradient (5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, and 100%) was used. The type material is housed at

Table 4. Character matrix with 32 terminal taxa and 41 morphological characters used in the analysis

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Gammaropsis sp.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Photis sp.	2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1
Bonnierella linearis	2	1	1	1	1	1	2	1	1	1	1	2	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	2	1	1	1	1
***Bonnierella campensis* sp. nov.**	2	1	1	1	1	1	2	1	1	1	1	2	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	2	1	1	1	1
***Bonnierella laurensi* sp. nov.**	2	1	1	1	1	1	2	1	1	1	1	2	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	2	1	1	1	1
***Bathyphotis crenatipes* comb. nov.**	2	1	1	1	1	1	2	3	1	1	1	1	1	2	2	1	1	1	2	1	1	1	1	1	1	?	?	2	1	1	1	1	2	2	1	2	2	1	1	1	1
Bathyphotis tridentata	2	1	1	1	1	1	2	3	1	1	1	1	1	2	2	1	1	1	2	1	1	1	1	1	1	1	1	2	1	1	1	1	2	2	1	2	2	1	1	1	1
Pseudischyrocerus besnardi	2	1	1	1	1	1	2	3	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	3	2	1	2	2	1	1	1	1
Pseudischyrocerus denticauda	2	1	1	1	1	1	2	3	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	3	2	1	2	2	1	1	1	1
Pseudericthonius hesperidesi	2	1	1	1	1	1	1	3	2	2	2	2	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	2	1	2	1
Pseudericthonius gaussi	2	1	1	1	1	1	1	3	2	2	2	2	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	2	1	2	1
***Pseudericthonius concavus* sp. nov.**	2	1	1	1	1	1	1	3	2	2	2	2	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	2	1	2	1
Ericthonius brasiliensis	2	1	1	1	1	1	1	3	2	2	1	2	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	2	1	2	1
Ericthonius pugnax	2	1	1	1	1	1	1	3	2	2	1	2	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	2	1	2	1
Bathypoma enigma	2	1	2	1	1	1	2	1	1	1	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	3	1
Cerapus jonsoni	2	1	1	1	2	1	2	1	2	2	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	3	1
Notopoma stoddartae	2	1	2	1	1	1	2	1	2	3	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	3	1
Notopoma cidaridis	2	1	2	1	1	1	2	1	2	3	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	3	1
Runanga coxalis	2	1	1	2	1	1	2	1	2	3	3	2	1	1	1	1	2	2	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	3	1
***Myersius denticaudatus* gen. et sp. nov.**	2	1	1	1	1	1	2	2	1	1	1	1	1	2	2	1	1	1	?	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	2	1	1	1	2
***Pseudischyrocerus caecus* sp. nov.**	2	1	1	1	1	1	2	3	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	3	2	1	2	2	1	1	1	1
Cerapus tubularis	2	1	1	1	2	1	2	1	2	2	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	3	1
***Notopoma teresae* sp. nov.**	2	1	2	1	1	1	2	1	2	3	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	3	1
***Notopoma lowryi* sp. nov.**	2	1	2	1	1	1	2	1	2	3	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	3	1
Paracerapus polutovi	2	1	1	1	1	1	2	1	2	2	1	2	1	1	1	1	1	2	2	2	2	2	1	1	1	1	1	1	2	2	2	2	3	2	2	2	2	2	2	3	1
Borneoecetes wongi	2	2	1	1	1	2	2	3	1	1	1	3	1	1	1	1	1	2	3	2	3	2	2	2	1	2	1	1	2	2	2	2	1	2	2	2	2	2	1	1	1
Caribboecetes barbadensis	2	2	1	1	1	2	2	3	3	1	1	3	2	1	1	1	1	2	3	1	3	2	2	2	1	2	1	1	2	2	3	-	1	2	3	2	2	2	1	2	1
Rhinoecetes robustus	2	2	1	1	1	2	2	3	1	1	1	3	1	1	1	1	1	2	3	1	3	2	2	1	1	2	1	1	3	2	2	2	1	2	2	2	2	2	1	2	1
Australoecetes australis	2	2	1	1	1	2	2	1	3	1	1	3	1	1	1	1	1	2	3	2	3	2	2	2	1	2	1	1	2	2	2	2	1	2	2	2	2	2	1	2	1
Bubocorophium macropalpus	2	2	1	1	1	3	2	3	1	1	1	3	2	1	1	1	1	2	3	2	3	2	2	2	1	2	1	1	2	2	2	2	1	2	2	2	2	2	1	2	1
Concholestes dentalii	2	2	1	1	1	2	2	3	1	1	1	3	2	1	1	1	1	2	3	1	3	2	2	2	1	2	1	1	3	2	3	–	1	2	3	2	2	2	1	2	1
Siphonoecetes arabicus	2	2	1	1	1	2	2	3	3	1	1	3	1	1	1	1	1	2	3	1	3	2	2	2	1	2	1	1	2	2	1	2	1	2	2	2	2	2	1	2	1

Numerals 1–3 represent the character states listed and discussed in the results; ?, missing data; –, no applicable character.

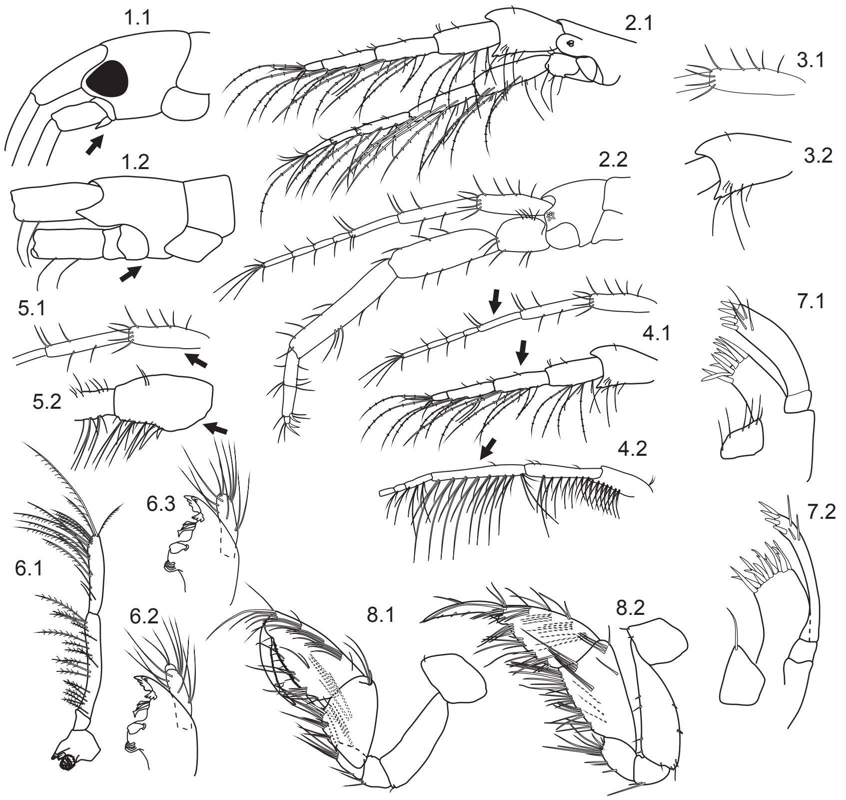

Figure 1. Characters 1–8. Head anteroventral margin moderately recessed (1.1), strongly recessed (1.2). Antenna 1 subequal to antenna 2 (2.1), shorter than antenna 2 (2.2). Antenna 1, peduncular article 1 long and rectangular (3.1), produced anterodistally and medially (3.2). Antenna 1 peduncular article 3 subequal or shorter than article 2 (4.1); longer than article 2 (4.2). Antenna 1 article 1 posterior margin without swelling (5.1), with swelling (5.2). Species: (1.1) *Gammaropsis* sp.; (1.2, 8.1) ***Bonnierella laurensi* sp. nov.**; (2.1, 3.2, 4.1) ***Notopoma teresae* sp. nov.**; (2.2, 3.1, 4.1, 5.1, 6.2) *Caribboecetes barbadensis* Just, 1983 (redrawn from Just, 1984); (4.2) *Runanga coxalis* J.L. Barnard, 1961 (redrawn from J.L. Barnard, 1962); (5.2) *Cerapus tubularis* Say, 1818 (redrawn from Lowry & Berents, 1996); (6.1, 7.1, 8.2) ***Pseudericthonius bousfieldi* sp. nov.**; (7.2) ***Bonnierella campensis* sp. nov.**

the Crustacean Collection of the Museu Nacional, Rio de Janeiro (MNRJ).

Abbreviations used: Ant, antenna; AF, accessory flagellum; Cx, coxa; EP, epistome; Gn, gnathopod; Hb, habitus; Hd, head; LL, lower lip; Md, mandible; Mx, maxilla; Mxp, maxilliped; P, pereopod; Pl, pleopod; Pr, pereonite; T, telson; UL, upper lip; Ur, uropod; f, female; l, left; m, male; r, right.

RESULTS

Phylogenetic analysis

Heuristic searches under equal weights resulted in two trees of length 90 steps (consistency index, CI = 0.622; homoplasy index, HI = 0.379; retention index, RI = 0.904; and rescaled consistency index, RC = 0.563; Fig. 7). Clade 1 (family Ischyroceridae) is monophyletic, and is well supported by five synapomorphies: head with anteroventral margin strongly recessed (1.2); coxae 1–7 wider than long (12.2); uropod 3 with recurved spines (33.2), this character state has also undergone reversal in the *Siphonoecetes* group, and has changed in *Paracerapus* and *Pseudischyrocerus* (clade 13); peduncle of uropod 3 broad proximally and narrow distally (34.2); and outer ramus of uropod 3 1-articulate (37.2).

Clade 1 divides into two monophyletic groups, clades 2 and 17, considered subfamilies Ischyrocerinae and Bonnierellinae, respectively. The Bonnierellinae (clade 17) is defined by coxa 5 with posterodorsal lobe absent (14.2) and pereopods 3–7 with rectangular basis (16.2). Ischyrocerinae (clade 2) is defined by: gnathopod 1 carpus longer than propodus (8.2) – this character state reverts in *Myersius* gen. nov., within clade 15, and in clade 6; and pereopod 5 dissimilar to pereopods 6 and 7 in shape and length (19.2) – this character changes within the *Siphonoecetes* clade (19.3).

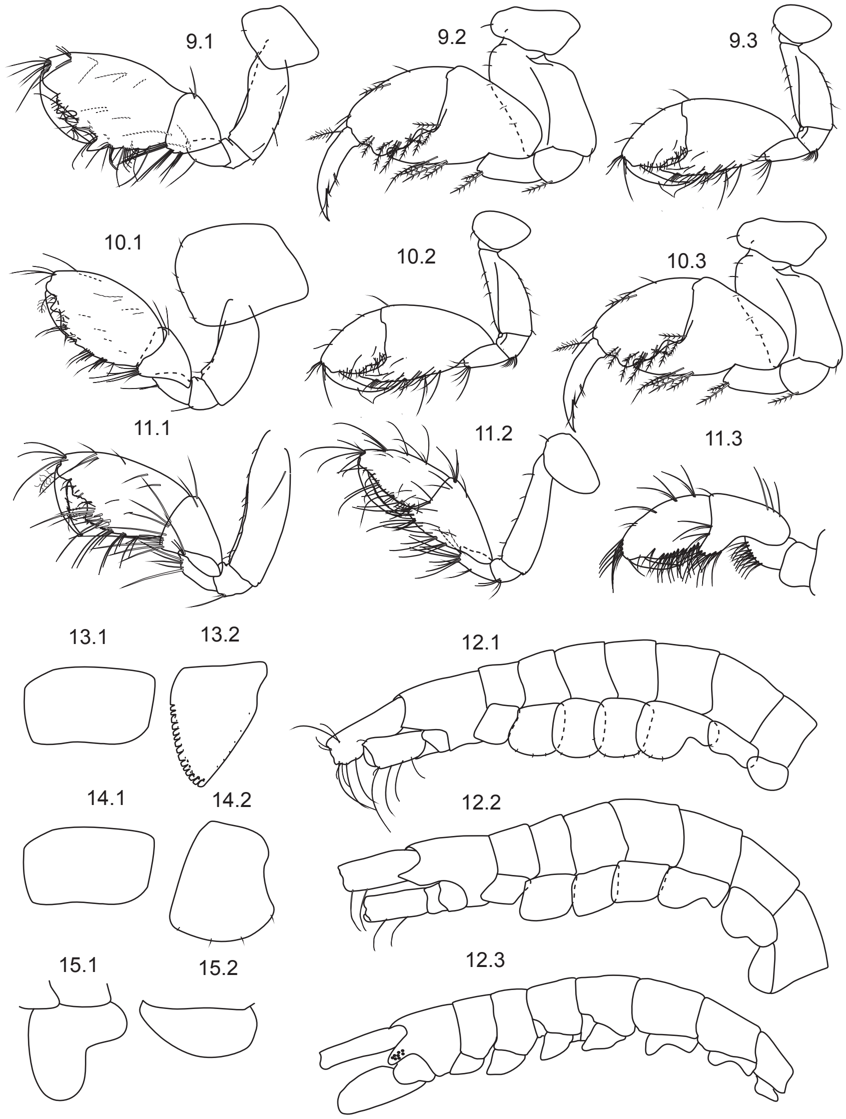

Figure 2. Characters 9–15. Gnathopod 2 male subchelate (9.1), carpochelate (9.2), (simple 9.3). Gnathopod 2 male, carpus shorter than propodus (10.1), longer than propodus (10.2), subequal to propodus (10.3). Gnathopod 2 female, carpus shorter than propodus (11.1), longer than propodus (11.2), subequal to propodus (11.3). Coxae 1–7. Coxae 1–5 longer than wide and coxae 6 and 7 wider than long (12.1); coxae 1–7 wider than long (12.2), coxae 1–4 longer than wide and coxae 5–7 wider than long (12.3). Coxa 4 margin smooth (13.1), serrate (13.2). Coxa 4 posterior margin not excavated (14.1), excavated (14.2). Coxa 5 with posterodorsal lobe (15.1), without posterodorsal lobe (15.2). Species: (9.1, 12.2, 13.1, 14.1) ***Bonnierella laurensi*** **sp. nov.**; (9.2, 10.3) ***Notopoma teresae*** **sp. nov.**; (12.3) *Caribboecetes barbadensis* Just, 1983 (redrawn from Just, 1984); (11.3) *Runanga coxalis* J.L. Barnard, 1961 (redrawn from J.L. Barnard, 1962); (9.3, 10.2, 11.2, 12.1, 15.2) ***Pseudericthonius bousfieldi*** **sp. nov.**; (10.1, 11.1, 14.2) ***Myersius spinicaudatus*** **gen. et sp. nov.** (12.1, 15.1) ***Pseudischyrocerus caecus*** **sp. nov.**

Clade 2 splits into two monophyletic groups, clades 3 and 13, tribes Ischyrocerini and Siphonoecetini, respectively. The Siphonoecetini (clade 13) is defined by coxae 1–5 longer than wide and coxae 6 and 7 wider than long (12.3). Within this clade we found three monophyletic genera. The first is *Pseudischyrocerus* (clade 14), which is defined by the tip of the outer ramus of uropod 3 with a plate bearing spines (33.3). Then, we have clade 15 comprising *Myersius* gen. nov. and *Bathyphotis* (clade 15), which are defined by coxa 4 with the posterior margin excavate (14.2) and coxa 5 lacking a posterodorsal lobe (15.2). *Myersius denticaudatus* gen. et sp. nov. can be defined by the telson with two subdistal spines

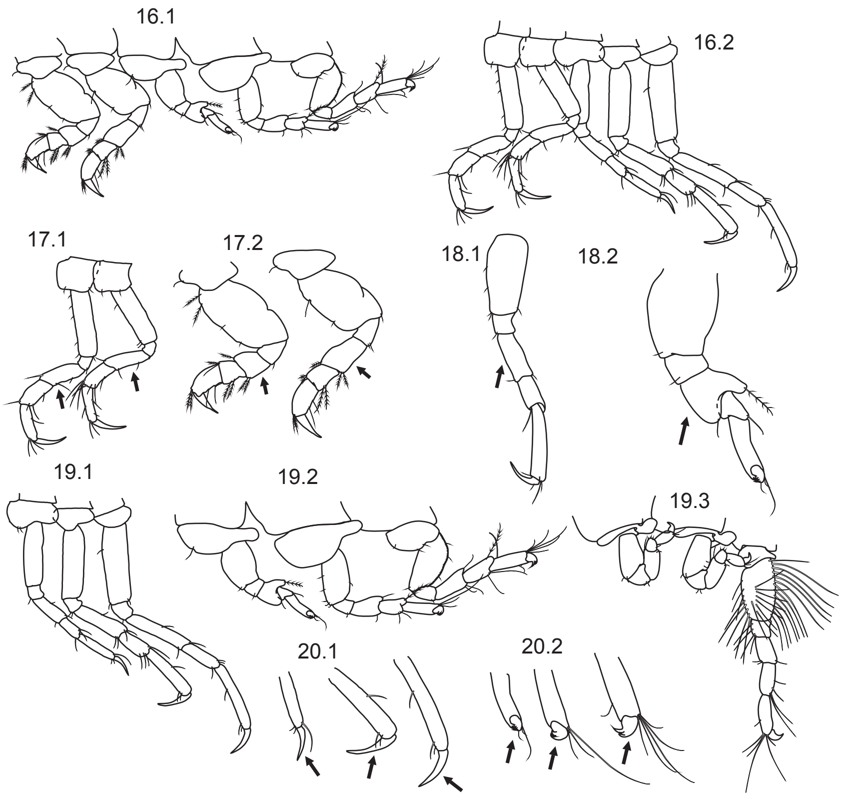

Figure 3. Characters 16–20. Pereopods 3–7 basis ovate (16.1), rectilinear (16.2). Pereopod 4 merus equal to merus of pereopod 3 (17.1), longer than merus of pereopod 3 (17.2). Pereopod 5 carpus subrectangular (18.1); lunate or reniform (18.2). Pereopods 5 similar to pereopods 6 and 7 (19.1); pereopod 5 dissimilar to pereopods 6 and 7 (19.2), pereopod 5 similar to pereopod 6 and dissimilar to pereopod 7 (19.3). Pereopods 5–7 dactylus without accessory spines (20.1), with accessory spines (20.2). Species: (16.1, 17.2, 18.2, 19.2, 20.2) ***Notopoma teresae*** **sp. nov.**; (19.3) *Caribboecetes barbadensis* Just, 1983 (redrawn from Just, 1984); (16.2, 17.1, 19.1, 20.1) *Bonnierella linearis*; (18.1) ***Bonnierella campensis*** **sp. nov.**

(41.2), and gnathopod 1 with the carpus shorter than the propodus (8.1); this character state appeared independently in clade 6.

Tribe Siphonoecetini (clade 3, Fig. 7) is defined by eight synapomorphies: gnathopod 2 of the male carpochelate (9.2) and with the carpus longer than the propodus (10.2) – these characters change in clade 5 (9.3, 10.1), and are reversed in *Bathypoma* (9.1, 10.1); pereopod 5 carpus short, lunate, or reniform (18.2); pereopods 5–7 dactylus with accessory spines (20.2); peduncle of uropod 1 with a distal corona (29.2); uropod 3 uniramous (35.2); and telson wider than long (38.2), with recurved spines in patches on the dorsum (40.2) – this character changes in clade 6 (40.3). Siphonoecetini is divided into two groups. Clade 4 (*Cerapus*-like genera + *Siphonoecetes* group) is defined by four synapomorphies: pereopod 5 with the distal part directed posteriorly (22.2); uropod 1 with the outer margin of the ramus dentate (30.2); uropod 2 outer margin of the ramus dentate, without robust setae (31.2); and uropod 2 uniramous (32.2). Clade 11 consists of a basal trichotomy, defined by outer margin of the inner plate of maxilla 1 with a row of setae (7.2): *Ericthonius brasiliensis* (Dana, 1853) + *Ericthonius pugnax* (Dana, 1853) + clade 13 (genus *Pseudericthonius*). Clade 13 was defined by the female gnathopod 2 with the carpus longer than the propodus (11.2).

Clade 6 is defined by the telson cleft (39.2) and with recurved dorsal rows of spines (40.3, homoplasy). Within this clade, the most basal group is the genus *Paracerapus*, which is defined by three reversal characters: pereopods 6 and 7 with the distal part directed anteriorly (23.1, 24.1); and with the tip of the outer ramus of uropod 3 with a plate bearing spines (33.3) – this last character also occurred in *Pseudischyrocerus* (clade 14).

Clade 7 comprises four closely related genera (*Cerapus*, *Runanga*, *Bathypoma*, and *Notopoma*), sharing four synapomorphies: merus of pereopod 4 longer than merus of pereopod 3 (17.2); pereopod 7 with the distal part directed posteriorly (24.2);

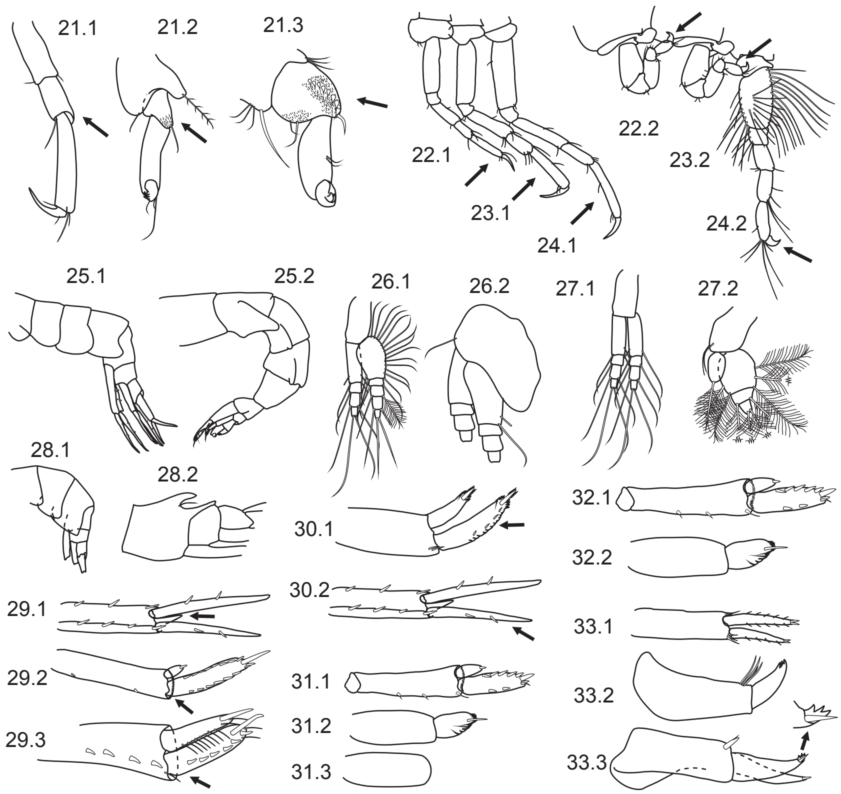

Figure 4. Characters 21–33. Pereopod 5 carpus without denticles or robust setae on posteroventral margin (21.1); with denticles on posteroventral margin (21.2); with denticles and short robust setae on posteroventral margin (21.3). Pereopod 5 distal part (at least the propodus and dactylus) directed anteriorly (22.1); distal part directed posteriorly (22.2). Pereopod 6 distal part (at least the propodus and dactylus) directed anteriorly (23.1); distal part directed posteriorly (23.2). Pereopod 7 distal part (at least the propodus and dactylus) directed anteriorly (24.1); distal part directed posteriorly (24.2). Pleosomite without lateral ridges (25.1); with lateral ridges (25.2). Pleopods peduncle slender, not expanded (26.1); broad, expanded (26.2). Pleopod 2 inner ramus present, as long as outer ramus (27.1); reduced or absent (27.2). Urosomite 1 without dorsal spines (28.1); with dorsal spines (28.2). Uropod 1 peduncle with interamal process (29.1); with distoventral corona (29.2); without distoventral corona or process (29.3). Uropod 1 outer margin of outer ramus smooth (30.1); dentate (30.2). Uropod 2 biramous (31.1); uniramous (31.2); rami absent (31.3). Uropod 2, outer margin of rami smooth and with robust setae (32.1); dentate and without robust setae (32.2). Uropod 3, tip of outer ramus without spines (33.1); with spines (33.2); with plate bearing spines (33.3). Species: (27.1, 33.1) *Gammaropsis* sp.; (22.1, 23.1, 24.1, 25.1, 29.1, 30.2) ***Bonnierella laurensi* sp. nov.**; (21.2, 25.2, 26.1, 27.2, 30.1, 31.2, 32.2) ***Notopoma teresae* sp. nov.**; (21.3, 22.2, 23.2, 24.2, 26.2, 29.3, 31.3) *Caribboecetes barbadensis* Just, 1983 (redrawn from Just, 1984); (29.2, 31.1, 32.2, 33.2) ***Pseudericthonius bousfieldi* sp. nov.**; (21.1) ***Bonnierella campensis* sp. nov.**; (28.1) ***Myersius spinicaudatus* gen. et sp. nov.**; (33.3) ***Pseudischyrocerus caecus* sp. nov.**; (28.2) *Bathyphotis tridentata*.

pleosomite with lateral ridges (25.2); and pleopod 2 with the inner ramus reduced or absent (28.2). The genus *Cerapus* (clade 10) is defined by one synapomorphy, antenna 1 posterior margin with a swelling (5.2). Clade 8 is defined by gnathopod 2 of the male subequal to the propodus (10.3), and is divided in two sister groups: *Runanga* and clade 9. The genus *Runanga* is defined by the peduncular article 3 of antenna 1 longer than article 3 (4.2) and the carpus of pereopod 5 without denticles or spines on the posteroventral margin (21.1, homoplasy). Clade 9 (*Notopoma* + *Bathypoma*) shares one character state: peduncular article 1 of antenna 1 produced anterodistally and medially (3.2). The genus *Bathypoma*, represented by *Bathypoma enigma* Lowry & Berents, 1996, is defined by two reversal characters, gnathopod 2 of the male subchelate (9.1), with the carpus shorter than the propodus (10.3). *Notopoma*, on the other hand, seems to have no clear synapomorphy and appeared as an unresolved clade.

Clade 5 (*Siphonoecetes* group) is defined by: antenna 1 shorter and often more slender than antenna 2 (2.2); mandibular palp 1-articulate (6.3); gnathopod 2 of the male simple (11.3, it changes

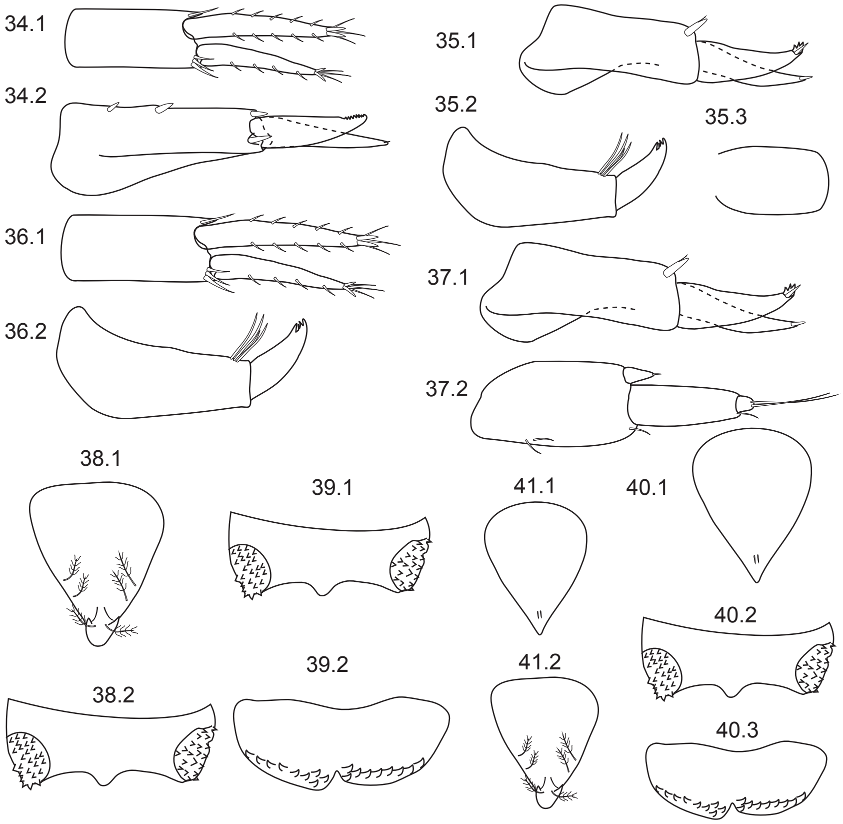

Figure 5. Characters 34–40. Uropod 3, peduncle parallel-sided (34.1); broad proximally and narrow distally (34.2). Uropod 3 biramous (35.1), uniramous (35.2), absent (35.3). Uropod 3 rami or ramus longer than peduncle (36.1), shorter than peduncle (36.2). Uropod 3, outer ramus 2-articulate, second one rudimentary (37.1), 1-articulate (37.2). Telson longer than wide (38.1), wider than long (38.2). Telson entire (39.1), cleft (39.2). Telson dorsal margin without recurved spines (40.1); with recurved spines in patches (40.2); with recurved spines in rows (40.3). Telson tip without distolateral spines (41.1); with two distolateral spines (41.2). Species: (34.1, 36.1) *Gammaropsis* sp.; (40.1, 41.1) ***Bonnierella laurensi* sp. nov.**; (39.2, 40.3) ***Notopoma teresae* sp. nov.**; (35.3) *Caribboecetes barbadensis* Just, 1983 (redrawn from Just, 1984); (35.38.2, 39.1, 40.3) ***Pseudericthonius bousfieldi* sp. nov.**; (40.1, 41.1) ***Bonnierella campensis* sp. nov.**; (34.2, 38.1, 41.2) ***Myersius spinicaudatus* gen. et sp. nov.**; (35.3, 37.1) ***Pseudischyrocerus caecus* sp. nov.**; (37.2) *Photis sarae*.

in some genera); coxae 1–4 longer than wide and coxae 5–7 wider than long (12.3, homoplasy); pereopod 5 similar to pereopod 6, but dissimilar to pereopod 7 (19.3); peduncle of the pleopod broad and expanded (26.2); and uropod 3 without recurved spines (33.1, reversal). The *Siphonoecetes* clade appeared as a single branch in the strict consensus tree and will not be discussed further here. For discussions of this group, see Just (1983) and Lowry & Berents (1996).

Tree discussion

The hypothesis of the family Ischyroceridae as a monophyletic group is herein corroborated. Myers & Lowry (2003), who conducted a wider evolutionary treatment of the corophioideans, defined the Ischyroceridae based on two characters: the peduncle

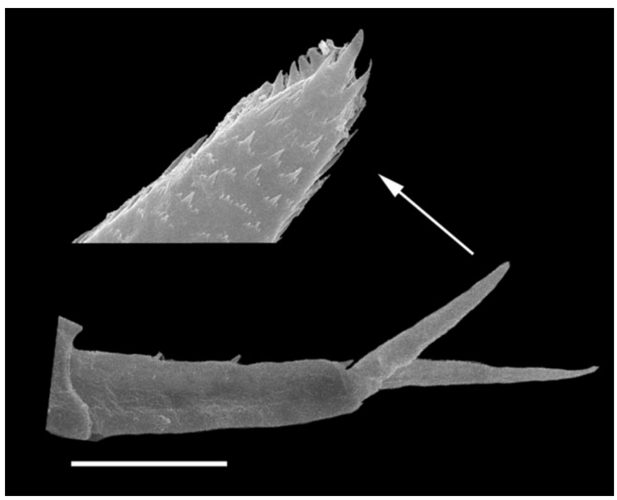

Figure 6. Detail of outer ramus tip of ***Bonnierella campensis* sp. nov.**

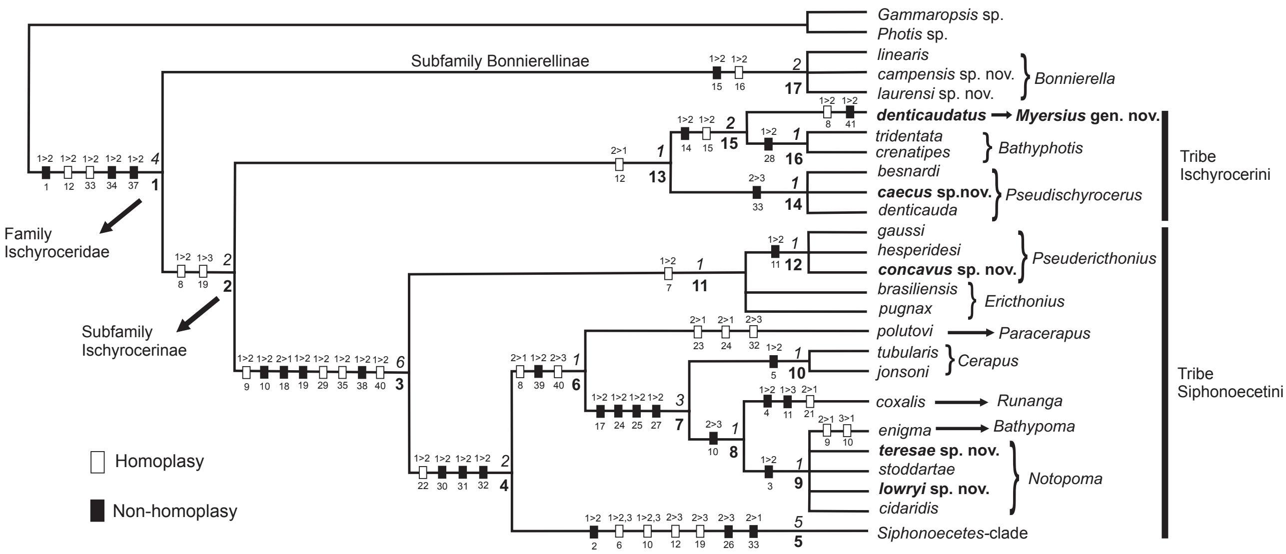

Figure 7. Strict consensus cladogram (tree length = 90; consistency index, CI = 0.622; homoplasy index, HI = 0.379; retention index, RI = 0.904; rescaled consistency index, RC = 0.563), calculated from the four fundamental trees. Numbers of nodes are included in **bold** under each branch, weith the Bremer support set in *italics* below.

of uropod 3 long, broad proximally, and narrow distally; and the rami of uropod 3 with tiny apical setae. The classical character of the presence of recurved spines on the outer ramus of uropod 3, which has been used to define the Ischyroceridae, was used to characterize only the Ischyrocerinae, as the basal subfamily Bonnierellinae was defined as lacking these spines. However, in our analysis, this character state was found to define the family Ischyroceridae (clade 1) rather than just the subfamily Ischyrocerinae (clade 2). This was possible because we noted that species of *Bonnierella* do have recurved spines on uropod 3, as observed herein (Fig. 6), and also in some other studies on *Bonnierella* (e.g. J.L. Barnard, 1964: fig. 33m; J.L. Barnard, 1966: fig. 11h; J.L. Barnard, 1967: fig. 13l). Thus, we assume that the ancestor of ischyrocerids had spines on the outer ramus of uropod 3, with the loss of these spines occurring only in clade 5 (*Siphonoecetes* group). Also, in our analysis, we found five synapomorphies for the Ischyroceridae (Fig. 7), but only one of these was used by Myers & Lowry (2003) (character 33.2).

Within the Tribe Ischyrocerini (clade 13), *Pseudischyrocerus crenatipes* Bellan-Santini & Ledoyer, 1987 appeared as the sister taxon of *Bathyphotis tridentata* Stephensen, 1944, forming clade 16, and is herein transferred to the genus *Bathyphotis*, which is defined by the presence of two dorsal spines on urosomite 1 (28.2). The genera *Bathyphotis* and *Myersius* gen. nov. (clade 15) are sister groups, sharing the posterior margin of coxa 4 excavated, a character state unique among both Corophiidae and Ischyroceridae. Moreover, *Myersius* gen. nov. was confirmed as a well-defined genus based on two synapomorphies: gnathopod 1 carpus longer than the propodus (8.2) and the telson with two distolateral spines (41.2).

Clade 11 formed a trichotomy with species of *Ericthonius* and *Pseudericthonius*. *Pseudericthonius* was erected by Schellenberg (1926) based on *Pseudericthonius gaussi* (Schellenberg, 1926), and it was distinguished from *Ericthonius* by two characters: female gnathopod 2 almost carpochelate; and with a much-reduced inner rami of uropods 1 and 2. For almost 70 years, only the type species of *Pseudericthonius* was known. Presently, with five described species, it was possible to re-evaluate the characters used to define this genus. The first character also occurs in females of *Ericthonius*, which have a strongly lobate carpus in gnathopod 1. The second is a continuous character that varies within the genus, for example: the inner rami of uropods 1 and 2 can be longer than the outer ramus in *E. pugnax* (Dana, 1853); three-quarters of the outer ramus in *Pseudericthonius stephenseni* Myers & McGrath, 1984; two-thirds of the outer ramus in *Pseudericthonius concavus* sp. nov.; and one-quarter of the outer ramus in *Pseudericthonius bousfieldi* sp. nov. and *P. gaussi*. The same continuous character is observed in the genera *Cerapus* and *Notopoma*, and should be used at the species level. In the analysis of Lowry & Berents (1996), *Ericthonius* and *Pseudericthonius* appeared in a trichotomy together with a group formed with the *Cerapus* clade + siphonocetid clade. Thus, *Ericthonius* and *Pseudericthonius* would be synonymized (Lowry & Berents, 1996). In our analysis, we found *Ericthonius* and *Pseudericthonius* forming clade 11, supported by maxilla 1 outer margin of the inner plate with a row of setae (7.2), and separated from clade 6 (*Paracerapus*, *Cerapus*, *Runanga*, *Bathypoma*, *Notopoma*, and the siphonocetid clade). No synapomorphies for the genus *Ericthonius* were found, however, which appeared as unresolved in the analysis, whereas the species of *Pseudericthonius* (clade 12) formed a monophyletic group sharing female gnathopod 2 with the carpus longer than the propodus (11.2). To reach a better solution, a wider analysis should be performed, including all species of these two genera.

Concerning clade 6 (*Cerapus* clade), we found some differences from the topology described by Lowry & Berents (1996). In their analysis, the genus *Runanga*, characterized by having a rudimentary accessory flagellum, was derived early in the *Cerapus* group. Then, the *Paracerapus* + *Cerapus* clade was defined by having the carpus longer than the propodus in the male gnathopod 2, and formed a sister group with the *Notopoma* + *Bathypoma* clade, which was defined by the medial and distal expanded peduncle of antenna 1. Nevertheless, the present analysis showed that *Paracerapus* diverged earlier in the evolution of the group as the basal genus within clade 6, and it did not form a separate group with *Cerapus*. Also, the presence of the carpus longer than the propodus in the male gnathopod 2 appeared earlier as a synapomorphy of clade 3 (tribe Ischyrocerini), and cannot be used to characterize *Paracerapus* + *Cerapus*. The next branch in our analysis corresponds to the genus *Cerapus* (clade 10), which appeared to be monophyletic and is herein characterized by the posterior margin of article 1 of antenna 1 with a swelling. The genus *Runanga* is the sister group of *Notopoma* and *Bathypoma* (clade 9). Lowry & Berents (1996) showed that the presence of an accessory flagellum on antenna 1 was a synapomorphy of *Runanga*, and its absence characterized the *Ericthonius* group; however, an accessory flagellum is also found in other genera within the tribe Ischyrocerini, including all species of *Ericthonius* and some species of *Notopoma* (*Notopoma cidaridis* Berge, Vader & Lockhart, 2004 and *Notopoma lowryi* sp. nov.), and its presence or absence should be checked in future studies. Clade 9 showed that *Notopoma* shares a common ancestor with *Bathypoma*, as noted by Lowry & Berents (1996); however, *Notopoma* did not appear as a monophyletic group. Even examining almost all descriptions available in the literature, including the new species described herein, we could not find a synapomorphy for *Notopoma*. *Bathypoma* can be distinguished from *Notopoma* by the subchelate male gnathopod 2 (9.1), whereas the carpochelate male gnathopod 2 (9.2) appeared as a synapomorphy for the tribe Siphonoecetini (clade 3). Nevertheless, our present opinion is that *Notopoma* and *Bathypoma* should be maintained separately, as we did not have all species of these genera to compare. Moreover, we are aware of some species of *Notopoma* from the south-western Atlantic Ocean that await description, which should provide new insights into this problem.

SYSTEMATICS

Order Amphipoda Latreille, 1816

Suborder Senticaudata Lowry & Myers, 2013

Infraorder Corophiida Leach, 1814

Family Ischyroceridae Stebbing, 1899

Diagnosis

Head lateral cephalic lobe not or only weakly extended, eye, if present, situated proximal to lobe; anteroventral margin moderately to strongly recessed and moderately excavated. Mandible palp, if present, article 3 symmetrical, distally rounded, setae extending along most of posterodistal margin, posterior margin with setae of variable length. Gnathopod 1 not enlarged in males or females. Gnathopod 2 enlarged in males. Pereopods 5–7 not subchelate. Urosomites usually not coalesced. Uropod 3 peduncle broad proximally and narrow distally; rami with tiny apical setae, outer ramus 1-articulate, with or without recurved apical spines. Telson with or without rows of recurved hooks, with or without patches of short denticles (modified from Myers & Lowry, 2003).

Subfamily Bonnierellinae Myers & Lowry, 2003

Diagnosis

Pereopods 3–7 with basis rectangular. Pereopods 5–7 dactyli without accessory spines on anterior margin. Coxa 5 with posterodorsal lobe absent. Uropods 1 and 2, peduncle with acute inter-ramal process. Uropod 3 outer ramus with recurved spines (only visible with high magnification). Telson without hooks or denticles (modified from Myers & Lowry, 2003).

Included genera

Bonnierella Chevreux, 1900 and *Bogenfelsia* J.L. Barnard, 1962.

Genus *Bonnierella* Chevreux, 1900

Bonnierella Chevreux, 1900: 97. – Stebbing, 1906: 737. – J.L. Barnard, 1962: 70. – J.L. Barnard,

KEY TO THE GENERA OF ISCHYROCERIDAE USED IN THIS ANALYSIS

1. Pereopods 5–7 with accessory spines; uropods 1 and 2 peduncle with distoventral corona of spines; uropod 3 uniramous; telson rectangular, wider than long, with rows or patches of recurved spines 2
– Pereopods 5–7 without accessory spines; uropods 1 and 2 peduncle with acute interamal process; uropod 3 biramous; telson triangular, longer than wide, without rows or patches of recurved spines 9
2. Telson with two patches of recurved spines on each side...3
– Telson with rows of recurved spines on distal margin...5
3. Antenna 1 shorter and often more slender than antenna 2..*Siphonoecetes* group
– Antenna 1 subequal to antenna 2...4
4. Gnathopod 2 carpus shorter than propodus in female ....*Ericthonius*
– Gnathopod 2 carpus longer than propodus in female ....*Pseudericthonius*
5. Antenna 1 article 1 with anterior margin medially and distally expanded...6
– Antenna 1 article 1 with anterior margin not medially and distally expanded..7
6. Gnathopod 2 subchelate in both male and female...*Bathypoma*
– Gnathopod 2 carpochelate in male and subchelate in female...*Notopoma*
7. Pereopods 5–7, distal part directed posteriorly..*Paracerapus*
– Pereopods 5–7, at least the propodus and dactylus directed anteriorly...8
8. Antenna 1, posterior margin of peduncular article 1 lacking swelling, peduncular article 3 longer than article 2, accessory flagellum vestigial...*Runanga*
– Antenna 1, posterior margin of peduncular article 1 with swelling, peduncular article 3 shorter than article 2, accessory flagellum absent ....*Cerapus*
9. Gnathopod 1 carpus longer than propodus; coxa 5 with posterior lobe; tip of outer ramus of uropod 3 with a plate bearing spines...*Pseudischyrocerus*
– Gnathopod 1 carpus shorter than or subequal to propodus; coxa 5 without posterior lobe; outer ramus of uropod 3 without accessory spines near apex, but with recurved spines..10
10. Coxa 4 not excavated posteriorly, basis of pereopods 3–7 rectangular...*Bonnierella*
– Coxa 4 excavated posteriorly; basis of pereopods 3–7 not rectangular...11
11. Urosomite 1 with two dorsal teeth; telson without subapical spines..*Bathyphotis*
– Urosomite 1 without dorsal teeth; telson with a pair of subapical spines.........................***Myersius* gen. nov.**

1964: 42. – J.L. Barnard, 1969. – J.L. Barnard, 1973. – Ledoyer, 1982: 184. – J.L. Barnard & Karaman, 1991: 176.

Type species
Podoceropsis abyssi Chevreux, 1887.

Diagnosis
Antenna 1 subequal to antenna 2; peduncular article 1 long and rectangular; article 1 longer than article 2. Eyes absent. Mandibular palp well developed and 3-articulate. Gnathopod 1 carpus shorter than propodus. Gnathopod 2 subchelate in both sexes; carpus shorter than propodus. Coxae 1–7 wider than long. Coxa 4 posterior margin not excavated. Pereopods 3–7 basis rectangular. Pereopod 4 merus equal to merus of pereopod 3. Pereopod 5 similar to pereopods 6 and 7; carpus long, subrectangular, and without denticles or spines on posteroventral margin. Pleosomite without lateral ridges. Peduncle of pleopods slender and not expanded. Pleopod 2 inner ramus present, as long as outer ramus. Urosomite 1 without dorsal spines. Uropod 1 peduncle with acute interamal process; outer margin of outer ramus smooth. Uropod 2 biramous; outer margin of rami smooth, with robust setae. Uropod 3, outer ramus with recurved spines (only visible with high magnification). Telson without hooks or denticles.

Included species
Bonnierella abyssi (Chevreux, 1887); *Bonnierella abyssorum* (Bonnier, 1896); *Bonnierella angolae* J.L. Barnard, 1962; *Bonnierella californica* J.L. Barnard, 1966; *Bonnierella campensis* sp. nov.; *Bonnierella compar* Myers & Cunha, 2004; *Bonnierella dimorpha* Ledoyer, 1982; *Bonnierella lapisi* (J.L. Barnard, 1962); *Bonnierella laurensi* sp. nov.; *Bonnierella linearis* J.L. Barnard, 1964; *Bonnierella palenquia* J.L. Barnard, 1967.

Excluded species
Bonnierella longiramus Ledoyer, 1982, *incertae sedis*.

General remarks
The genus *Bonnierella* was erected by Chevreux (1900) in the family Photidae based on the species *Podoceropsis abyssi* Chevreux, 1887, differing from other genera by: the shape of male gnathopod 2; rectangular basis of pereopods 3–7; and telson triangular. Later, J.L. Barnard (1964) transferred

Bonnierella to the family Ischyroceridae based on the presence of spines on the outer ramus of uropod 3 and the rami of uropod 3 shorter than the peduncle. The spines on the outer ramus of uropod 3 in *Bonnierella* are visible only at high magnification. Subsequently, Myers & Lowry (2003) erected the subfamily Bonnierellinae in their phylogenetic study of the suborder Corophiidea. These authors showed that this subfamily, composed of *Bonnierella* and *Bogenfelsia* Barnard, 1964, is the basal branch of the family Ischyroceridae.

The genus *Bonnierella* has been, until the present study, composed of ten species, and this number is now raised to 11 (Table 5). The reason is that *B. longiramus* Ledoyer, 1982 shows some characters outside the diagnosis of *Bonnierella*, and should be removed from the genus. This species has the anteroventral margin of the head moderately excavated, gnathopod 1 with the carpus longer than the propodus, coxae 1–4 longer than wide, uropod 3 with the rami longer than the peduncle, the outer ramus with a rudimentary second article, and the telson trapezoid with two subdistal crests (Ledoyer, 1982: fig. 64). Considering that the last two characters do not fit the diagnosis of the family Ischyroceridae, the position of this species is still unclear.

Geographic distribution
Cosmopolite, deep sea.

***Bonnierella campensis* sp. nov.** (Figs 8–10)

Bonnierella sp. Souza-Filho & Serejo, 2010a: 180.

Material examined
Holotype: male (3.7 mm), OCEANPROF I, BC-SUL, #79, Campos Basin, Rio de Janeiro, Brazil, 22°20′44.82″S, 40°01′24.72″W, 775 m, 21 November 2002, MNRJ 21218.

Paratypes: One female (3.3 mm) (dissected and drawn), OCEANPROF I, BC-SUL, #79, Campos Basin, Rio de Janeiro, Brazil, 22°20′44.82″S, 40°01′24.72″W, 775 m, 26 November 2002, MNRJ 21484. One female, OCEANPROF I, BC-SUL, #74, Campos Basin, Rio de Janeiro, Brazil, 22°28′3.24″S, 40°09′23.22″W, 750 m, 12 December 2002, MNRJ 21215. One female, OCEANPROF I, BC-NORTE, #59, Campos Basin, Rio de Janeiro, Brazil, 21°53′59.22″S, 39°55′30,66″W, 750 m, 1 July 2003, MNRJ 21216. One female, OCEANPROF II, BC #44, BC-NORTE, Campos Basin, Rio de Janeiro, Brazil, 22°11′27″S, 39°54′45″W, 749 m, 26 November 2002, MNRJ 21217. One male, OCEANPROF I, BC-NORTE, #59, Campos Basin, Rio de Janeiro, Brazil, 21°53′59.22″S, 39°55′30.66″W, 750 m, 12 December 2002, MNRJ 21219. One male, OCEANPROF II, BC-NORTE, #54, Campos Basin, Rio de Janeiro, Brazil, 21°57′23.58″S, 39°56′0.42″W, 750 m, 29 July 2003, MNRJ 21220. One male and one female, OCEANPROF II, BC-SUL, #79, Campos Basin, Rio de Janeiro, Brazil, 22°20′44.82″S, 40°01′24.72″W, 750 m, 21 June 2003, MNRJ 21221. One female, OCEANPROF I, BC-NORTE, #60, Campos Basin, Rio de Janeiro, Brazil, 21°53′40.92″S, 39°51′42.60″W, 1050 m, 12 December 2002, MNRJ 21228. One female, OCEANPROF II, BC-SUL, #59, Campos Basin, Rio de Janeiro, Brazil, 21°52′59.2″S, 39°55′32.2″W, 750 m, 29 June 2003, MNRJ 19049. One male and one female, OCEANPROF II, BC-SUL, #74, Campos Basin, Rio de Janeiro, Brazil, 22°28′02.22″S 40°09′23.52″W, 750 m, 18 June 2003, MNRJ 21230. One male, OCEANPROF I, BC-SUL, #84, Campos Basin, Rio de Janeiro, Brazil, 22°26′41.4″ S 39°58′53.28″ W, 1050 m, 20 June 2003, MNRJ 21232.

Etymology
The name *campensis* refers to the type locality, Campos Basin, Rio de Janeiro, Brazil.

Type locality
Campos Basin, Rio de Janeiro, Brazil.

Diagnosis
Maxilliped outer plate ovate, extending to two-thirds of palp article 2; palp 4-articulate, article 4 longer than article 3, with apical nail. Gnathopod 2 carpus triangular and short; propodus massive, 2.6 × carpus length, palm shorter than posterior margin with two processes, first process proximal and tridentate and second process truncate, separated by a U-shaped excavation followed by a concave crenulated portion, palmar corner defined by a short acute spine, facial margin with two pairs of robust setae; dactylus stout with a spine on inner margin. Uropod 1 peduncle interamal process about one-fifth of peduncle length; rami with one apical seta. Uropod 2 interamal process rudimentary; rami with one apical seta. Uropod 3 peduncle 1.4 × outer ramus length, outer ramus with four subapical tiny spines. Telson triangular with two short subapical setae.

Description
Based on holotype male (3.7 mm), MNRJ 21218. Head as long as pereonites 1 and 2 together; lateral cephalic lobe acute; eyes absent; anteroventral margin strongly recessed. Antennae 1 and 2 missing. Epistome acute and turned upwards. Mandible lacinia mobilis asymmetrical; palp article 2 longer than article 3, with 11 slender setae; article 3

Table 5. Comparative morphological characters of all species of the genus *Bonnierella*

Species	Maxilliped outer plate reaching	Gnathopod 1 propodus palm	Sexual dimorphism	Male gnathopod 2 palm of propodus with	Male gnathopod 2 palmar corner with	Female gnathopod 2 palm of propodus	Uropod 1 peduncle	Uropod 3 outer rami × peduncle length	Telson tip
B. abyssi (Chevreux, 1887)	1/3 of palp article 2	Ornamented	?	3 simple blunt processes	group of setae	?	1 large distoventral acute process	0.7×	Rounded
B. abyssorum (Bonnier, 1896)	?	Ornamented	?	?	?	?	?	?	?
B. angolae J.L. Barnard, 1962	1/3 of palp article 2	Ornamented	?	2 simple blunt processes	A short process	?	1 large distoventral acute process	0.6×	Rounded
B. californica J.L. Barnard, 1966	1/3 of palp article 2	Unornamented	Weak	2 blunt processes, the first bifid	A short process	with U-shaped excavation	1 large distoventral acute process	0.45×	Rounded
***B. campensis* sp. nov.**	2/3 of palp article 2	Unornamented	Strong	2 simple blunt processes	A short process	lacks excavation	1 large distoventral acute process	0.7×	Acute
B. compar Myers & Cunha, 2004	1/3 of palp article 2	Unornamented	Weak	2 blunt processes, the first crenulate	A short process	with U-shaped excavation	1 large distoventral acute process	0.3×	Rounded
B. dimorpha Ledoyer, 1982	1/3 of palp article 2	Unornamented	Weak	groups of robust setae	A group of robust setae	with U-shaped excavation	1 large distoventral acute process	0.7×	Rounded
B. lapisi (J.L. Barnard, 1962)	1/3 of palp article 2	Unornamented	Strong	2 blunt processes, the first crenulate	A large acute process	with V-shaped excavation	1 large distoventral acute process	0.6×	Truncated
***B. laurensi* sp. nov.**	1/3 of palp article 2	Unornamented	Strong	2 blunt processes, the first crenulate	A large acute process	with triangular process	1 large distoventral acute process	0.8×	Acute
B. linearis J.L. Barnard, 1964	1/3 of palp article 2	Unornamented	Weak	2 blunt processes, the first crenulate	A large acute process	with U-shaped excavation	1 large distoventral acute process	0.5×	Acute
B. palenquia J.L. Barnard, 1967	1/3 of palp article 2	Unornamented	Weak	?	?	with V-shaped excavation	2 large distal acute processes	0.5×	Acute

Information from the literature and from observed material.

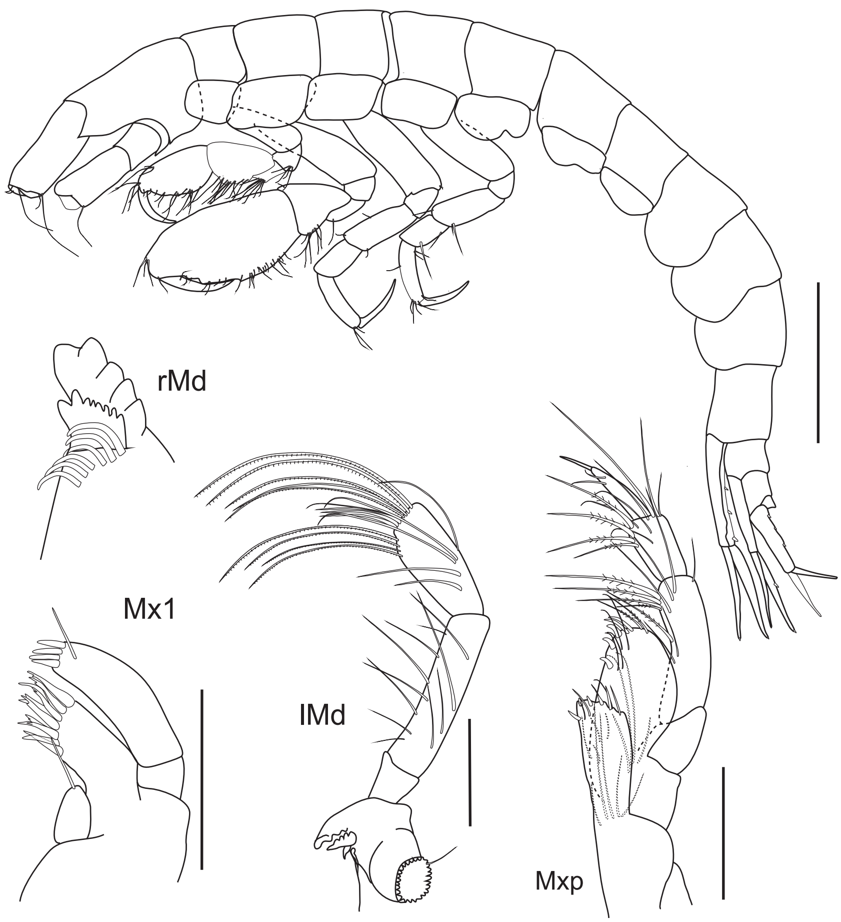

Figure 8. ***Bonnierella campensis*** **sp. nov.** Holotype: male (3.7 mm), OCEANPROF I, BC-SUL, #79, 775 m, 21 November 2002, MNRJ 21218. Scale bars: 0.1 mm.

spatulate, with long facial and long setae. Maxilla 1 inner plate with one long seta; outer plate with ten robust setae; palp longer than outer plate, with four robust apical setae and one slender facial seta. Maxilliped inner plate rectangular, with three apical short robust setae; outer plate ovate, extending to two-thirds of palp article 2; palp 4-articulate, article 4 longer than article 3 with apical nail. Upper lip, lower lip, and maxilla 2 with basic characters for the genus.

Coxae 1–7 wider than long. Coxa 2 wider than other coxae, with seven short setae on distal margin. Coxae 5 and 6 excavate distally. Gnathopod 1 basis slender, without setae; propodus subovoid, slightly longer than carpus, palm evenly rounded and crenulated; dactylus fitting propodus. Gnathopod 2 basis, anterior margin with some sparse setae, anterodistal angle with a short process, posterior margin weakly convex; carpus triangular and short; propodus massive, 2.6 × carpus length, palm shorter than posterior margin, with two processes, first process proximal and tridentate and second process truncate, both separated by a U-shaped excavation followed by a concave crenulated portion, palmar corner defined by a short acute spine, facial margin with two pairs of robust setae; dactylus stout, with a spine on inner margin. Pereopods 3 and 4 similar in shape and length; basis long and slender, as long as merus and carpus together, both anterior and posterior margins without setae; merus with anterior margin produced; propodus longer than carpus; dactylus slightly shorter than propodus. Pereopods 5–7 missing.

Epimera 1–3 rounded. Uropods 1 and 2 reaching equally apex of uropod 3. Uropod 1 peduncle inner margin with four short robust marginal setae and one distal seta, outer margin with only one marginal seta; interamal process about one-fifth peduncle length; rami with one apical seta; inner ramus longer than outer ramus, with one short robust seta about midlength of ramus; outer ramus naked. Uropod 2, inner margin with one short robust marginal seta and one robust apical seta; interamal process rudimentary; rami with one apical seta; inner ramus longer than outer ramus, with one single short robust

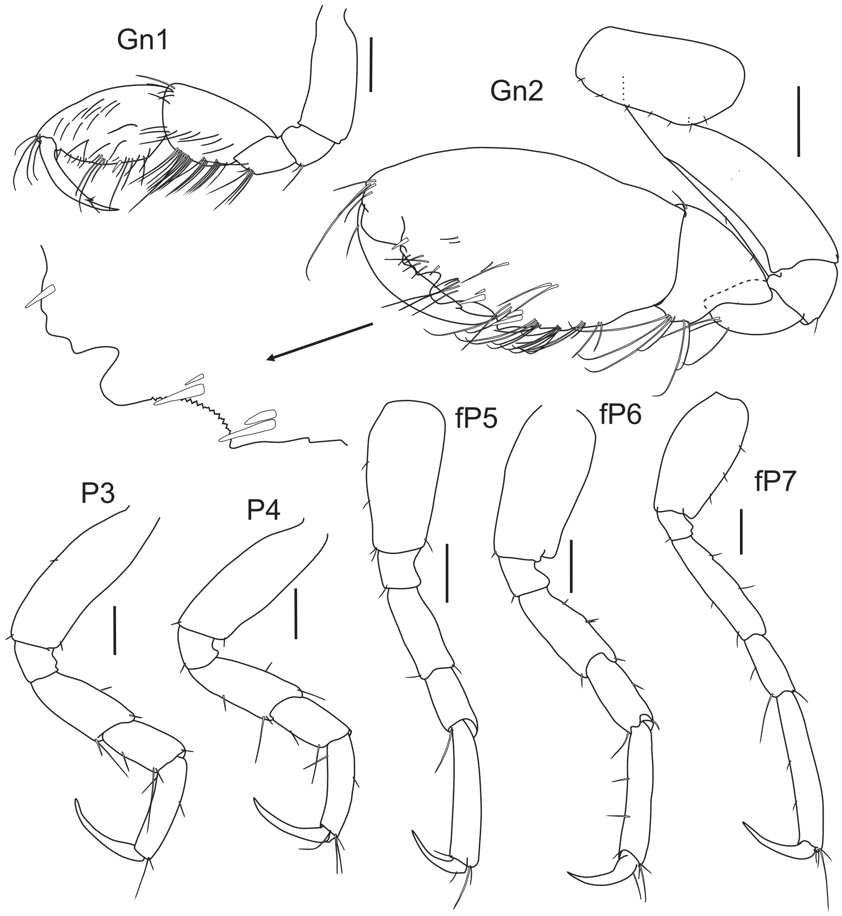

Figure 9. ***Bonnierella campensis* sp. nov.** Holotype: male (3.7 mm), OCEANPROF I, BC-SUL, #79, 775 m, 21 November 2002, MNRJ 21218. Paratype: female (3.3 mm) OCEANPROF I, BC-SUL, #79, 775 m, 26 November 2002, MNRJ 21484. Scale bars: 0.1 mm.

seta about midlength of ramus. Uropod 3 peduncle 1.4 × length of outer ramus, with three robust marginal setae; inner ramus longer than outer ramus, naked; outer ramus with four tiny subapical spines. Telson triangular, with two short subapical setae.

Sexually dimorphic characters
Females differ from males by the more-inflated body, and in the shape of gnathopod 2, in which the propodus is 1.9 × length of the carpus, and the palm is evenly rounded, with two crenulated portions separated by a shallow oblique excavation with a small spine.

Additional description
Based on female paratype (3.3 mm), MNRJ 21484. Pereopod 5, basis subrectangular; merus longer than carpus, with posterior margin produced; carpus 0.37 × propodus length; propodus long; dactylus about one-quarter of propodus length. Pereopod 6, basis rectangular; merus shorter than basis, with posterior margin produced; carpus 0.57 × propodus length; propodus long; dactylus more than one-thrid propodus length. Pereopod 7, basis rectangular, posterior margin with three slender setae; merus longer than basis; propodus long; dactylus more than one-third propodus length.

Remarks
Bonnierella campensis sp. nov. shows some similarities with *B. lapisi*, such as the shape of gnathopods 1 and 2 in the male, and the basis of pereopods 5 and 6 rectangular; however, *B. campensis* sp. nov. has the palm of gnathopod 2 with two blunt processes, and the palmar corner is defined by a short process in the male, whereas *B. lapisi* has two acute processes and the palmar corner is defined by a large acute process. Also, *B. campensis* sp. nov. has less setose rami of uropods 1 and 2, and the outer rami of uropod 3 measures 0.7 × the peduncle length. Moreover, the female gnathopod 2 of *B. campensis* sp. nov. lacks an excavation on the palm.

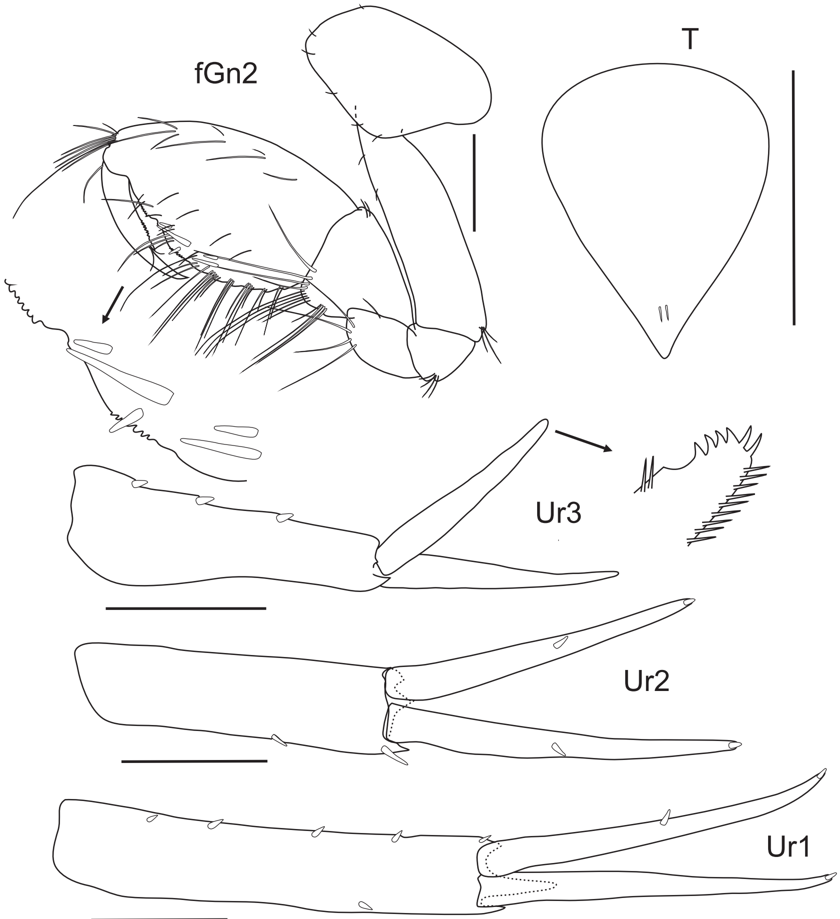

Figure 10. ***Bonnierella campensis*** **sp. nov.** Holotype: male (3.7 mm), OCEANPROF I, BC-SUL, #79, 775 m, 21 November 2002, MNRJ 21218. Paratype: female (3.3 mm) OCEANPROF I, BC-SUL, #79, 775 m, 26 November 2002, MNRJ 21484. Scale bars: 0.1 mm.

Bonnierella campensis sp. nov. is also closely related to *B. californica*, in the shape of gnathopods 1 and 2, basis of pereopods 5 and 6, and uropods 1 and 3. Nevertheless, *B. campensis* sp. nov. has gnathopod 1 sparsely setose, with the dactylus short, both margins of the basis of pereopod 3 sparsely setose, the tip of the telson acute, and the rami of uropod 3 elongate. Additionally, *B. campensis* sp. nov. differs from all other species of the genus in having an elongate and ovate outer plate of the maxilliped (Table 5).

Geographic distribution
South-western Atlantic: Campos Basin, Rio de Janeiro, Brazil.

BONNIERELLA LAURENSI SP. NOV. (FIGS 11–13)

Type material
Holotype: Male (3.1 mm; dissected and drawn), OCEANPROF II, BC-SUL, #84, Campos Basin, Rio de Janeiro, Brazil, 22°26′41.4″S. 39°58′53.28″W, 1050 m, 20 June 2003, MNRJ 21231.

Paratypes: Two females (one female dissected and drawn, 3.2 mm), OCEANPROF II, BC-SUL, #84, Campos Basin, Rio de Janeiro, Brazil, 22°26′57.6″S, 39°58′53.28″W, 1050 m, 20 June 2003, MNRJ 21422. Two males, OCEANPROF I, BC-SUL, #71, Campos Basin, Rio de Janeiro, Brazil, 22°39′47.22″S, 40°04′14.22″W, 1350 m, 23 November 2002, MNRJ 21207. One female, OCEANPROF II, BC-NORTE, #44, Campos Basin, Rio de Janeiro, Brazil, 22°11′27″S, 39°54′45″W, 749 m, 1 July 2003, MNRJ 21210. One female, OCEANPROF I, BC-SUL, #66, Campos Basin, Rio de Janeiro, Brazil, 22°45′37.2″S, 40°10′12″W, 1350 m, 22 November 2002, MNRJ 21485.

Etymology
Bonnierella laurensi sp. nov. is named in honour of Dr Jerry Laurens Barnard (1928–1992), one of the most

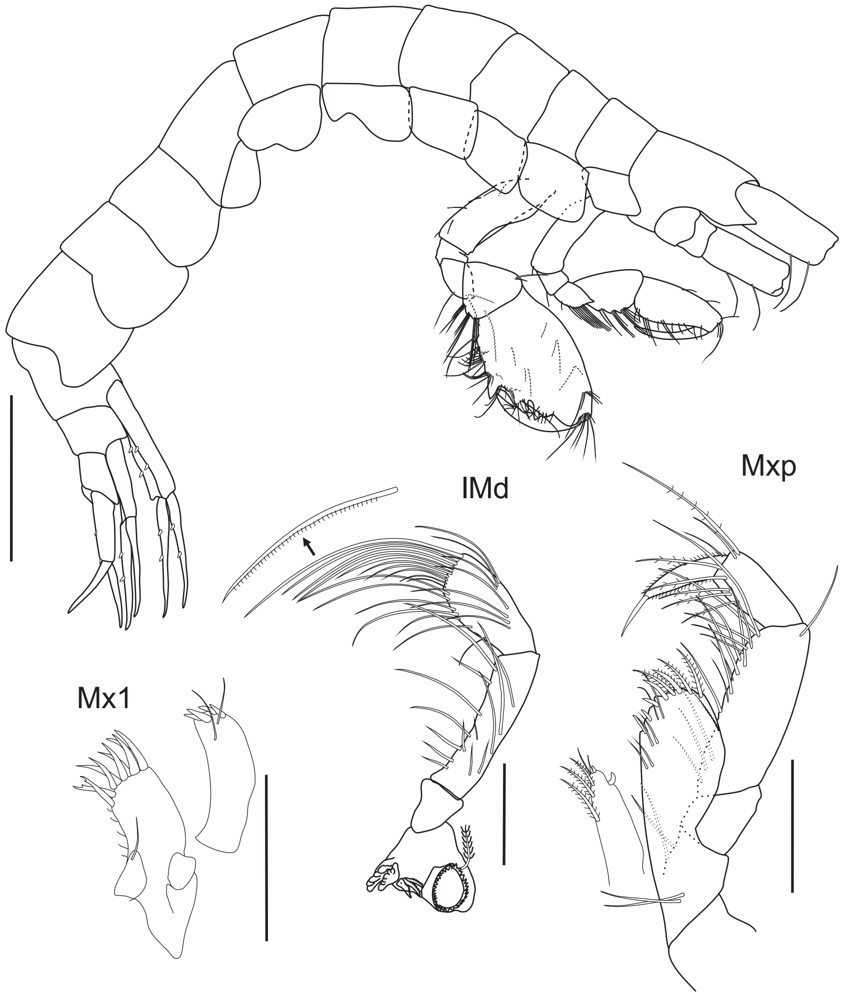

Figure 11. ***Bonnierella laurensi*** **sp. nov.** Holotype: male (3.1 mm), OCEANPROF II, BC-SUL, #84, 1050 m, 20 June 2003, MNRJ 21231.

important amphipodologists in the last century, who made important contributions to the systematics of this genus.

Type locality

Campos Basin, Rio de Janeiro, Brazil.

Diagnosis

Maxilliped outer plate ovate, reaching more than half of palp article 2; palp 4-articulate, article 4 slightly shorter than article 3, with apical nail. Gnathopod 1 propodus triangular, setose, and longer than carpus, palm acute and crenulated; dactylus fitting palm. Gnathopod 2 carpus triangular and short; propodus massive, 2.6 × carpus length, palm shorter than posterior margin with two processes, first one proximal and triangular, dentate on anterior part, second one blunt, both separated by a deep U-shaped excavation followed by a concave crenulate portion, palmar corner defined by a well-developed acute process, facial margin with one pair of short and long robust setae, inner surface with two robust setae; dactylus stout with a spine about two-thirds its length. Pereopod 6, basis with posterior margin sinuous. Uropod 1 peduncle interamal process about one-fifth of peduncle length; rami with one apical seta. Uropod 2 interamal process short and blunt. Uropod 3 peduncle 1.2 × outer ramus length; outer ramus with five subapical tiny spines. Telson triangular, longer than wide with two dorsal slender setae and three pairs of pappose setae, tip acute.

Description

Based on holotype male (3.1 mm). Head longer than pereonites 1 and 2 together; lateral cephalic lobe acute; eyes absent; anteroventral margin strongly recessed. Antennae 1 and 2 missing. Epistome acute and turned upwards. Mandible lacinia mobilis

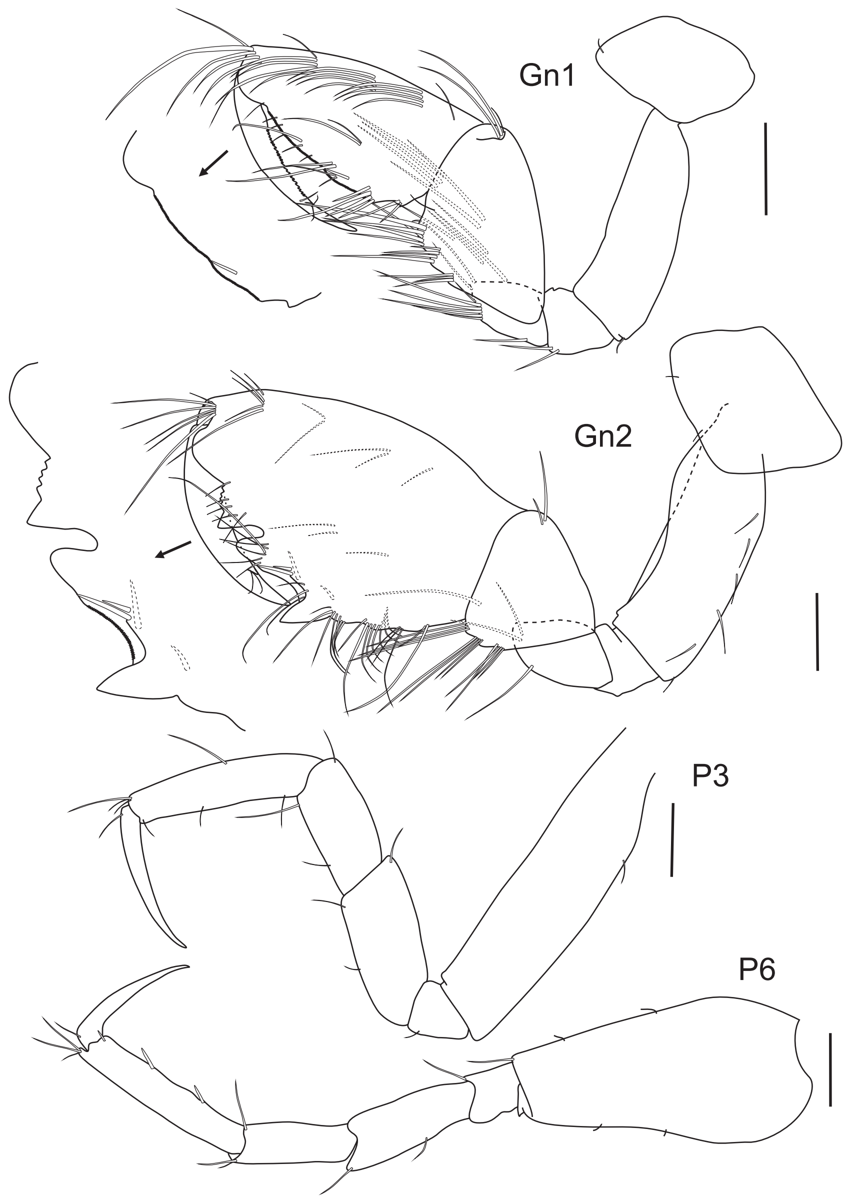

Figure 12. ***Bonnierella laurensi*** **sp. nov.** Holotype: male (3.1 mm), OCEANPROF II, BC-SUL, #84, 1050 m, 20 June 2003, MNRJ 21231.

asymmetric; palp article 2 longer than article 3, with many slender setae; article 3 spatulate with long sub to apical setae and a row of facial setae. Maxilla 1 inner plate with one long seta; outer plate with nine robust setae; palp longer than outer plate with four apical robust setae and two facial slender setae. Maxilliped inner plate rectangular with two apical short robust setae; outer plate ovate, reaching more than one-half of palp article 2; palp 4-articulate, article 4 slightly shorter than article 3 with apical nail. Upper lip, lower lip, and maxilla 2 with basic characters for the genus.

Coxae 1–7 wider than long. Coxae 5–6 excavate distally. Gnathopod 1 basis slender; propodus triangular, setose, and longer than carpus, palm acute and crenulated; dactylus fitting palm. Gnathopod 2 basis with five setae on posterior margin, anterodistal angle with a short process; carpus triangular and short; propodus massive, 2.6 × carpus length, palm shorter than posterior margin with two processes, first one proximal and triangular dentate on anterior part, second one blunt, both separated by a deep U-shaped excavation followed by a concave crenulate portion, palmar corner defined by well-developed

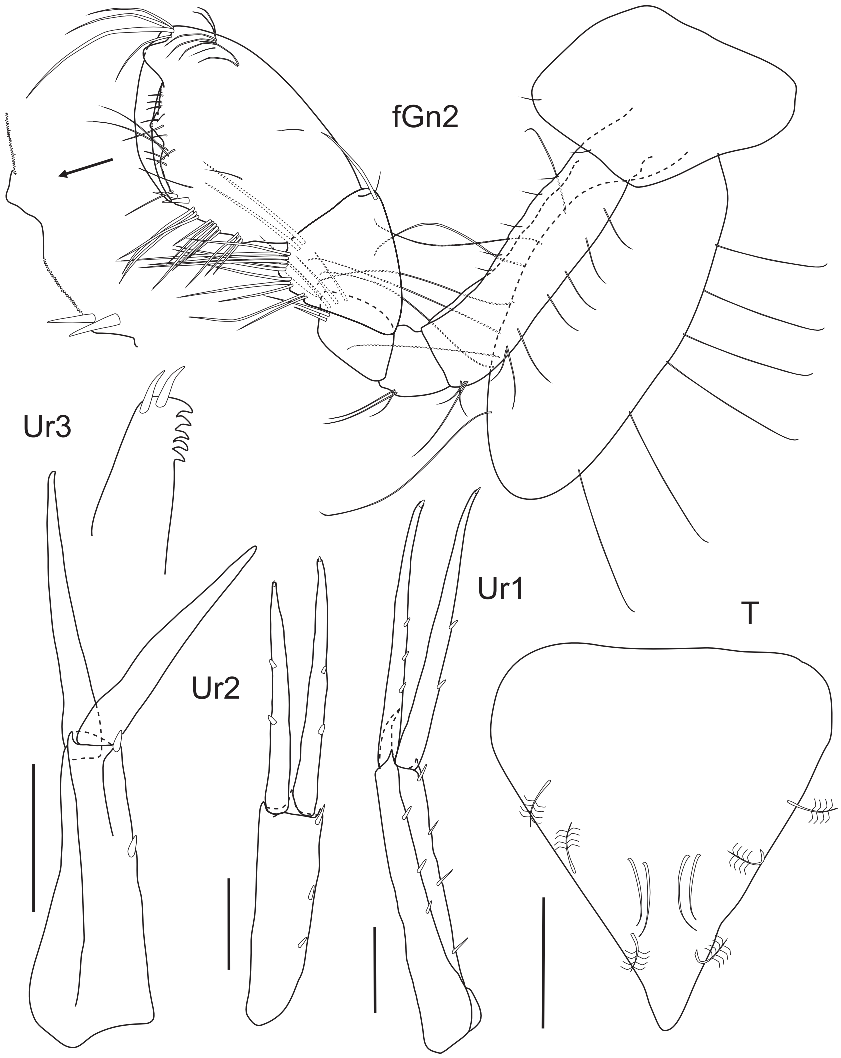

Figure 13. ***Bonnierella laurensi* sp. nov.** Holotype: male (3.1 mm), OCEANPROF II, BC-SUL, #84, 1050 m, 20 June 2003, MNRJ 21231. Paratype: female (3.2 mm), OCEANPROF II, BC-SUL, #84, 1050 m, 20 June 2003, MNRJ 21422.

acute process, facial margin with one pair of one short seta and one long robust seta, inner face with two robust setae; dactylus stout with a spine about two-thirds its length. Pereopod 3 basis rectangular and slender, longer than merus and carpus together; merus with anterior margin produced; propodus longer than carpus; dactylus shorter than propodus. Pereopods 4 and 5 missing. Pereopod 6, basis with posterior margin sinuous; merus longer than carpus with posterior margin produced; carpus 0.7 × propodus length; propodus long; dactylus about two-thirds propodus length. Pereopod 7 missing.

Epimera 1–3 rounded. Uropods 1 and 2 reaching apex of uropod 3 equally. Uropod 1 peduncle inner margin with three marginal and one distolateral robust setae, outer margin with five marginal and one distolateral setae; interamal process about one-fifth of peduncle length; rami with one apical setae; inner ramus longer than outer ramus, with two short robust setae about halfway along ramus length; outer ramus with three short robust setae about halfway along ramus length. Uropod 2 inner margin longer than outer ramus, both with two marginal robust setae and one apical seta; interamal process short and blunt. Uropod 3 peduncle 1.2 × outer ramus length, with one marginal and one distolateral robust setae; inner ramus longer than outer ramus, naked; outer ramus with five subapical tiny spines. Telson triangular, longer than wide, with two dorsal slender setae and three pairs of pappose setae, tip acute.

Sexually dimorphic characters
Females differs from males in two ways: first by a more inflated body; and second in the shape of gnathopod 2, which has the basis slender with setae on both anterior and posterior margins, propodus 1.6 × carpus length, and palm acute with two crenulate portions separated by a triangular process followed by a shallow oblique excavation, and palmar corner with two robust setae.

Remarks
Bonnierella laurensi sp. nov. is closely related to *B. campensis* sp. nov. in having pereopod 6 with a sinuous basis and uropod 3 with elongate rami; however, it differs from *B. campensis* sp. nov. by the gnathopod 1 with a triangular propodus, the shape of the palmar processes of gnathopod 2, setose uropods 1 and 2, the peduncle of uropod 3 with one robust seta on the anterior margin, the outer ramus 1.2 × peduncle length, and the more setose telson. Also, the female of *B. laurensi* sp. nov. has gnathopod 1 with the basis setose, the palmar margin with a well-developed triangular process, and only two robust setae on the palmar corner.

Bonnierella laurensi sp. nov. also resembles *B. lapisi* in the shape of gnathopods 1 and 2, and the maxilliped. Nevertheless, it is quite different in the less setose gnathopods, the U-shaped excavation in the palm of the male gnathopod 2, more elongate rami of uropods 1–3, and the setose telson. Females of *B. laurensi* have a triangular process on the palm of gnathopod 2, whereas *B. lapisi* has a deep V-shaped excavation.

The shape of the male gnathopod 2 of *B. laurensi* sp. nov. and *B. californica*, as well as the basis of pereopod 6, are very similar. On the other hand, *B. laurensi* sp. nov. shows pronounced sexual dimorphism, less setose gnathopods, a triangular propodus, and a short dactylus of gnathopod 1, as well as the telson with an acute tip (Table 5).

Geographic distribution
South Atlantic: Campos Basin, Rio de Janeiro, Brazil.

BONNIERELLA LINEARIS J.L. BARNARD, 1964
(FIGS 14–15)

Bonnierella linearis J.L. Barnard, 1964: 43, fig. 33.
Bonnierella linearis linearis J.L. Barnard, 1966: 63.

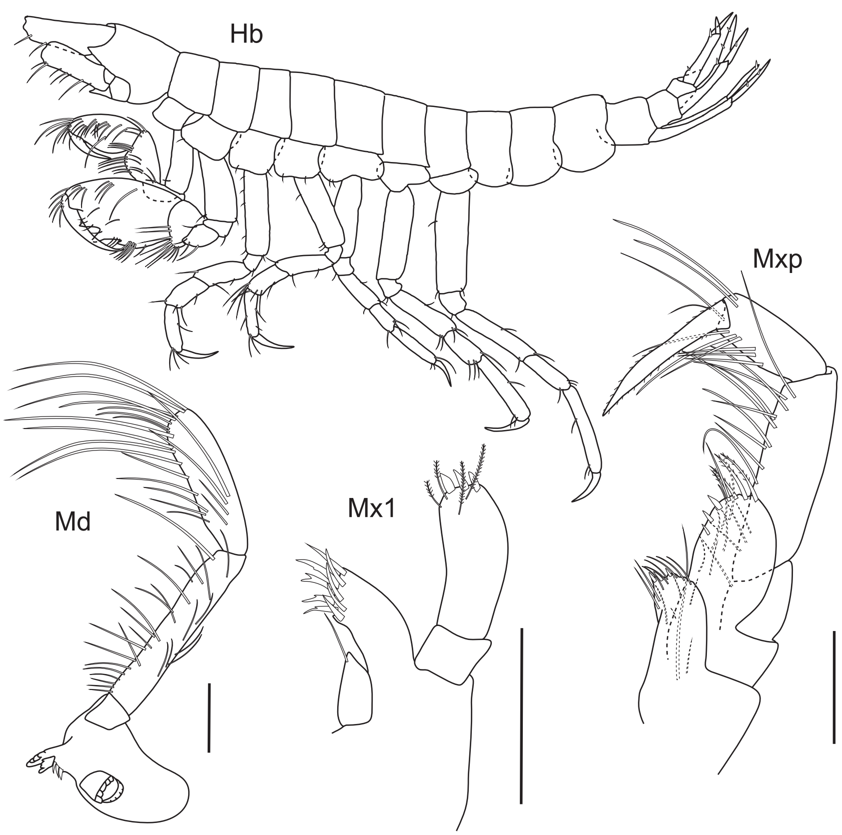

Figure 14. *Bonnierella linearis* J.L. Barnard, 1964. Holotype: male (4 mm), station V-15-69, off Peru, 10°13′S, 80°05′W, 6324 m, 9 December 1958, AMNH 12348. Habitus redrawn from Barnard (1964), with permission from the American Museum of Natural History.

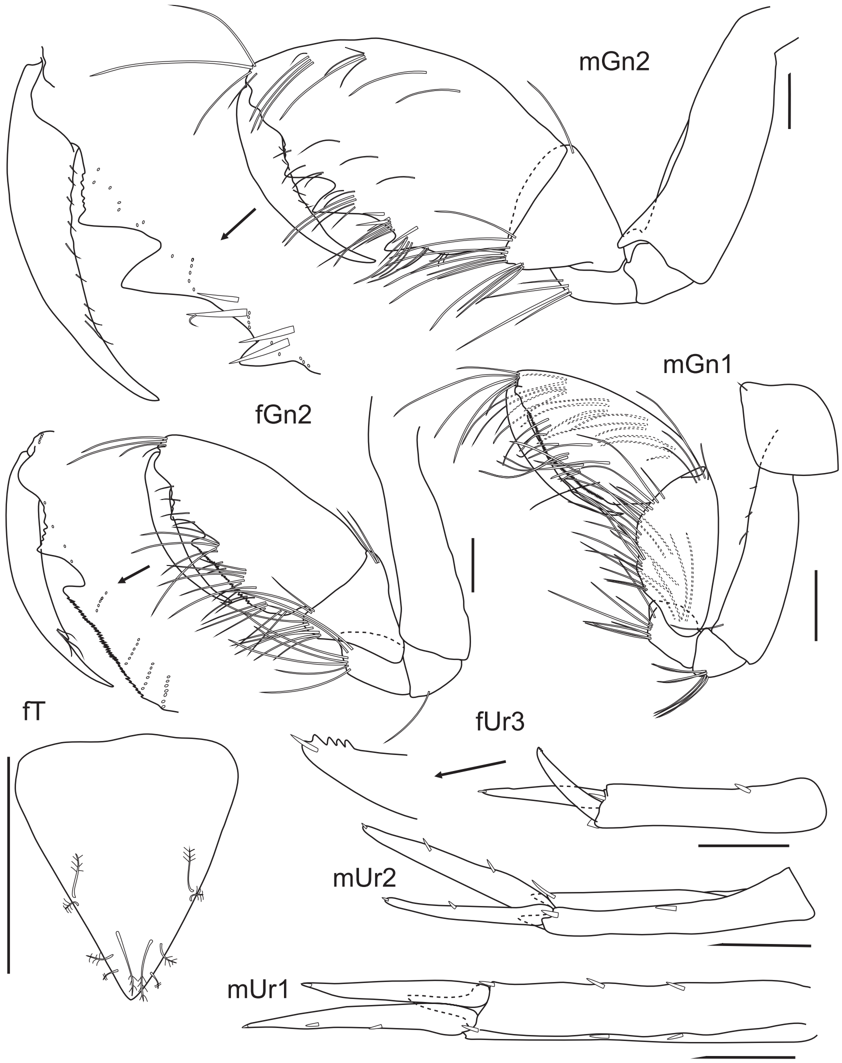

Figure 15. *Bonnierella linearis* J.L. Barnard, 1964. Holotype: male (4 mm), station V-15-69, off Peru, 10°13′S, 80°05′W, 6324 m, 9 December 1958, AMNH 12348. Paratype: female (3.8 mm), station V-15-69, off Peru, 10°13′S, 80°05′W, 6324 m, 9 December 1958, RV *Vema* col., AMNH 12351.

Material examined

Holotype: Male (4 mm), station V-15-69, off Peru, 10°13′S, 80°05′W, 6324 m, 9 December 1958, AMNH 12348.

Paratypes: Eighteen males and 13 females, station V-15-69, off Peru, 10°13′S, 80°05′W, 6324 m, 9 December 1958, RV *Vema* col., AMNH 12351.

Type locality

Off Peru, 10°13′S, 80°05′W.

Description

Based on holotype male (4 mm). Head, lateral cephalic lobe acute; eyes absent; anteroventral margin strongly recessed. Antennae 1 and 2 missing. Epistome acute and turned upwards. Mandible palp article 1 with marginal setae; article 2 shorter than article 3, with marginal and facial setae; article 3 spatulate, with long sub to apical row of setae. Maxilla 1 inner plate with one distal seta. Maxilliped inner plate rectangular, with three apical short robust setae; outer plate ovate, extending to about one-third of palp article 2; palp 4-articulate, article 4 longer than article 3 without apical nail. Upper lip, lower lip, and maxilla 2 with basic characters for the genus.

Coxae 1–7 wider than long. Coxa 5 excavate distally. Gnathopod 1 basis slender; propodus subovoid, slightly longer than carpus, both weakly setose; palm evenly rounded and crenulated; dactylus fitting propodus. Gnathopod 2 basis anterior margin without setules, anterodistal angle produced, posterior margin almost straight; carpus triangular and short; propodus massive, 3.2 × carpus length, palm longer than posterior margin, with two processes separated by a U-shaped excavation, first process proximal and crenulate, and second process acute; palmar corner defined by a well-developed spine; dactylus stout, reaching palmar corner. Pereopods 3 and 4 similar in shape and length; basis rectangular, long, and slender, longer than merus and carpus together, anterior margin with some slender setae; merus with anterior margin slightly produced; propodus longer than carpus; dactylus shorter than propodus. Pereopod 5, basis rectangular, posterior margin straight; merus longer than carpus; carpus 0.56 × propodus length; propodus long; dactylus about one-half propodus length. Pereopod 6 basis rectangular, posterior margin straight; merus 1.5 × carpus length; carpus 0.54 × propodus length; propodus long; dactylus more than one-half propodus length. Pereopod 7 basis rectangular, posterior margin straight; merus 1.5 × carpus length; carpus 0.6 × propodus length; propodus long; dactylus about one-thrid propodus length.

Epimera 1–3 rounded. Uropods 1 and 2 reaching equally apex of uropod 3. Uropod 1 peduncle inner margin with three marginal robust setae and one distal robust seta, outer margin with two marginal setae; interamal process about one-sixth peduncle length; rami lacking apical setae; inner ramus shorter than outer ramus, without setae; outer ramus with two robust setae. Uropod 2 peduncle inner margin with one marginal robust setae and two distolateral robust setae; interamal process little developed; rami with one apical setae; inner ramus longer than outer ramus, with two robust setae; outer ramus with one robust setae. Uropod 3 peduncle 2 × outer ramus length, with two distal robust setae; inner ramus longer than outer ramus, with two marginal setae; outer ramus with subapical tiny spines. Telson triangular, with four subapical and four lateral setae, tip acute.

Sexually dimorphic characters

Female with pronouced sexual dimorphism. Differs from male by less robust gnathopod 2, which lacks the palmar corner, and the two palmar processes are subacute, instead of crenulate.

Additional description

Based on paratype female (3.8 mm), AMNH 12351. Antenna 1 article 1 about 0.5 × article 2 length; article 3 longer than article 2; accessory flagellum 2-articulate, first article long and second article rudimentary; primary flagellum longer than peduncle, with eight articles. Antenna 2 article 4 shorter than article 5; flagellum shorter than peduncle, with seven articles.

Remarks

Bonnierella linearis J.L. Barnard, 1964 was described from off Peru. Later on, J.L. Barnard (1966) described *B. californica* from the Tanner Basin of southern California as a subspecies of *B. linearis*. Nevertheless, the distinctive character states detailed by J.L. Barnard seem to be sufficient to warrant specific rank for these taxa.

Indeed, *B. linearis* is very close to *B. californica*, but these species are quite different from each other in a number of character states. As a whole, *B. californica* is distinguished from *B. linearis* by: article 1 of mandibular palp lacking setae and about 0.15 × length of article 2; male gnathopod 2 with a lobate process near the hinge of the dactylus (versus a multicrenulate process); gnathopod 1 of both males and females more setose; basis of pereopods 3 with several setae along both anterior and posterior margins; outer ramus of uropod 1 0.7 × peduncle length (versus 0.3×); outer ramus of uropod 3 0.6 × peduncle length (versus 0.5×); and telson with a rounded tip (versus acute tip).

Also, the female of *B. californica* can be separated from *B. linearis* by gnathopod 2 with a well-developed palmar corner. Although J.L. Barnard (1966) considered this character a matter of age difference, the paratype female of *B. linearis* (3.4 mm) is larger than that of *B. californica* (2.75 mm). Therefore, we considered these characters as valid in separating these species from each other. For comparison with other species, see Table 5.

Geographic distribution

Known only from the type locality.

SUBFAMILY ISCHYROCERINAE STEBBING, 1899

TRIBE ISCHYROCERINI STEBBING, 1899

Diagnosis

Pereopod 5 carpus long, subrectangular. Pereopods 5–7 dactyli lacking accessory spines on anterior margin. Uropods 1 and 2 peduncle with acute interamal process, without distoventral corona of cuticular spines. Uropod 3 peduncle long, broad proximally, narrow distally. Telson entire, without rows of hooks or patches of denticles (Myers & Lowry, 2003).

Included genera

Bathyphotis Stephensen, 1944; *Coxischyrocerus* Just, 2009; *Isaeopsis* K.H. Barnard, 1916; *Ischyrocerus* Krøyer, 1838; *Jassa* Leach, 1814; *Microjassa* Stebbing, 1899; *Myersius* gen. nov.; *Neoischyrocerus*

Conlan, 1995; *Paradryope* Stebbing, 1888; *Parajassa* Stebbing, 1899; *Pseudischyrocerus* Schellenberg, 1931; *Ruffojassa* Vader & Myers, 1996; *Scutischyrocerus* Myers, 1995; *Tropischyrocerus* Just, 2009; *Ventojassa* J.L. Barnard, 1970; *Veronajassa* Vader & Myers, 1996.

GENUS *BATHYPHOTIS* STEPHENSEN, 1944

Bathyphotis Stephensen, 1944: 25.
Pseudischyrocerus – Bellan-Santini & Ledoyer, 1986: 397 (*partim*) (not Schellenberg, 1931).

Type species
Bathyphotis tridentata Stephensen, 1944.

Diagnosis
Antenna 1 subequal to antenna 2; peduncular article 1 long and rectangular; accessory flagellum with between three and six articles. Eyes present. Mandibular palp well developed and 3-articulate. Gnathopod 1 carpus shorter than propodus. Gnathopod 2 male subchelate; carpus longer than propodus. Coxae 1–4 longer than wide and coxae 5–7 wider than long. Coxa 4 posterior margin excavated. Coxa 5 with posterodorsal lobe absent. Pereopods 3 and 4 with merus equal in size. Pereopods 5–7 dactylus distal part (at least the propodus and dactylus) directed anteriorly; dactylus without accessory spines. Pereopod 5 carpus expanded, longer than propodus, without denticles or spines on a posteroventral margin. Pleosomite without lateral ridges. Pleopods peduncle slender and not expanded. Urosomite 1 with dorsal spines.

Included species
Bathyphotis crenatipes comb. nov. (Bellan-Santini & Ledoyer, 1986) and *B. tridentata* Stephensen, 1944.

Remarks
The cladistic analysis showed that *Bathyphotis* and *Myersius* gen. nov. are sister groups (clade 14), sharing the posterior margin of coxa 4 excavated and coxae 1–4 longer than wide as synapomorphies. *Bathyphotis* can be distinguished from *Myersius* gen. nov. by urosomite 1 with two dorsal teeth, outer ramus of uropod 3 with a recurved and weakly dentate tip, and telson without subapical spines.

Geographic distribution
Arctic Ocean; Atlantic Ocean, west of Cape Point, South Africa; Prince Edward Island, subantarctic region.

GENUS *MYERSIUS* GEN. NOV.

Type species
Myersius denticaudatus sp. nov., by monotypy.

Etymology
Named in honour of Dr Alan A. Myers, in recognition of his immense contributions to the systematics of the Corophioidea.

Diagnosis
Antenna 1 subequal to antenna 2; peduncular article 1 long and rectangular; accessory flagellum 2-articulate, article 1 longer than article 2. Mandibular palp well developed and 3-articulate. Eyes absent. Gnathopod 1 carpus shorter than propodus. Gnathopod 2 male subchelate; carpus shorter than propodus. Coxae 1–5 longer than wide and coxae 6 and 7 wider than long. Coxa 4 posterior margin excavated. Coxa 5 with posterodorsal lobe absent. Pereopods 3 and 4 with merus equal in size. Pereopods 5–7 with at least the propodus and dactylus directed anteriorly; dactylus without accessory spines. Pereopod 5 carpus long, subrectangular, and without denticles or spines on a posteroventral margin. Pleosomite without lateral ridges. Pleopods peduncle slender and not expanded. Pleopod 2 inner ramus present, as long as outer ramus. Urosomite 1 without dorsal spines. Uropod 1 peduncle with acute interamal process; outer margin of outer ramus smooth. Uropod 2 biramous; outer margin of ramus smooth with robust setae. Telson longer than wide (triangular), entire and with two subapical spines.

Geographic distribution
South-western Atlantic: Campos Basin, Rio de Janeiro, Brazil.

Remarks
See remarks on *Bathyphotis*.

MYERSIUS DENTICAUDATUS SP. NOV. (FIGS 16–18)

Etymology
The specific name *denticaudatus* is derived from the Latin 'denti' (= teeth) and 'cauda' (= tail, telson), and refers to the subdistal spines on the telson.

Material examined
Holotype: Male (2.5 mm), OCEANPROF II, BC-SUL, #59, Campos Basin, Rio de Janeiro, Brazil, 21°53′58.38″S, 39°55′32.22″W, 29 June 2003, 750 m, MNRJ 21424.

Paratype: One female (3.2 mm) (dissected and illustrated), OCEANPROF I, BC-NORTE, #59,

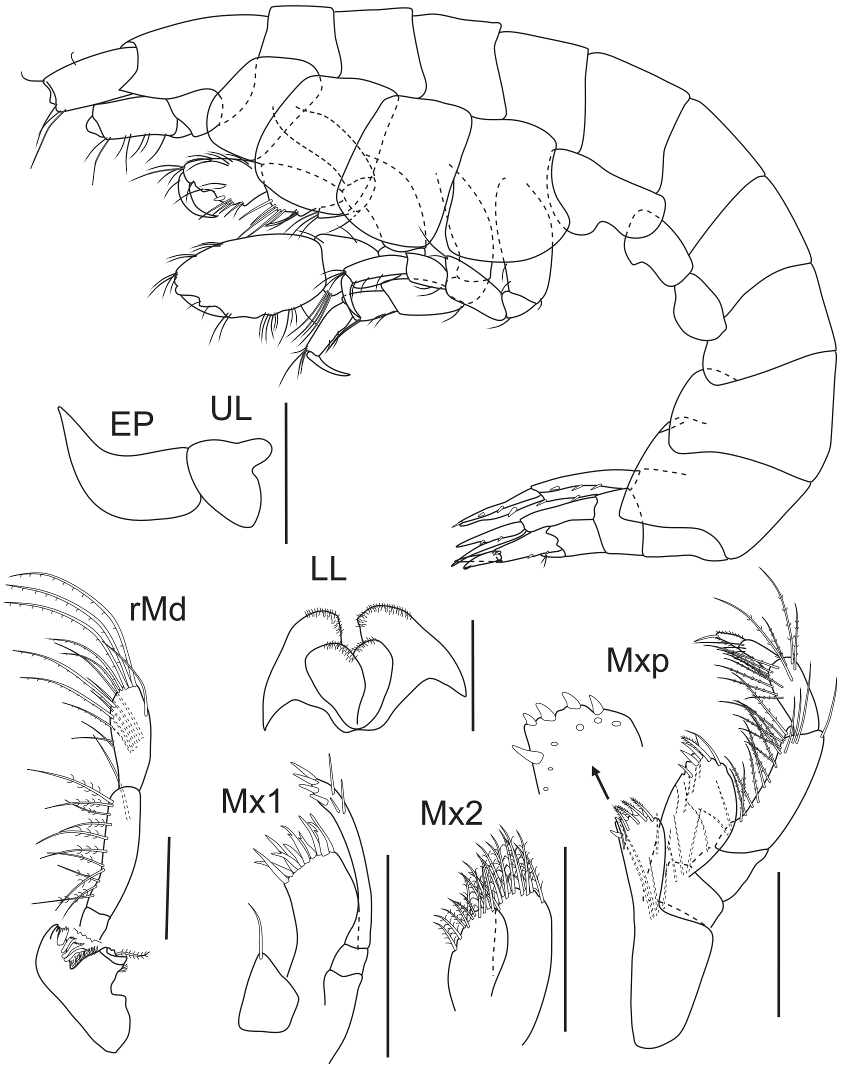

Figure 16. ***Myersius denticaudatus* sp. nov.** Holotype: male (2.5 mm), OCEANPROF II, BC-SUL, #59, 29 June 2003, 750 m, MNRJ 21424.

Campos Basin, Rio de Janeiro, Brazil, 21°53′59.22″S, 39°55′30.36″W, 12 December 2002, 750 m, MNRJ 21227.

Type locality
Campos Basin, Rio de Janeiro, Brazil.

Diagnosis
Gnathopod 1 basis moderately stout, posterior margin convex, smooth; propodus palm acute, with two portions serrate, separated by a shallow dentate excavation, without palmar corner. Gnathopod 2 propodus ovate, massive; palm shorter than posterior margin, with one proximal triangular process followed by a large blunt process, palm corner defined by a short spine with three robust setae; dactylus slender, inner margin with three spines. Epimeron 3 rectangular. Uropod 1 peduncle interamal process 0.3 × peduncle length; outer margin with three marginal robust setae and one distal robust seta. Uropod 2 peduncle interamal process 0.16 × peduncle length. Uropod 3 outer ramus robust and shorter than inner ramus, with a subapical row of spines. Telson with three pairs of dorsomarginal pappose setae, one pair of dorsal slender setae, and two subapical spines.

Description
Based on holotype male (2.5 mm), MNRJ 21424. Head longer than pereonites 1 and 2 together; anteroventral margin strongly recessed; lateral cephalic lobe acute; eyes absent. Antennae missing. Epistome acute and turned upwards. Mandible, palp article 3 spatulate, shorter than article 2, both with

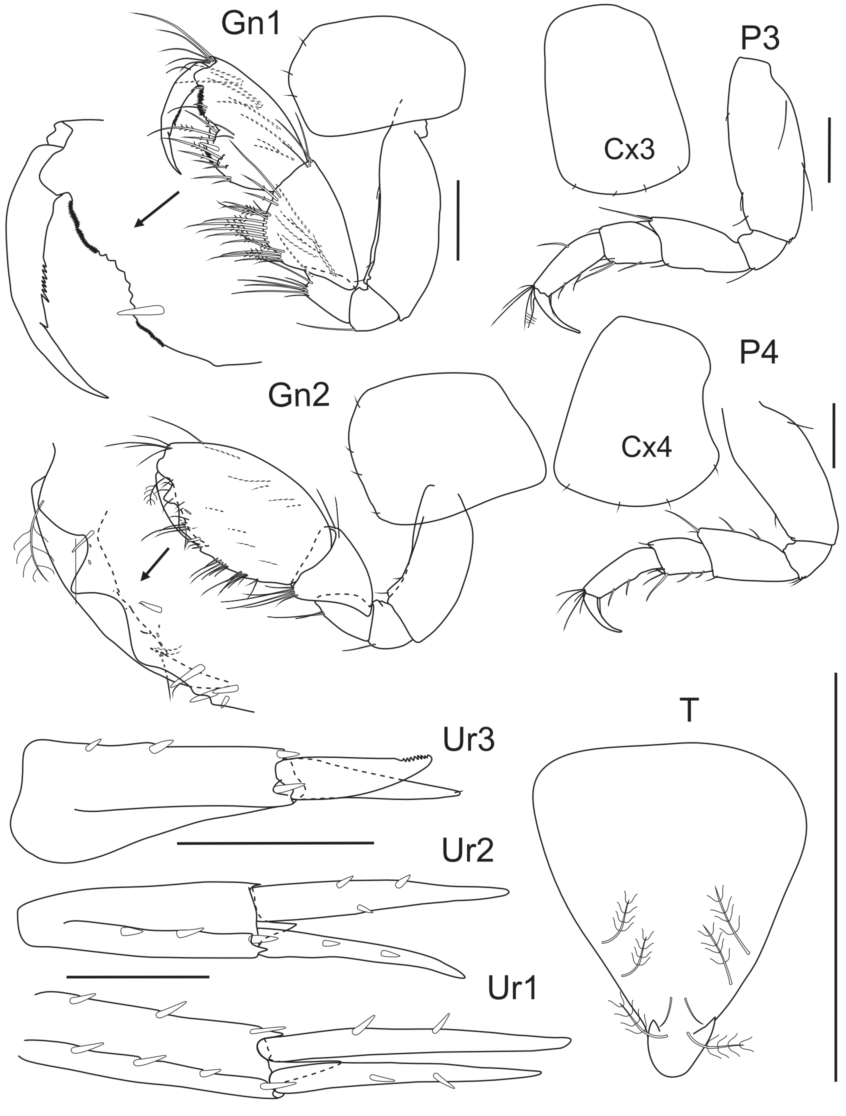

Figure 17. ***Myersius denticaudatus* sp. nov.** Holotype: male (2.5 mm), OCEANPROF II, BC-SUL, #59, 29 June 2003, 750 m, MNRJ 21424.

long pappose setae. Maxilla 1, inner plate with a single setae; outer plate with four bifid robust setae and six simple robust setae; palp 2-articulate and extended beyond outer plate, apex with four robust setae, and three slender facial setae. Maxilla 2 outer plate longer and wider than inner plate; both plates with marginal and submarginal pappose setae. Lower lip inner lobes well developed; mandibular process acute. Maxilliped, inner plate rectangular, with four distal robust setae and one subdistal seta; outer plate ovate, reaching about two-thirds the length of palp article 2, with three subdistal to distal robust setae, one slender seta, and one pappose robust seta; palp slender, 5-articulate; article 3 wider distally; articles 4 and 5 with a distal seta.

Coxae 1–4 rectangular, slightly wider distally. Coxa 4 excavated posteriorly. Coxae 5–7 wider than long. Coxae 6 and 7 almost the same size, and shorter than coxa 5. Gnathopod 1 basis moderately stout, posterior margin convex, smooth; merus excavate; carpus slightly shorter than propodus, weakly lobate, posterior margin with many pappose setae; propodus palm acute, with two portions serrate separated by a shallow dentate excavation, without palmar corner; dactylus slender and long with medial serration. Gnathopod 2 basis moderately stout, posterior margin smooth, convex, inner margin slightly concave; merus longer than ischium; carpus triangulate, 0.54 × propodus length; propodus ovate, massive; palm shorter than posterior margin, with

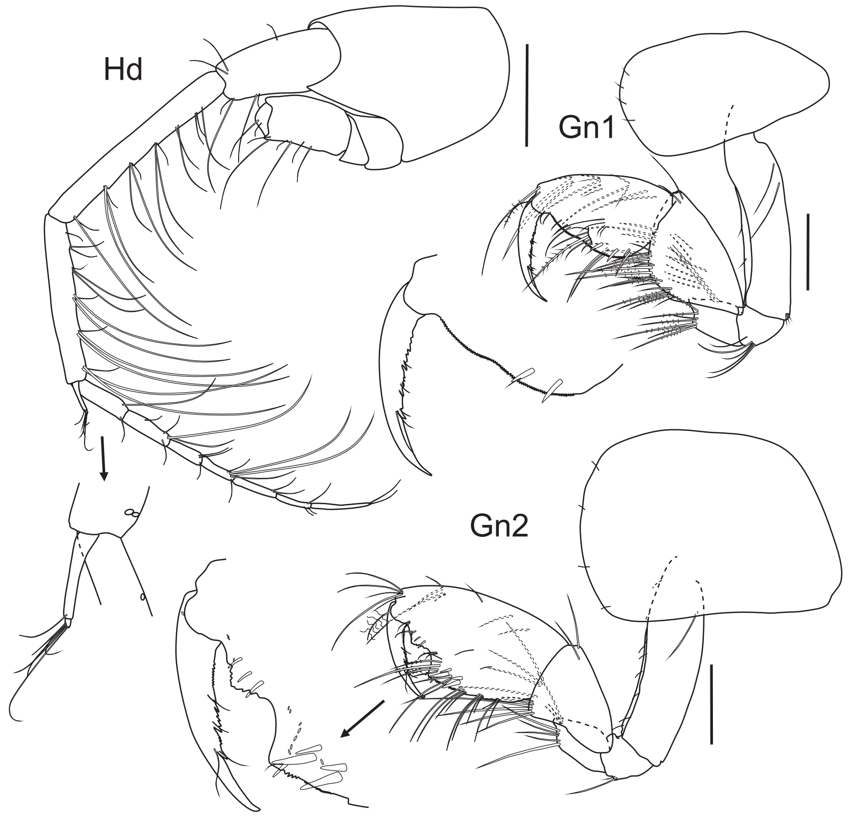

Figure 18. ***Myersius denticaudatus*** **sp. nov.** Paratype: female (3.2 mm), OCEANPROF I, BC-NORTE, #59, 12 December 2002, 750 m, MNRJ 21227.

one proximal triangular process follow by a large blunt process, palm corner defined by a short spine with three robust setae; dactylus slender, inner margin with three spines. Pereopods 3 and 4 similar, basis moderately inflated; merus anterior margin expanded; propodus longer than carpus; dactylus slender and shorter than propodus.

Epimeron 3 rectangular. Uropod 1 peduncle inner margin with two marginal robust setae and one distal robust seta; interamal process 0.3 × peduncle length; outer margin with three marginal robust setae and one distal robust seta. Uropod 2 peduncle shorter than inner ramus, with three marginal to apicolateral robust setae; interamal process 0.16 × peduncle length; inner ramus longer than outer ramus, with three marginal robust setae; outer ramus bearing two marginal robust setae. Uropod 3 peduncle with two marginal robust setae and two apical robust setae; outer ramus robust and shorter than inner ramus, with a subapical row of spines; inner ramus naked, with only one apical setule. Telson with three pairs of dorsomarginal pappose setae, one pair of dorsal slender setae, and two subapical spines.

Variations

Paratype female (3.2 mm), MNRJ 21227. Antenna 1 setose, article 1 shorter than article 3; article 2 longer than article 3; accessory flagellum 2-articulate, article 1 longer than article 2.

Sexually dimorphic characters

Overall, the females of *M. denticaudatus* sp. nov. differ from males by: gnathopod 1 basis slender, posterior margin straight with two long setae; merus moderately excavate; carpus as long as propodus, posterior margin densely setose; propodus setose, palm serrate and acute, with one robust seta defining palmar corner; dactylus long, slender, inner margin serrate. Gnathopod 2 basis slender; carpus triangular and shorter than propodus, palm acute with one dentate triangular process near insertion of dactylus, followed by a large U-shaped excavation; palmar corner acute, with two pairs of facial robust setae.

Geographic distribution

South-western Atlantic: Campos Basin, Rio de Janeiro, Brazil.

GENUS *PSEUDISCHYROCERUS* SCHELLENBERG, 1931

Pseudischyrocerus Schellenberg, 1931: 234. – J.L. Barnard, 1973: 26. – J.L. Barnard & Karaman, 1991: 229. – Valério-Berardo, 2001: 65.

Type species
Pseudischyrocerus denticauda Schellenberg, 1931.

Diagnosis
Antenna 1 subequal to antenna 2, peduncular article 1 long and rectangular; accessory flagellum 2-articulate, article 1 longer than article 2. Eyes present or absent. Mandibular palp well developed and 3-articulate. Gnathopod 1 carpus longer than propodus. Gnathopod 2 male subchelate; carpus shorter than propodus. Coxae 1–5 longer than wide, and coxae 6 and 7 wider than long. Coxa 4 posterior margin not excavated. Coxa 5 with posterodorsal lobe. Pereopods 3 and 4 merus equal in size. Pereopods 5–7 with at least the propodus and dactylus directed anteriorly, and without accessory spines. Pereopod 5 dissimilar to pereopods 6 and 7 in shape and length; carpus long, subrectangular, and without denticles or spines on a posteroventral margin. Pleosomite without lateral ridges. Pleopods peduncle slender and not expanded. Pleopod 2 inner ramus present, as long as outer ramus. Urosomite 1 without dorsal spines. Uropod 2 biramous; outer margin of outer ramus smooth, with robust setae.

Included species
Pseudischyrocerus besnardi Valério-Berardo, 2001; *Pseudischyrocerus caecus* sp. nov.; *Pseudischyrocerus denticauda* Schellenberg, 1931; and *Pseudischyrocerus distichon* (K.H. Barnard, 1930).

Excluded species: Pseudischyrocerus crenatipes Bellan-Santini & Ledoyer, 1986 is herein removed to the genus *Bathyphotis* Stephensen, 1944.

PSEUDISCHYROCERUS CAECUS SP. NOV. (FIGS 19–21)

Etymology
The specific name is derived from the Latin *caecus*, meaning blind, referring to a unique character within the genus.

Type material
Holotype: One male, Campos Basin, 11 March 2006, 1058 m, ECOPROF, MNRJ 21604.

Paratypes: One female, Campos Basin, 11 March 2006, 1058 m, ECOPROF, MNRJ 21604. One male (2.5 mm, dissected and drawn) OCEANPROF II, BC-SUL, #59 (0–2 CM), Campos Basin, Rio de Janeiro, Brazil, 21°52′59″S, 39°55′32″W, 29 June 2003, 750 m, MNRJ 21225. One female, OCEANPROF I, BC-NORTE, #44, Campos Basin, Rio de Janeiro,Brazil, 22°11′44″S, 39°54′46″W, 12 December 2002, 750 m, MNRJ 21226.

Type locality
Campos Basin, Rio de Janeiro, Brazil.

Diagnosis
Eyes absent. Antennae 1 accessory flagellum 2- or 3-articulate. Coxa 1, shorter than coxae 2–4, anterodistal angle slightly produced. Gnathopod 1 basis slender; carpus longer than propodus. Gnathopod 2 basis moderately stout, posterior margin with two or three long setae; carpus triangular, shallowly lobate, one-third of propodus length; propodus massive, ovate, palm acute, serrate with a rounded and serrate process near hinge of dactylus bearing one facial robust seta; palmar corner defining by a subacute spine and one facial robust setae; dactylus curved, not reaching end of palm. Pereopod 5 basis broad, ovoid, posterior margin excavate, posteroventral corner rounded and produced. Uropod 1 peduncle interamal process one-third of inner ramus length. Uropod 2 peduncle interamal process one-quarter of outer ramus length. Uropod 3 peduncle with two robust setae and two slender setae on distolateral angle, ventral margin with four robust setae; inner ramus with two marginal and one apical setae; outer ramus with two middle robust setae, tip with one subdistal robust seta, and a plate bearing three recurved spines. Telson triangular, wider than long; tip rounded; lateral margins with two pairs of pappose setae and two groups of three robust setae; dorsal margin with two pairs of robust and pappose setae.

Description
Based on holotype male. Head anteroventral margin strongly recessed; lateral cephalic lobe acute; eyes absent. Antennae 1 accessory flagellum 2- or 3-articulate. Epistome acute and upturned. Mandibular palp strong, article 3 spatulate, shorter than article 2. Maxilla 1, inner plate with a single seta; outer plate with seven robust setae; palp article 2 with four robust setae, and three slender facial setae. Maxilla 2, plates with almost the same width and apically setose; inner plate without row of facial setae. Lower lip with developed inner lobes; mandibular process acute. Maxilliped, inner plate rectangular; outer plate reaching one-third of palp article 2, with four medial to distal robust setae; palp 4-articulate; article 3 wider distally than proximally; article 4 with a long distal seta.

Coxa 1, shorter than coxae 2–4, anterodistal angle slightly produced. Coxae 2–4, similar in size, anterior

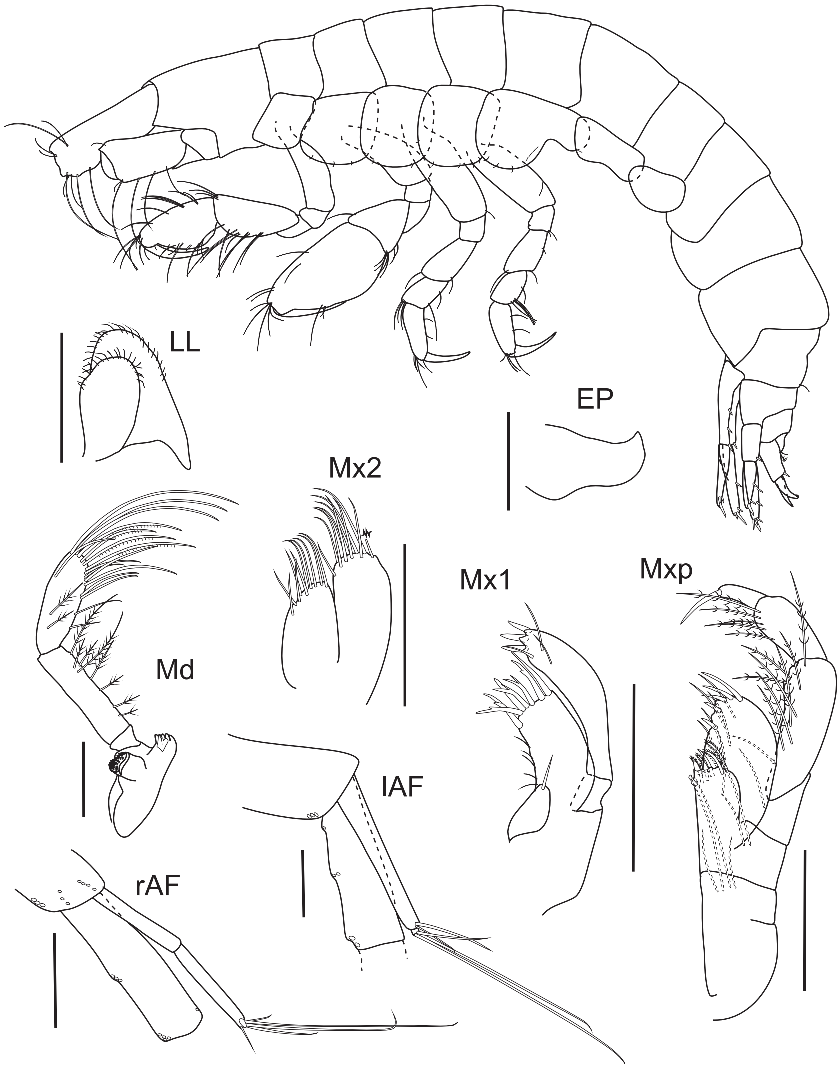

Figure 19. ***Pseudischyrocerus caecus*** **sp. nov.** Paratype: male (2.5 mm), OCEANPROF II, BC-SUL, #59, 29 June 2003, 750 m, MNRJ 21225. lAF and rAF from holotype male (6.2 mm), Campos Basin, 11 March 2006, 1058 m, ECOPROF, MNRJ 21604. Scale bars: 0.1 mm.

and posterior margins straight, angles rounded and distally with some setules. Coxa 5 with posterior lobe. Coxa 6 wider than long; slightly excavate distally. Coxa 7 shorter than coxa 6, subovate. Gnathopod 1 basis slender; carpus longer than propodus; posterior margin with long pappose setae; propodus setose; palm acute, with some marginal and facial setae; dactylus long, slender, inner margin serrate, outer margin with one plumose seta. Gnathopod 2 basis moderately stout, posterior margin with two or three long setae; carpus triangular, shallowly lobate, one-third of propodus length; propodus massive, ovate, palm acute, serrate with one facial robust seta and a rounded and serrated process near dactylus hinge; palmar corner defined by a subacute spine and one facial robust seta; dactylus curved, not reaching end of palm. Pereopods 3 and 4 similar in shape and size; basis subrectangular; merus, anterodistal angle slightly produced; dactylus slender and shorter than propodus. Pereopod 5 basis broad, ovate, posterior margin excavate, posteroventral corner rounded and produced; merus anterior and posterior distal angles produced, propodus longer than carpus and merus together, with one very long robust seta and one short robust seta. Pereopods 6 and 7 slender, similar; basis subrectangular, posterior margin sinuous; merus and carpus with antero- and posterodistal angle produced; propodus long, three times longer than merus; dactylus about one-third length of propodus, posterior margin with one plumose setae. Pereopod 6 propodus anterior margin with one robust seta and three robust setae on

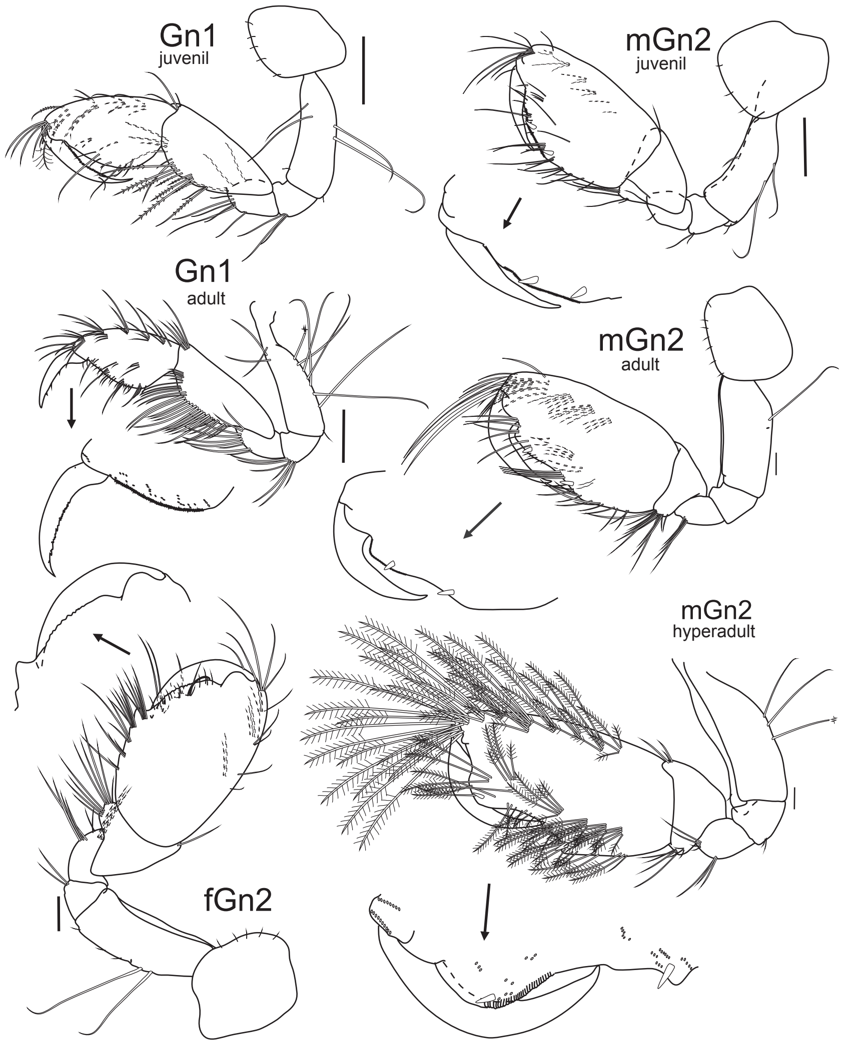

Figure 20. ***Pseudischyrocerus caecus*** **sp. nov.** Paratype: male (2.5 mm), OCEANPROF II, BC-SUL, #59, 29 June 2003, 750 m, MNRJ 21225. Holotype: hyperadult male (6.2 mm), Campos Basin, 11 March 2006, 1058 m, ECOPROF, MNRJ 21604. Paratype: female, Campos Basin, 11 March 2006, 1058 m, ECOPROF, MNRJ 21604. Paratype: adult male OCEANPROF II, BC-SUL, #59, 29 June 2003, 750 m, MNRJ 21225. Scale bars: 0.1 mm.

anterodistal angle, posterodistal angle with a tuft of long setae. Pereopod 7 propodus anterior margin with one robust seta on anterodistal angle, posterodistal angle with a tuft of long setae.

Epimera 1 and 2 posteroventral corner rounded. Epimeron 3 posteroventral corner acute, with posterior margin excavated. Uropod 1 not exceeding apex of uropod 2, peduncle longer than rami, inner margin with three robust setae, outer margin with four robust setae; interamal process one-third of inner ramus length; outer ramus with one marginal and four distal robust setae; inner ramus shorter than outer ramus, with four distal setae. Uropod 2 peduncle with one distolateral robust setae; interamal process one-quarter of outer ramus length; inner ramus longer than outer ramus, with two marginal robust setae and three distal robust setae; outer ramus with one marginal robust seta and four distal robust setae. Uropod 3 peduncle longer than rami, broad proximally and narrow distally, with two robust setae and two slender setae on distolateral angle, ventral margin with four robust setae; inner ramus more slender than outer ramus, with two marginal and one apical seta; outer ramus slightly recurved, with two middle robust setae, tip with one subdistal robust seta and a plate bearing three recurved spines. Telson triangular, wider than long; tip rounded; lateral margins with two pairs of pappose setae and two groups of three robust setae; dorsal margin with two pairs of robust and pappose setae.

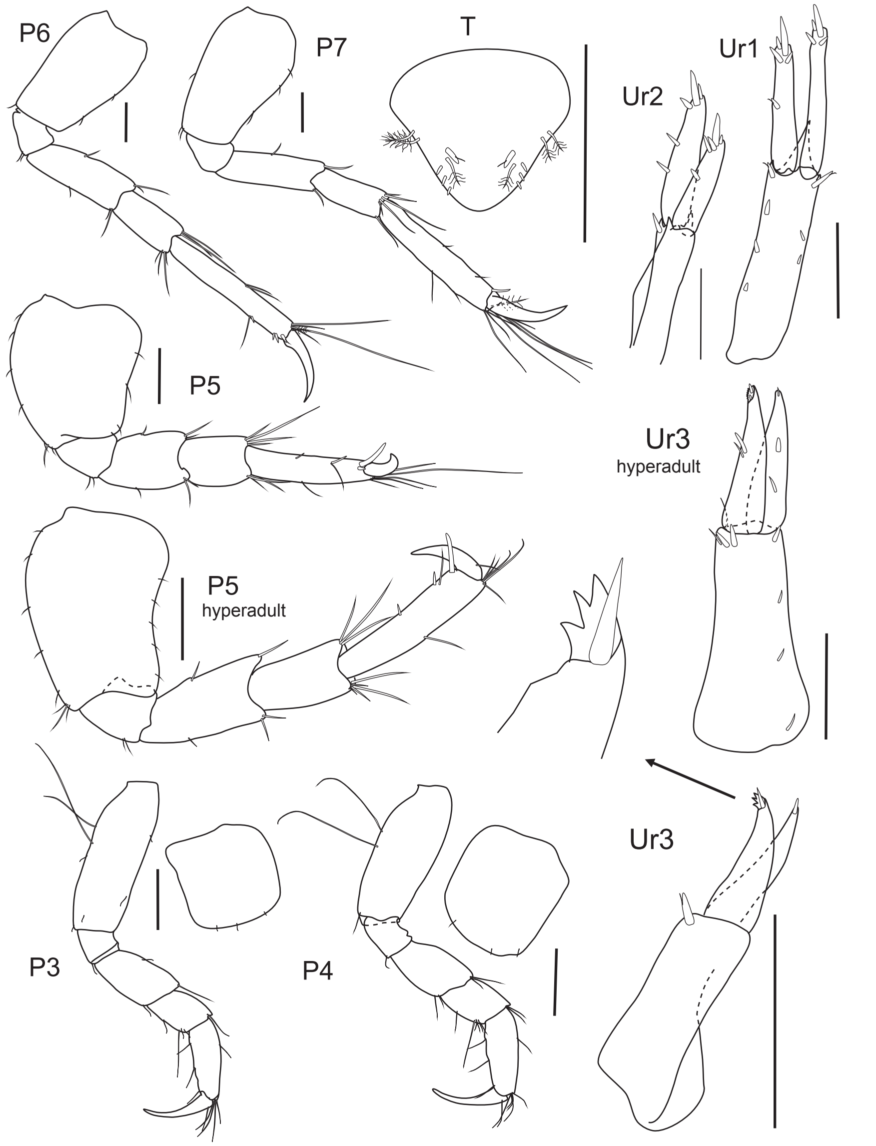

Figure 21. ***Pseudischyrocerus caecus*** **sp. nov.** Paratype: male (2.5 mm), OCEANPROF II, BC-SUL, #59, 29 June 2003, 750 m, MNRJ 21225. Holotype: hyperadult male, Campos Basin, 11 March 2006, 1058 m, ECOPROF, MNRJ 21604. Paratype: female, Campos Basin, 11 March 2006, 1058 m, ECOPROF, MNRJ 21604. Scale bars: 0.1 mm.

Sexually dimorphic characters

Pseudischyrocerus caecus sp. nov. presents a weak sexual dimorphism. The female differs mainly in gnathopod 2 less setose and propodal palm lacking process.

Variation

The males of *P. caecus* sp. nov. show extensive ontogenetic modification in some structures, including the number of articles in the accessory flagellum, gnathopods 1 and 2, basis of pereopod 5, and uropod 3. In juvenile and adult specimens the number of articles in the accessory flagellum varies from two to three; also, one female showed a difference between the right and left side. In juvenile specimens the carpus of gnathopod 1 is about as long as the propodus, the basis of pereopod 5 is slightly concave, and uropod 3 has the peduncle with only one robust distal seta and the rami are naked; however, in adults and hyperadults the carpus of gnathopod 1 is about 1.5 × propodus length, the basis of pereopod 5 is strongly concave, and the uropod 3 peduncle bears four robust setae on the ventral margin, and both rami have two robust setae. The most important modification is observed in gnathopod 2, as in juveniles the propodus is sparsely setose, the palm is serrate and without a palmar corner, whereas in adults it becomes densely setose with a rounded crenulate process near the dactylus hinge. Moreover, in hyperadults a palmar corner is developed and the dactylus is strongly curved, reaching three-quarters of the palm.

Remarks

As a whole, *P. caecus* sp. nov. differs from the other three species of the genus by the following combination of characters: eyes absent; palm of the male gnathopod 2 with two robust facial setae; and a distinctly more setose telson.

Geographic distribution

South-western Atlantic: Campos Basin, Rio de Janeiro, Brazil.

Tribe Siphonoecetini Just, 1983

Genus *Notopoma* Lowry & Berents, 1996

Notopoma Lowry & Berents, 1996: 85. – Berge, Vader & Lockhart, 2004: 1725. – Alonso de Pina, 2005: 528. – Valério-Berardo, Souza & Rodrigues, 2008: 60.

Type species

Notopoma stoddartae Lowry & Berents, 1996.

Diagnosis

Antenna 1 subequal to antenna 2, peduncular article 1 produced anterodistally and medially; accessory flagellum absent or present, if present 1-articulate, rudimentary. Eyes present or absent. Mandibular palp well developed and 3-articulate. Gnathopod 1 carpus shorter than propodus. Gnathopod 2 male carpochelate. Carpus subequal to the propodus. Coxae 1–7 wider than long, with margin smooth. Coxa 4 posterior margin not excavated. Coxae 5–7 with posterodorsal lobe. Pereopod 4 merus longer than merus of pereopod 3. Pereopods 5–7 dactylus distal part directed posteriorly and with accessory spines. Pereopod 5 dissimilar to pereopods 6 and 7 (in shape and length), with carpus short, lunate, or reniform, with denticles on a posteroventral margin. Pleosomite with lateral ridges. Pleopods peduncle slender and not expanded. Pleopod 2 inner ramus present, reduced, or absent. Urosomite 1 without dorsal spines. Uropod 1 peduncle with distoventral corona; outer margin of outer ramus dentate. Uropod 2 uniramous; outer margin of ramus dentate, without robust setae. Uropod 3 uniramous with recurved spines. Telson cleft with recurved rows of spines on the dorsum.

Included species

Notopoma argentina Alonso de Pina, 2005; *Notopoma africana* Lowry & Berents, 1996; *Notopoma cidaridis* Berge, Vader & Lockhart, 2004; *Notopoma crassicornis* (Bate, 1857); *Notopoma fallohideus* (Lowry, 1981); *Notopoma fluminense* Valério-Berardo, Souza & Rodrigues 2008; *Notopoma harfoota* (Lowry, 1981); *Notopoma lutkini* (Tzvetkova, 1990); *Notopoma lowryi* sp. nov.; *Notopoma moorea* Lowry & Berents, 1996; *Notopoma opposita* (K.H. Barnard, 1931); *Notopoma sismithi* (Stebbing, 1888); *Notopoma stoddartae* Lowry & Berents, 1996; *Notopoma stoora* (Lowry, 1981); *Notopoma teresae* sp. nov.

***Notopoma lowryi* sp. nov.** (Figs 22–24)

Notopoma sp. Souza-Filho & Serejo, 2010b: 182.

Type material

Holotype: Male (3 mm), OCEANPROF I, #59, Campos Basin, Rio de Janeiro, Brazil, 21°53′59.22″S, 39°55′30.66″ W, 12 December 2002, 750 m, MNRJ 21244.

Etymology

Named in honour of Dr James K. Lowry, in recognition of his contributions to Amphipoda systematics.

Type locality

Campos Basin, Rio de Janeiro, Brazil.

Diagnosis

Head eyes absent; rostrum extended slightly beyond lateral lobes. Antenna 1 stout, setose, longer than pereonites 1–6 together; article 2 slightly shorter than article 3; flagellum with three articles; flagellum article 1 with dense aesthetascs; accessory flagellum rudimentary, 1-articulate. Gnathopod 1 propodus palm acute and serrate, with short and long pappose setae; dactylus extended beyond end of palm. Gnathopod 2 carpochelate; basis anterior margin convex and crenulate; carpus enlarged, with one large posterodistal bidentate process, little produced anteriorly, with distal U-shaped excavation; propodus 2.2 times as long as wide, posterior margin excavate; dactylus as long as propodus and with one marginal tooth. Pleopod 3 uniramous very reduced, as long as inner ramus of pleopod 2. Telson broader than long; cleft almost one-half of its length.

Description

Based on holotype male (3 mm), MNRJ 21244. Head anteroventral margin strongly recessed; eyes absent; rostrum extended slightly beyond lateral lobes. Antenna 1 stout, setose, longer than pereonites 1–6 together; article 2 slightly shorter than article 3;

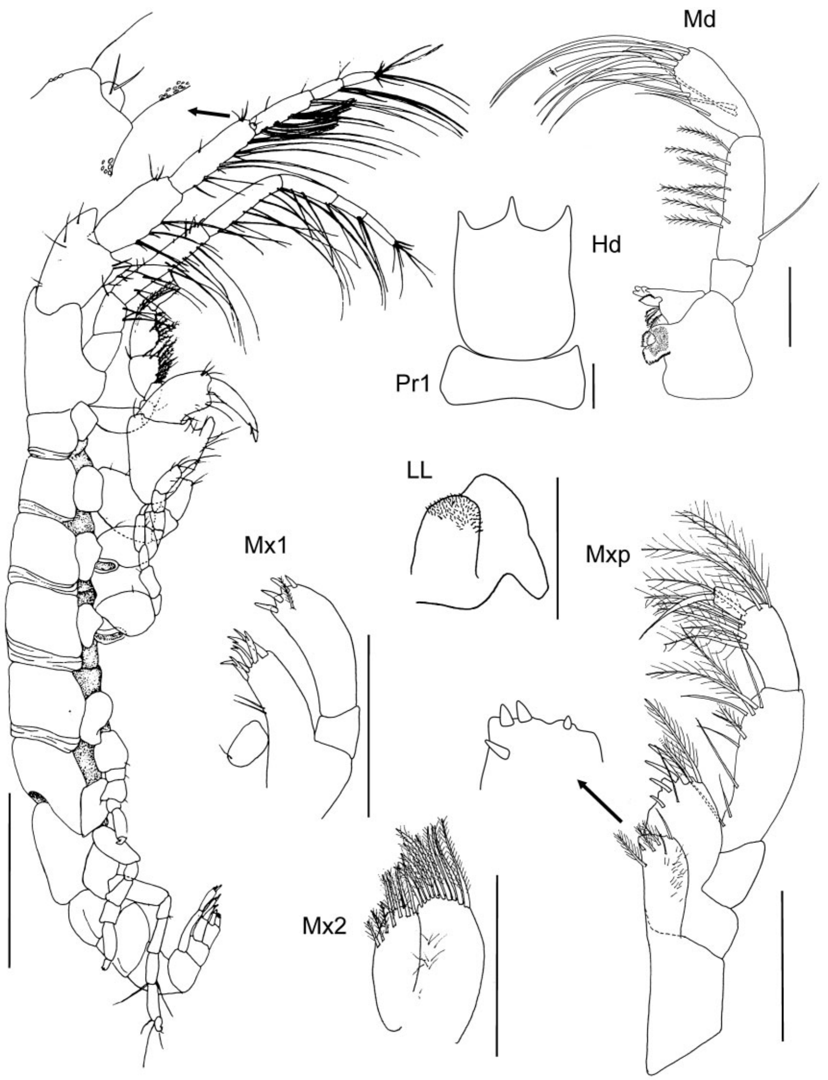

Figure 22. ***Notopoma lowryi*** **sp. nov.** Holotype: male (3 mm), OCEANPROF I, #59, 12 December 2002, 750 m, MNRJ 21244. Scale bars: 0.1 mm.

flagellum with three articles; flagellum article 1 with dense aesthetascs; accessory flagellum rudimentary, 1-articulate. Antenna 2 peduncle article 4 setose, 1.2 times as long as article 5; flagellum with three articles. Mandible molar triturative; right mandible, incisor with four teeth; lacinia mobilis minutely serrate, accessory setal row with three pappose robust setae; palp article 3 shorter than article 2, spatulate, with long setae medially and distally. Maxilla 1 inner plate short and with a distal single seta; outer plate with six robust setae; palp with four distal robust setae and one facial pappose seta. Maxilla 2 outer plate slightly longer than inner plate; with a row of pappose medial and distal setae. Lower lip inner lobes present; mandibular process well developed. Maxilliped inner plate subquadrate, with three short and robust setae on distal margin and one subdistal short and robust seta; outer plate ovate, with three medial to distal robust setae and one distal robust pappose seta; palp articles 1–3 with long pappose setae along inner margin; palp article 2 2.5 × length of article 1; palp article 4 with one very long distal robust seta.

Coxae 1–7 wider than long. Gnathopod 1 subchelate, carpus lobate and shorter than propodus; palm acute and serrate, with short and long pappose setae; dactylus extended beyond end of palm. Gnathopod 2 carpochelate; basis 1.3 times longer than broad; anterior margin convex and crenulate; carpus enlarged, with one large ventrodistal bidentate process weakly produced anteriorly, with distal U-shaped excavation; propodus 2.2 times as long as wide, posterior margin

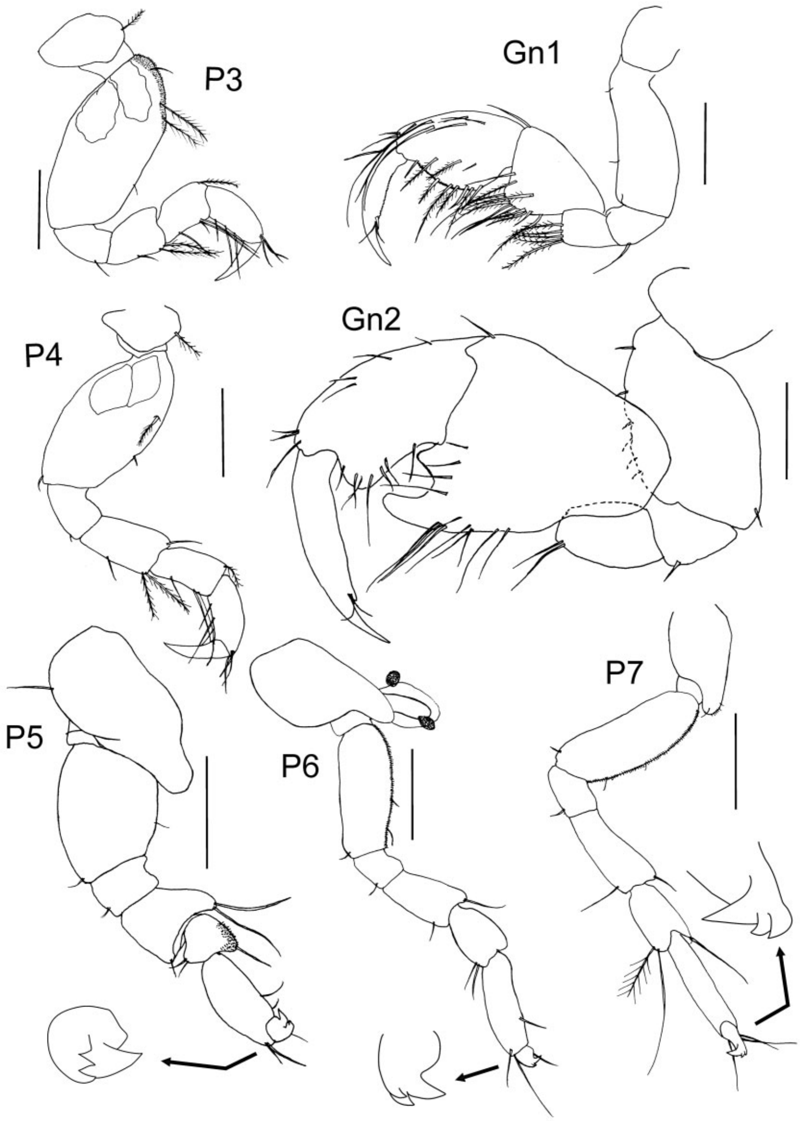

Figure 23. ***Notopoma lowryi*** **sp. nov.** Holotype: male (3 mm), OCEANPROF I, #59, 12 December 2002, 750 m, MNRJ 21244. Scale bars: 0.1 mm.

excavate; dactylus as long as propodus, and with one marginal tooth. Pereopod 3 basis subovate; merus anterodistal angle produced and shorter than propodus; dactylus acute and shorter than propodus. Pereopod 4 similar to pereopod 3, but merus as long as propodus. Pereopod 5 basis ovate; merus with anterior and posterior margin produced; propodus triangular and short; carpus longer than merus; dactylus with three accessory spines. Pereopod 6 thin, basis slender and subrectangular; merus and carpus with anterior and posterior margin produced; dactylus with two accessory spines. Pereopod 7 similar to pereopod 6, except for basis broad with posterior margin rounded.

Pleonites with lateral ridges. Pleopod 1 large and biramous. Pleopod 2 biramous, inner ramus 1-articulate, half the length of article 1 of outer ramus. Pleopod 3 uniramous, much reduced, as long as inner ramus of pleopod 2. Uropod 1 peduncle 1.1 times longer than outer ramus; rami denticulate distally, with one pappose seta; inner ramus shorter than outer ramus, with one distal robust and pappose seta; outer margin of outer ramus denticulate, with a row of short robust setae. Uropod 2 uniramous; outer margin of ramus denticulate, with one long seta distally and one seta subdistally. Uropod 3 uniramous, short, almost as long as length of ramus of uropod 2; peduncle broad, with one seta distally;

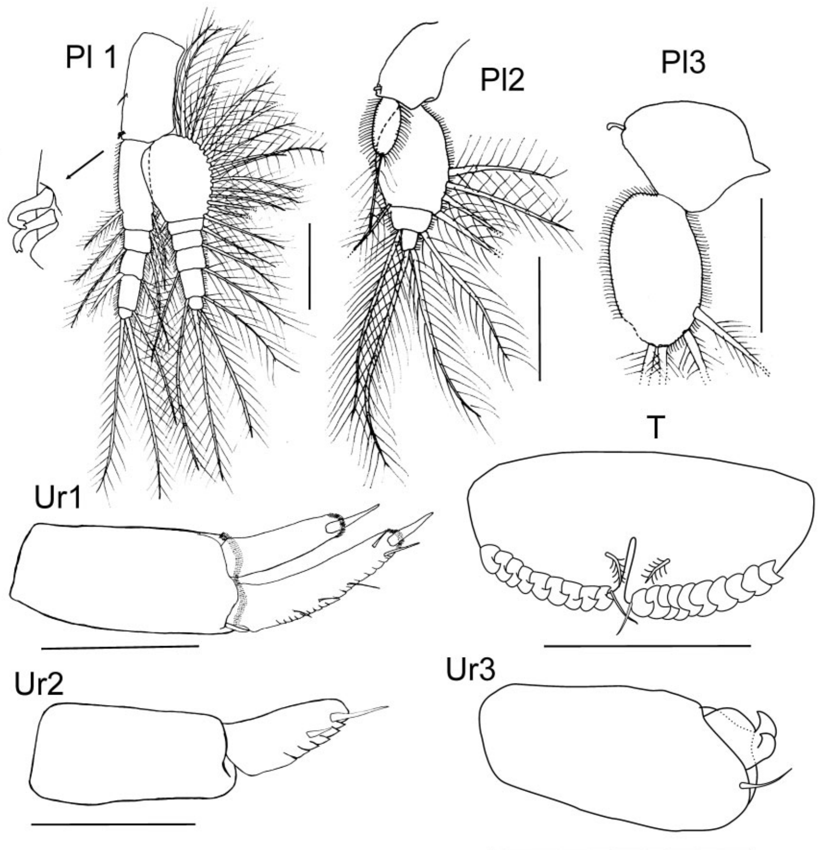

Figure 24. ***Notopoma lowryi* sp. nov.** Holotype: male (3 mm), OCEANPROF I, #59, 12 December 2002, 750 m, MNRJ 21244. Scale bars: 0.1 mm.

ramus very reduced, with two short upturned spines. Telson broader than long; cleft almost one-half of its length.

Tube
Unknown.

Remarks
Notopoma lowryi sp. nov. is similar to *N. cidaridis*, from Elephant Island, Antarctica, in having antenna 1 with the accessory flagellum rudimentary and 1-articulate, eyes absent, and pleopod 3 uniramous; however, *N. lowryi* sp. nov. differs from *N. cidaridis* by the flagellum of antennae 1 and 2 with three articles instead of four articles, the rostrum slightly longer than the lateral cephalic lobes (versus much longer), gnathopod 2 with the posterior margin of the propodus smooth (versus crenulate) and the carpus with the posterodistal process weakly produced anteriorly (versus strongly produced anteriorly), and the basis of pereopods 6 and 7 more slender and subrectangular.

***Notopoma teresae* sp. nov.** (Figs 25–27)

Material examined
Holotype: Male (1.77 mm), OCEANPROF II, #44, Campos Basin, Rio de Janeiro, Brazil, 22°11′32.4″S, 39°54′45″W, 1 July 2003, 749 m, MNRJ 21239.

Paratypes: One male, OCEANPROF I, #79, Campos Basin, Rio de Janeiro, Brazil, 22°20′40.26″S, 40°00′35.1″W, 26 December 2002, 775 m, MNRJ 21238. One female (dissected and drawn), Campos Basin, Rio de Janeiro, Brazil, 22°11′32.4″S, 39°54′45″W, 1 July 2003, 749 m, MNRJ 21239.

Etymology
Named in honour of Dr Maria Teresa Valério-Berardo, in recognition of her contribution to the taxonomy of Brazilian Amphipoda.

Type locality
Campos Basin, Rio de Janeiro, Brazil.

Diagnosis
Head eyes present; rostrum subequal to lateral cephalic lobes. Antenna 1 stout, setose, longer than

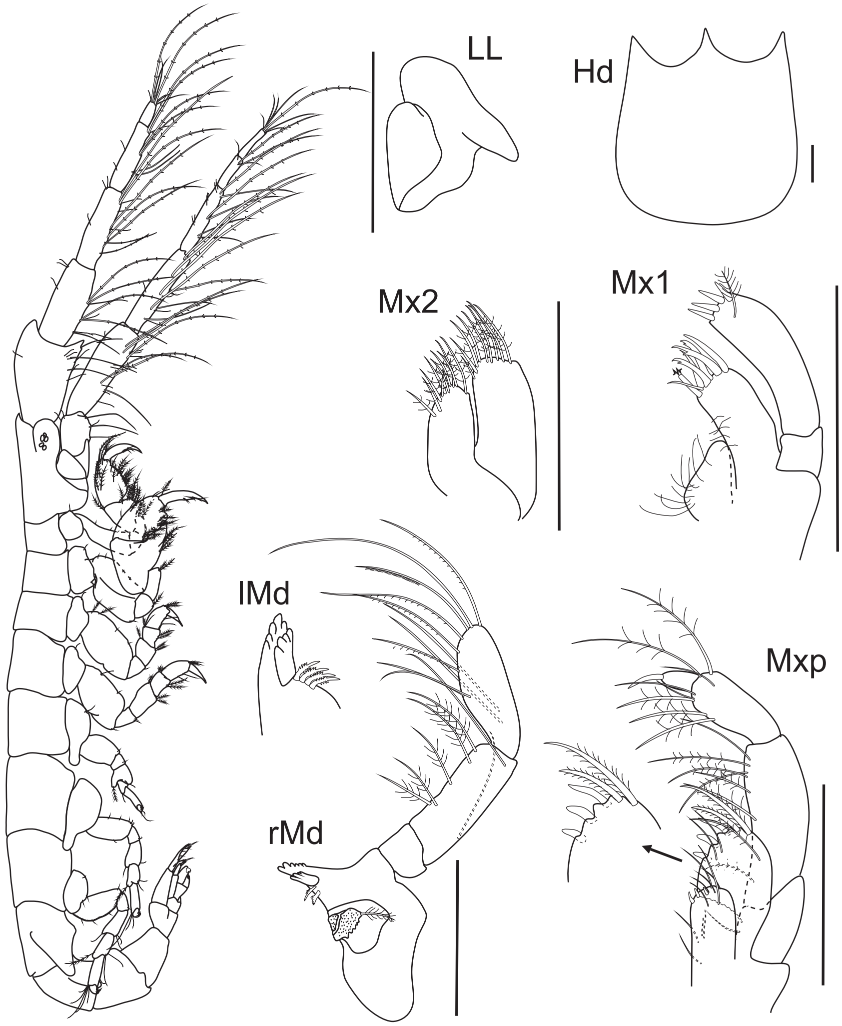

Figure 25. ***Notopoma teresae* sp. nov.** Holotype: male (1.77 mm), OCEANPROF II, #44, 1 July 2003, 749 m, MNRJ 21239. Scale bars: 0.05 mm.

pereonites 1–6 together; article 2 slightly shorter than article 3; flagellum with two articles; flagellum article 1 with few aesthetascs; accessory flagellum absent. Gnathopod 1 propodus palm acute, serrate, and with short and long pappose setae; dactylus not reaching end of palm. Gnathopod 2 carpochelate; basis anterior margin slightly concave and smooth; carpus enlarged, with one large posterodistal process very produced forward, with a middle tooth; propodus 1.9 times as long as wide; propodus posterior margin straight; dactylus slightly shorter than propodus, with one marginal tooth. Pleopod 3 absent. Telson wider than long and weakly cleft.

Description

Based on holotype male (1.77 mm), MNRJ 21239. Head, anteroventral margin strongly recessed; eyes present; rostrum subequal to lateral cephalic lobes. Antenna 1 stout, setose, longer than pereonites 1–6 together; article 2 slightly shorter than article 3; flagellum with two articles; flagellum article 1 with few aesthetascs; accessory flagellum absent. Antenna 2 peduncle article 4 setose, 1.3 times as long as article 5; flagellum with three articles. Mandible palp article 3 shorter than article 2, spatulate, with long setae medially and distally; molar triturative; lacinia mobilis present; right mandible, incisor with six teeth; setal row with two setae; left mandible incisor with five teeth; setal row with four setae. Maxilla 1 inner plate short, with many long marginal setae; outer plate with seven robust setae; palp with four distal robust setae; palp with one facial pappose seta. Maxilla 2 outer plate longer than inner plate; with a row of pappose medial and distal setae. Lower lip inner lobes present; mandibular process well developed. Maxilliped inner plate suquadrate, with two

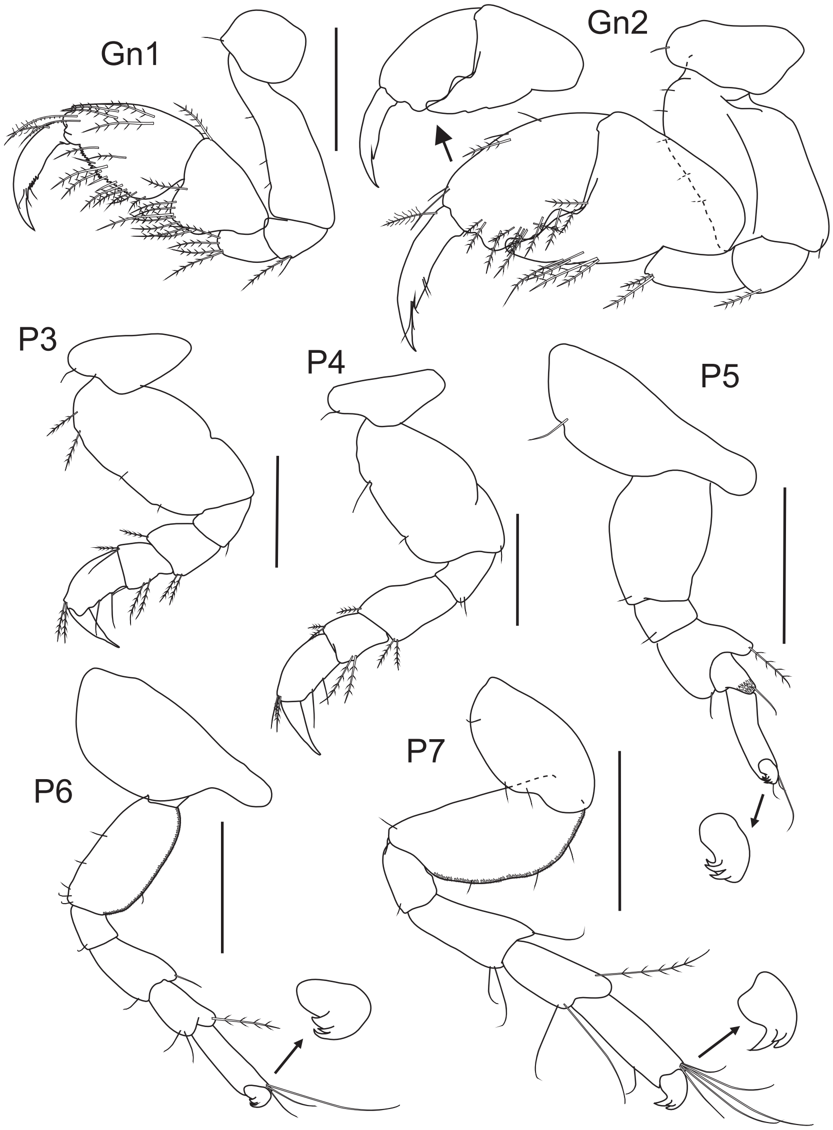

Figure 26. ***Notopoma teresae*** **sp. nov.** Holotype: male (1.77 mm), OCEANPROF II, #44, 1 July 2003, 749 m, MNRJ 21239. Scale bars: 0.1 mm.

short and robust setae along distal margin and one subdistal short and robust seta; outer plate ovate, with three medial to distal robust setae and two distal robust pappose setae; palp articles 1–3 with long pappose setae along inner margin; palp article 2 2 × length of article 1; palp article 4 with one distal robust seta as long as article 4 length.

Coxae wider than long. Gnathopod 1 subchelate, carpus lobate and shorter than propodus; palm acute, serrate, and with short and long pappose setae; dactylus not reaching end of palm. Gnathopod 2 carpochelate; basis 1.3 times longer than broad; basis anterior margin slightly concave and smooth; carpus enlarged, with one large ventrodistal process very produced forward, with a middle tooth; propodus 1.9 times as long as wide; propodus posterior margin straight; dactylus slightly shorter than propodus, with one marginal tooth. Pereopod 3 basis subovate; merus 1.1 times as long as wide, with anterodistal angle produced; dactylus acute and shorter than propodus. Pereopod 4 similar to pereopod 3, but merus 1.6 times as long as wide. Pereopod 5 basis ovate; merus with anterior and posterior margin produced; propodus triangular, short; carpus longer than merus; dactylus with two accessory spines. Pereopod 6 thin, basis subrectangular; merus and carpus with anterior and posterior margin produced; dactylus with two accessory spines. Pereopod 7 similar to pereopod 6, except for basis broad with posterior margin rounded.

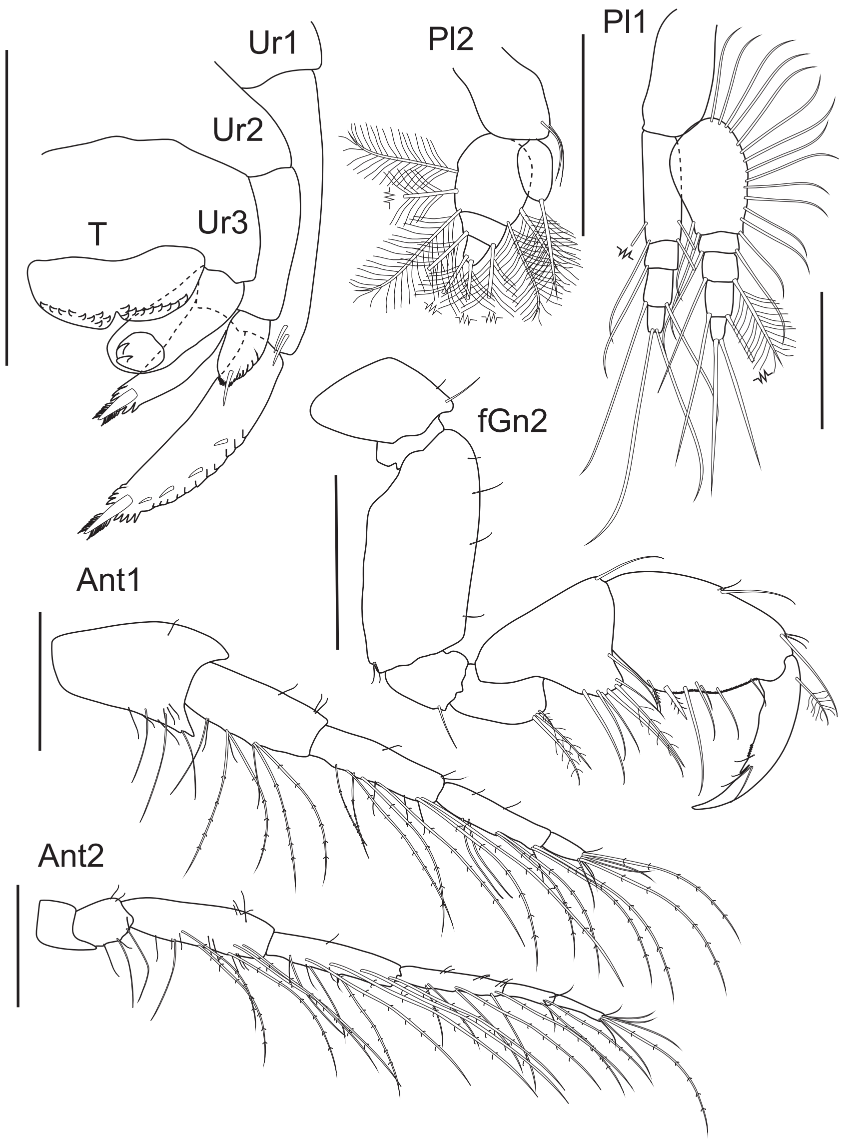

Figure 27. ***Notopoma teresae* sp. nov.** Holotype: male (1.77 mm), OCEANPROF II, #44, 1 July 2003, 749 m, MNRJ 21239. Paratype: female (1.9 mm), 1 July 2003, 749 m, MNRJ 21239. Scale bars: 0.1 mm.

Pleonites with lateral ridges. Pleopod 1 large and biramous. Pleopod 2 biramous, inner ramus 1-articulate, about 1.5 times the length of article 1 of outer ramus. Pleopod 3 absent. Uropod 1 peduncle 1.3 times longer than outer ramus; rami denticulate distally, with one robust seta and one pappose seta; inner ramus with one distal robust and pappose seta; outer margin of outer ramus denticulate, with a row of short robust setae. Uropod 2 uniramous; ramus outer margin denticulate, with one long seta distally. Uropod 3 uniramous, almost as long as ramus of uropod 2; peduncle broad; ramus short with two short upturned spines. Telson wider than long and weakly cleft.

Sexually dimorphic characters

Based on paratype female (1.9 mm), MNRJ 21238. Very similar to male, but with gnathopod 2 subchelate, basis stout, 2 times longer than wide, with a few long setae on the anterior margin; merus triangulate, produced; propodus ovate, longer than carpus, with long setae along the palm. Pereonite 5 is wider than others.

Tube

Unknown.

Remarks

Notopoma teresae sp. nov. is similar to *N. africana* Lowry & Berents, 1996 and *N. fallohidea* (Lowry,

1981) in the long thin antennae, about half the body length, and the dactylus of gnathopod 2 more than half the propodus length. It also resembles *N. africana* in having a slender palp of the mandible and seven robust setae on the outer plate of maxilla 1; however, *N. teresae* sp. nov. can be distinguished from both species by the 2-articulate flagellum of antenna 1, the distoventral process of gnathopod 2 more produced anteriorly, and a more inflated propodus. Furthermore, *N. teresae* sp. nov. differs from *N. africana* by the presence of eyes, absence of pleopod 3, the inner ramus of uropod 3 about two-thirds the outer ramus length, and the telson weakly cleft.

Geographic distribution
South-western Atlantic: Campos Basin, Rio de Janeiro, Brazil.

Genus *Pseudericthonius* Schellenberg, 1926

Pseudericthonius Schellenberg, 1926: 385. – J.L. Barnard, 1969: 196. – J.L. Barnard, 1973: 26. J.L. Barnard & Karaman, 1991: 228. – Rauschert, 1997: 28.

Diagnosis
Antenna 1 subequal to antenna 2; peduncular article 1 long and rectangular; accessory flagellum 1-articulate, rudimentary. Eyes present or absent. Mandibular palp well developed and 3-articulate. Maxilla 1 outer margin of inner plate with a row of setae. Gnathopod 1 carpus longer than propodus. Gnathopod 2 male carpochelate; carpus longer and larger than propodus. Gnathopod 2 female carpus longer than propodus. Coxae 1–7 wider than long. Coxa 4 margin smooth; posterior margin not excavated. Coxa 5 with posterodorsal lobe. Pereopods 3 and 4 merus equal in size. Pereopods 5–7 dactylus distal part (at least the propodus and dactylus) directed anteriorly, and with accessory spines. Pereopod 5 dissimilar to pereopods 6 and 7 (in shape and length); carpus short, lunate or reniform, and without denticles or spines on posteroventral margin. Pleosomite without lateral ridges. Pleopods peduncle slender and not expanded. Pleopod 2 inner ramus present, as long as outer ramus. Urosomite 1 without dorsal spines. Uropod 1 peduncle with distoventral

Key to world species of the genus *Notopoma* Lowry & Berents, 1996

1. Antenna 1 with accessory flagellum present (minute) 2
– Antenna 1 with accessory flagellum absent 3
2. Gnathopod 2 male propodus with posterior margin undulate .... *Notopoma cidaridis*
– Gnathopod 2 male propodus with posterior margin not undulate .... ***Notopoma lowryi* sp. nov.**
3. Antenna 1 flagellum bearing four or five articles, subequal to peduncle articles 2 and 3 combined (with the exception of *Notopoma fluminense*) 4
– Antenna 1 flagellum bearing two or three articles, shorter than peduncle articles 2 and 3 combined 7
4. Mandible palp slender, long; uropod 1 inner ramus 0.8 × outer ramus .... *Notopoma africana*
– Mandible palp robust, short; uropod 1 inner ramus 0.5–0.6 × outer ramus 5
5. Gnathopod 2 male carpus with two distal spines .... *Notopoma fallohidea*
– Gnathopod 2 male carpus with one distal spine 6
6. Antenna 1 flagellum subequal than peduncle articles 2 and 3 combined; gnathopod 2 male propodus slender and longer than carpus; carpus with convex palm .... *Notopoma sismithi*
– Antenna 1 flagellum shorter than peduncle articles 2 and 3 combined; gnathopod 2 male propodus broad and subequal to carpus; carpus with oblique palm .... *Notopoma fluminense*
7. Gnathopod 2 male carpus with a spine midway along posterior margin 8
– Gnathopod 2 male carpus without a spine midway along posterior margin 9
8. Gnathopod 2 male propodus with rectangular process on posterior margin .... *Notopoma lutkini*
– Gnathopod 2 male propodus without process on posterior margin .... *Notopoma crassicornis*
9. Gnathopod 2 male dactylus short, subequal to propodus, distally bifid 10
– Gnathopod 2 male dactylus normal, clearly longer than propodus, distally acute 12
10. Pleopod 3 present, uniramous .... *Notopoma moorea*
– Pleopod 3 absent 11
11. Antenna 1 0.3 × body length; pleopod 2 biramous, inner ramus vestigial .... ***Notopoma teresae* sp. nov.**
– Antenna 1 0.7 × body length; pleopod 2 uniramous .... *Notopoma stoddartae*
12. Gnathopod 2 female propodus linear; antenna 1 peduncle article 1 only slightly produced distally .... *Notopoma harfoota*
– Gnathopod 2 female propodus broadly rectangular or oval; antenna 1 peduncle article 1 strongly produced distally **13**
13. Telson deeply cleft .... *Notopoma stoora*
– Telson emarginate .... *Notopoma opposita*

corona; inner ramus reduced; outer margin of outer ramus smooth. Uropod 2 biramous; inner ramus reduced; outer margin of outer ramus smooth with robust setae. Uropod 3 uniramous, with recurved spines. Telson wider than long, rectangular, entire, and with spines in patches on the dorsum.

Included species

Pseudericthonius bousfieldi sp. nov.; *Pseudericthonius concavus* sp. nov.; *Pseudericthonius gaussi* Schellenberg, 1926; *Pseudericthonius hesperidesi* Rauschert, 1997; *Pseudericthonius inflatus* Ren, 1991.

***PSEUDERICTHONIUS BOUSFIELDI* SP. NOV.**
(FIGS 28–30)

Pseudericthonius sp. 2 Souza-Filho & Serejo, 2010c: 186.

Type material

Holotype: Male (3.8 mm) (dissected and drawn), OCEANPROF II, BC–NORTE, #44, Campos Basin, Rio de Janeiro, Brazil, 22°10′43.5″S, 39°54′45″W, 1 July 2003, 749 m, MNRJ 21257.

Paratypes: One male and two females (one dissected and drawn), OCEANPROF II, BC-SUL, #75, Campos Basin, Rio de Janeiro, Brazil, 22°31′28.3″S, 40°03′49.3″W, 18 June 2003, 1050 m, MNRJ 21250. One female, OCEANPROF II, BC-SUL, #84, Campos Basin, Rio de Janeiro, Brazil, 22°26′28.8″S, 39°58′53.3″W, 20 June 2003, 1050 m, MNRJ 21246. One male and one female, OCEANPROF II, BC-SUL, #79, Campos Basin, Rio de Janeiro, Brazil, 22°20′22.4″S, 40°01′24.7″W, 21 June 2003, 750 m, MNRJ 21247. Two females, #RONCADOR, Campos Basin, Rio de Janeiro, Brazil, 21°58′32.2″S, 39°51′52.66″W, 24 September 2001, 1700 m, MNRJ 21249. One female, OCEANPROF I, BC-SUL, #84, Campos Basin, Rio de Janeiro, Brazil, 22°26′27.75″S, 39°58′51.65″W, 20 November 2002, 1050 m, MNRJ 21264.

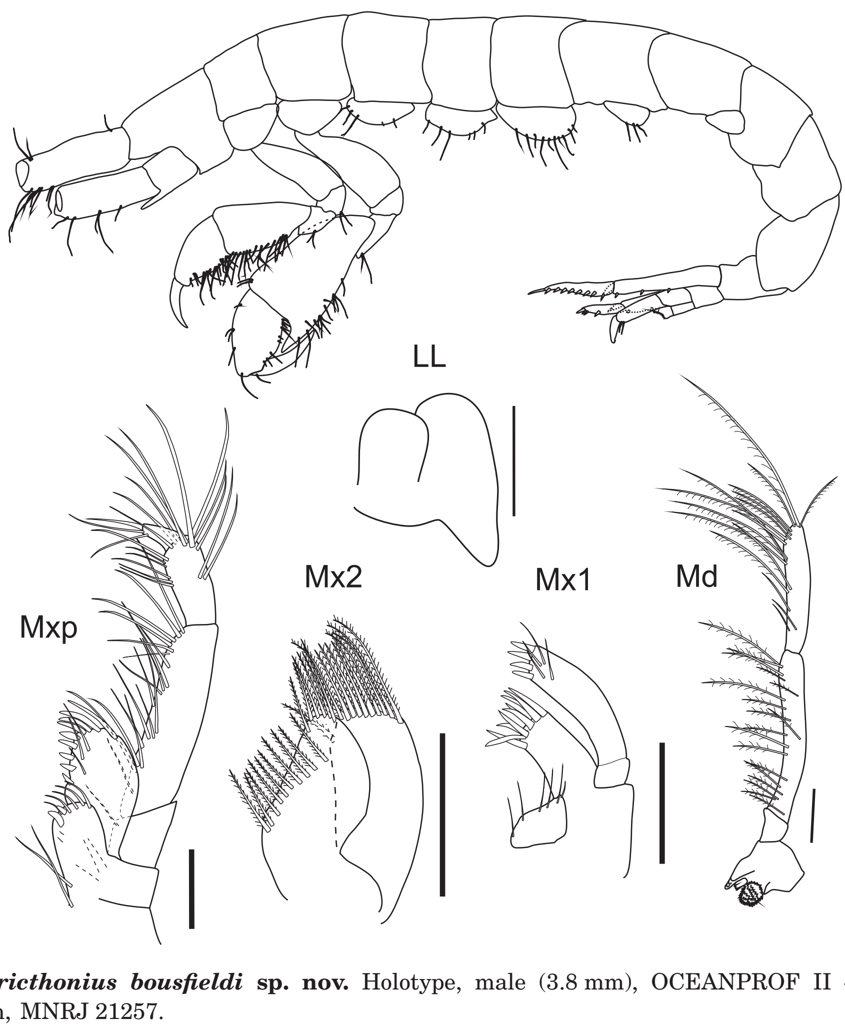

Figure 28. *Pseudericthonius bousfieldi* sp. nov. Holotype, male (3.8 mm), OCEANPROF II – BC -NORTE #44, 01 July 2003, 749 m, MNRJ 21257.

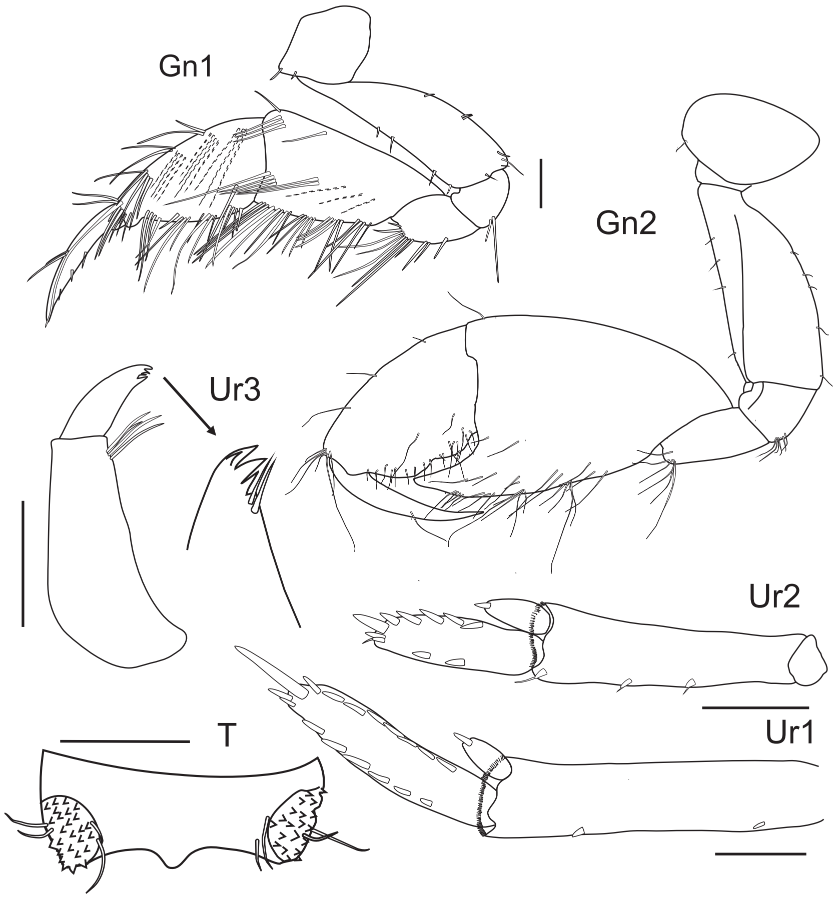

Figure 29. ***Pseudericthonius bousfieldi* sp. nov.** Holotype, male (3.8 mm), OCEANPROF II – BC -NORTE #44, 01 July 2003, 749 m, MNRJ 21257.

Etymology
The name *bousfieldi* is given in honour of Dr Edward Lloyd Bousfield (Canadian Museum of Nature) for his great contributions to amphipod taxonomy.

Type locality
Campos Basin, Rio de Janeiro, Brazil.

Diagnosis
Eyes absent. Mandibular palp very long, 5.5 times length of mandibular body. Gnathopod 1 carpus longer than propodus (1.2×), posterior margin densely setose, with posterodistal angle acute and slightly produced; propodus subtriangular, with both anterior and posterior margins setose. Gnathopod 2 strongly carpochelate; carpus massive, posterior margin setose, posterodistal angle produced into a long and acute process; propodus about two-thirds length of carpus, posterior margin setose, with a shallow middle excavation; dactylus as long as propodus, with a long seta on posterior margin. Uropod 1 long, peduncle with distoventral corona of spines, outer ramus with eight robust setae on both outer and inner margins, and one long robust apical seta; inner ramus one-quarter as long as outer ramus, with a single apical robust seta. Uropod 2 peduncle with distoventral corona of spines; outer ramus with two robust setae on outer margin, five robust setae on inner margin, and three distal robust setae; inner ramus one-third the length of outer ramus, with one distal robust seta. Uropod 3 peduncle with a distolateral tuft of setae; ramus without marginal robust setae, tip recurved with four spines and two setae. Telson subrectangular, wider than long, with acute process in middle of distal margin.

Description
Based on holotype male (3.8 mm), MNRJ 21257. Antennae missing. Head shorter than pereonites 1 and 2 together; anteroventral margin strongly recessed; eyes absent; lateral cephalic lobe acute. Epistome acute and turned upwards. Upper lip without distal notch. Mandibular palp very long, 5.5 times length of mandibular body, article 2 longer than

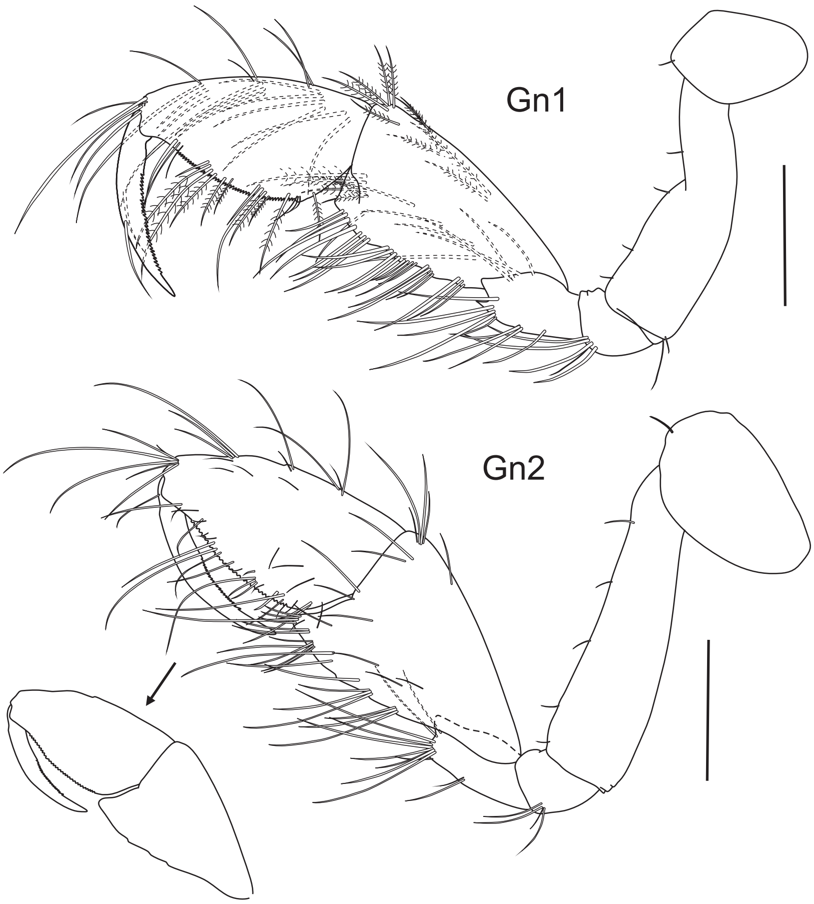

Figure 30. ***Pseudericthonius bousfieldi* sp. nov.** Paratype female (3.5 mm), OCEANPROF II (BC SUL) #75, 18 June 2003, 1050 m, MNRJ 21250.

article 3, with facial and marginal setae, article 3 with marginal and distal long setae. Maxilla 1 palp article 2 with four apical robust setae and four facial setae. Maxilla 2 outer plate broader than inner plate; inner plate with a row of facial setae. Maxilliped inner plate not extending beyond end of palp article 1; outer plate reaching one-third along palp article 2; article 4 with a long apical robust seta.

Coxae 1–7 wider than long, mostly discontinuous. Coxae 1 and 2 anteroventral angle rounded and not produced. Coxae 3 and 4 similar in shape to each other, and shorter than coxae 1 and 2. Coxa 5 longer than coxae 1–4, with ten long setae on distal margin. Coxae 6 and 7 short, similar in shape to each other, shorter than the others. Gnathopod 1 basis moderately stout, posterior margin slightly convex, with four short setae; carpus longer than propodus (1.2×), posterior margin densely setose, with posterodistal angle acute and slightly produced; propodus subtriangular, with antero and postero margins setose; palm acute and minutely serrate; dactylus moderately stout, reaching end of palm. Gnathopod 2 strongly carpochelate; basis stout, posterior margin with five short setae; ischium and merus with a tuft of setae on posterodistal angle; carpus massive, posterior margin setose, posterodistal angle produced into a long acute process; propodus about two-thirds the length of carpus, posterior margin setose, with a shallow middle excavation; dactylus as long as propodus, with a long setae on posterior margin. Pereopods 3–7 missing.

Epimera 1–3 posteroventral margin rounded. Epimeron 3 posterior margin smooth. Uropod 1 long, peduncle with distoventral corona of spines, with two robust setae on outer margin; outer ramus with eight robust setae on both outer and inner margins, and one long robust apical seta; inner ramus one-quarter as long as outer ramus, with a single apical robust seta. Uropod 2 peduncle with distoventral corona of spines, with two robust setae on outer margin; outer ramus with two robust setae on outer margin, five robust setae on inner margin, and three distal robust setae; inner ramus one-third length of outer ramus, with one distal robust seta. Uropod 3 peduncle with a distolateral tuft of setae; ramus without marginal robust setae, tip recurved with four spines and two setae. Telson subrectangular, wider than long, with acute process in middle of distal margin.

Sexually dimorphic characters
The female differs from the male in having gnathopod 2 subchelate.

Tube
Unknown.

Remarks
Pseudericthonius bousfieldi sp. nov. is closely related to *P. gaussi* and *P. hesperidesi* in having the eyes absent, the carpus of gnathopod 2 of the male with the posterodistal process acute, the very reduced inner ramus of uropods 1 and 2, and the telson with a medial distal process. Nevertheless, *P. bousfieldi* sp. nov. has the peduncle of uropod 1 with two robust marginal setae; the inner ramus is one-quarter as long as the outer ramus, with a single robust distal seta; and the peduncle of uropod 3 has a subdistal tuft of setae. In addition, *P. bousfieldi* sp. nov. has the mandibular palp very long, about 5.5 times length of mandibular body; article 2 of the palp of maxilla 1 with four robust setae; article 2 of the maxilliped palp 4.2 times longer than wide; and the ramus of uropod 3 without robust setae and its tip recurved, with four spines.

Geographic distribution
South-western Atlantic: Campos Basin, Rio de Janeiro, Brazil.

***PSEUDERICTHONIUS CONCAVUS* SP. NOV.**
(FIGS 31–33)

Pseudericthonius sp. 1 Souza-Filho & Serejo, 2010d: 184.

Type material
Holotype: One female (2.7 mm) (dissected and drawn), OCEANPROF II, BC, #50, Campos Basin, Rio de Janeiro, Brazil, 22°04′33.9″S, 39°52′05.1W, 30 June 2003, 1050 m, MNRJ 21423.

Paratypes: Two females, BARRACUDA-CARATINGA, #35, Campos Basin, Rio de Janeiro, Brazil, 22°35′10.8″S, 40°10′54.8″W, 19 May 2002, 1000 m, MNRJ 18142. One female, BARRACUDA-CARATINGA, #38, Campos Basin, Rio de Janeiro, Brazil, 22°41′12.5″S, 40°14′10.7″W, 19 May 2002, 1100 m, MNRJ 19008. Two females, BARRACUDA-CARATINGA, #32, Campos Basin, Rio de Janeiro, Brazil, 22°37′54.9″S, 40°17′31.34″W, 18 May 2002, 900 m, MNRJ 19199. One female, BARRACUDA-CARATINGA, #33, Campos Basin, Rio de Janeiro, Brazil, 22°35′40.99″S, 40°15′5.12″W, 19 May 2002, 900 m, MNRJ 19202. One female, OCEANPROF I, BC-SUL, #67, Campos Basin, Rio de Janeiro, Brazil, 22°46′59.0″S, 40°7′49.44″W, 22 November 2002, 1650 m, MNRJ 21248. One female, OCEANPROF II, BC-SUL, #79, Campos Basin, Rio de Janeiro, Brazil, 22°20′22.7″S, 40°01′24.7″W, 21 June 2003, 750 m, MNRJ 21251. Three females, OCEANPROF I, BC-SUL, #79, Campos Basin, Rio de Janeiro, Brazil, 22°20′40.26″S, 40°00′35.1″W, 26 November 2002, 775 m, MNRJ 21253. One female, OCEANPROF I, BC-SUL, #64, Campos Basin, Rio de Janeiro, Brazil, 22°36′30″S, 40°21′45.36″W, 22 November 2002, 750 m, MNRJ 21254. One female, OCEANPROF II, BC-NORTE, #44, Campos Basin, Rio de Janeiro, Brazil, 22°11′43.5″S, 39°54′45″W, 1 July 2003, 749 m, MNRJ 21255. Two females, OCEANPROF I, BC-SUL, #69, Campos Basin, Rio de Janeiro, Brazil, 22°31′12.47″S, 40°1511.08″W, 22 November 2002, 750 m, MNRJ 21256. One female, OCEANPROF II, BC-SUL, #74, Campos Basin, Rio de Janeiro, Brazil, 22°28′31.1″S, 40°09′23.5″W, 18 June 2003, 750 m, MNRJ 21258. One female, OCEANPROF I, #50, Campos Basin, Rio de Janeiro, Brazil, 22°04′33.99″S, 39°52′04.97″W, 24 November 2002, 1050 m, MNRJ 21259. One female, OCEANPROF I, BC-SUL, #74, Campos Basin, Rio de Janeiro, Brazil, 22°27′31.62″S, 40°09′23.19″W, 21 November 2002, 750 m, MNRJ 21260. One female, OCEANPROF II, BC-SUL, #59, Campos Basin, Rio de Janeiro, Brazil, 21°53′59.2″S, 39°55′32.2″W, 29 June 2003, 750 m, MNRJ 21261. Two females, OCEANPROF II, BC-SUL, #70, Campos Basin, Rio de Janeiro, Brazil, 22°35′03.7″S, 40°08′52.5″W, 15 June 2003, 1050 m, MNRJ 21262. One female, OCEANPROF II, BC, #50, Campos Basin, Rio de Janeiro, Brazil, 22°04′33.9″S, 39°52′05.1″W, 30 June 2003, 1050 m, MNRJ 21263. Two females, OCEANPROF I, BC-SUL, #84, Campos Basin, Rio de Janeiro, Brazil, 22°26′27.7″S, 39°58′51.65″W, 20 November 2002, 1050 m, MNRJ 21265. One female, OCEANPROF I, BC-SUL, #65, Campos Basin, Rio de Janeiro, Brazil, 22°41′55.68″S, 40°16′30.36″W, 22 November 2002, 1050 m, MNRJ 21266.

Type locality
Campos Basin, Rio de Janeiro, Brazil.

Diagnosis
Antenna 1 accessory flagellum present, rudimentary, 1-articulate. Eyes absent. Mandibular palp very long, 3.4 times length of mandibular body, article 2 longer than article 3. Gnathopod 1 carpus longer than propodus (1.4×), posterior margin densely setose, posterodistal angle oblique. Gnathopod 2 weakly

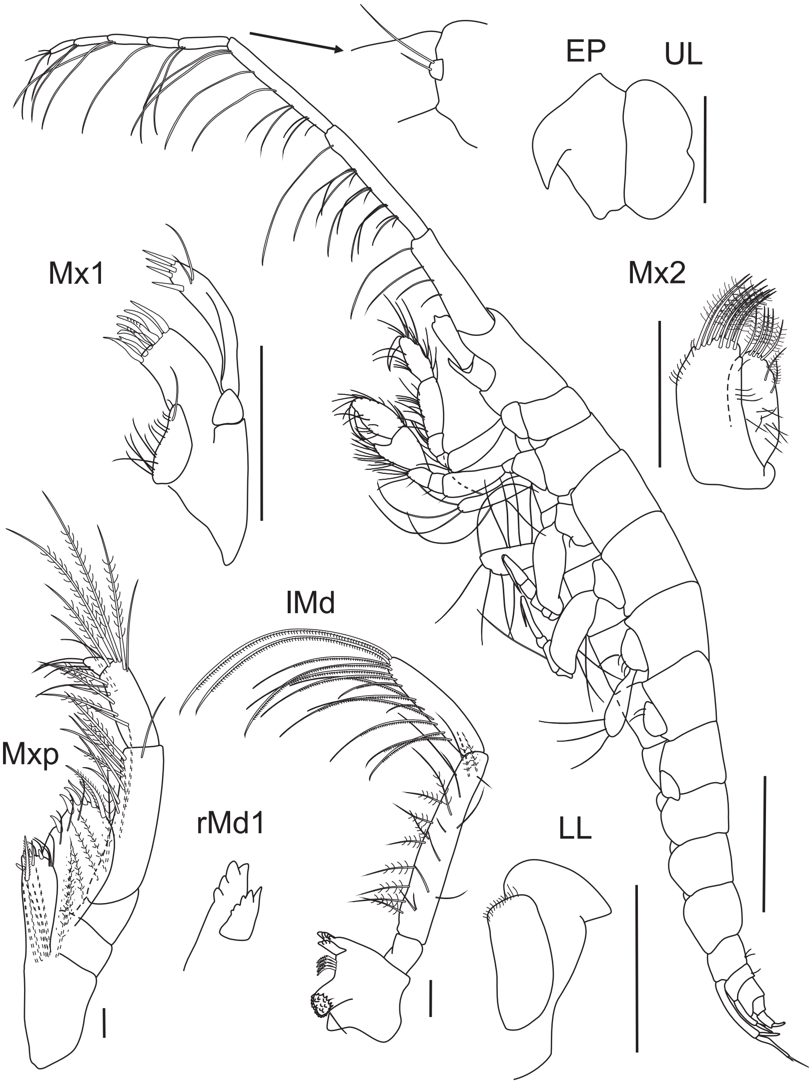

Figure 31. ***Pseudericthonius concavus* sp. nov.** Holotype, female (2.7 mm), OCEANPROF II BC, #50, 30 June 2003, 1050 m, MNRJ 21423.

carporchelate; basis moderately stout, enlarged distally; carpus triangular and massive, posterior margin with long setae, posterodistal angle produced into a subacute process; propodus subequal to carpus, anterior margin with long setae; palm rounded and minutely serrate, with long facial setae. Pereopod 5 basis subrectangular, three times longer than wide; dactylus with one accessory spine. Pereopods 6 and 7 dactylus with one accessory spine. Uropod 1 outer ramus with one long and robust apical seta, about 0.8 × ramus length, and one short apical robust seta; inner ramus half as long as outer ramus, with a short apical seta. Uropod 2 inner ramus half as long as outer ramus; inner ramus naked. Uropod 3 ramus without marginal robust setae, tip recurved with two spines and two setae. Telson subrectangular; wider than long, with shallow excavation distally and two patches of spines on both sides of telson.

Description

Based on holotype female (2.7 mm), MNRJ 21423. Antenna 1 article 3 longer than article 1; flagellum with five articles, accessory flagellum present, rudimentary, 1-articulate. Head longer than pereonites 1 and 2 together; anteroventral margin strongly recessed; eyes absent; lateral cephalic lobe acute. Epistome acute and curved upwards. Upper lip with distal notch. Mandibular palp very long, 3.4 times length of mandibular body, article 2 longer than article 3, with facial and marginal setae, article 3 marginal and distal long setae. Lower lip, mandibular process acute. Maxilla 1 inner plate with a row of

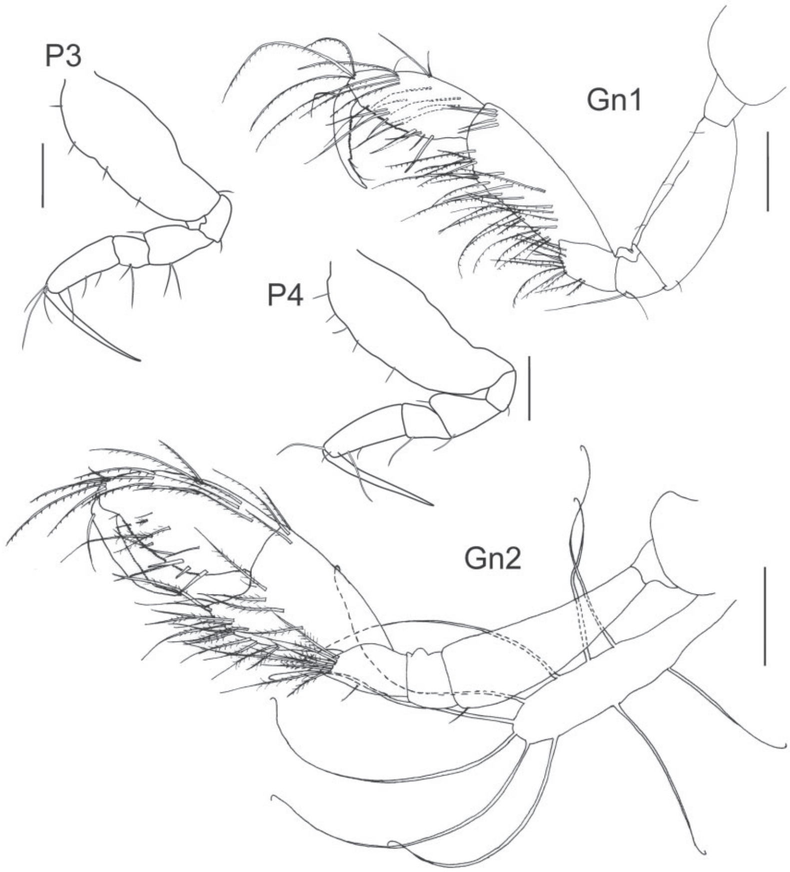

Figure 32. ***Pseudericthonius concavus*** **sp. nov.** Holotype, female (2.7 mm), OCEANPROF II BC, #50, 30 June 2003, 1050 m, MNRJ 21423.

marginal setae; outer plate with seven robust setae; palp with four apical robust setae and two facial setae. Maxilla 2 outer plate broader than inner plate; inner plate with a row of facial setae. Maxilliped inner plate extending beyond end of palp article 1; outer plate reaching about two-thirds along palp article 2; article 4 with a long apical robust setae.

Coxae 1–7 wider than long, mostly discontinuous. Coxae 1 and 2 anteroventral angle rounded and not produced. Coxae 3 and 4 similar in shape, and as deep as coxae 1 and 2. Coxa 5 as long as coxae 1–4, with a few long setae on distal margin. Coxae 6 and 7 short, similar in shape, shorter than others. Gnathopod 1 basis slender, posterior margin convex; carpus longer than propodus (1.4×), posterior margin densely setose, posterodistal angle oblique; propodus suboval, with long setae on antero, postero, and facial margin; palm evenly rounded and minutely serrate, without palmar corner; dactylus moderately stout, reaching end of palm. Gnathopod 2 weakly carporchelate; basis moderately stout, enlarged distally; carpus triangular and massive, posterior margin with long setae, posterodistal angle produced into a subacute process; propodus subequal to carpus, anterior margin with long setae; palm rounded and minutely serrate, with long facial setae. Pereopods 3 and 4 similar in shape and length, basis suboval, moderately inflated; merus, anterior margin well produced; dactylus longer than propodus. Pereopod 5 basis subrectangular, three times longer than wide; merus three times longer than wide; propodus long, 5 × carpus length; dactylus with one accessory spine. Pereopods 6 and 7 similar in shape, basis subrectangular, 2.1 times longer than wide; merus long, about 1.25 × propodus length; propodus a tuft of setae on posterodistal angle; dactylus with one accessory spine.

Epimera 1–3 distoventral margin rounded. Epimeron 3 posterior margin smooth. Uropod 1 long, peduncle with distoventral corona of spines, without robust setae on outer margin; outer ramus with outer and inner margins naked, with one long and robust apical seta about 0.8 × ramus length and one short apical robust seta; inner ramus half as long as outer ramus, with a short apical seta. Uropod 2 peduncle with distoventral corona of spines, without robust setae along outer margin; outer ramus without setae;

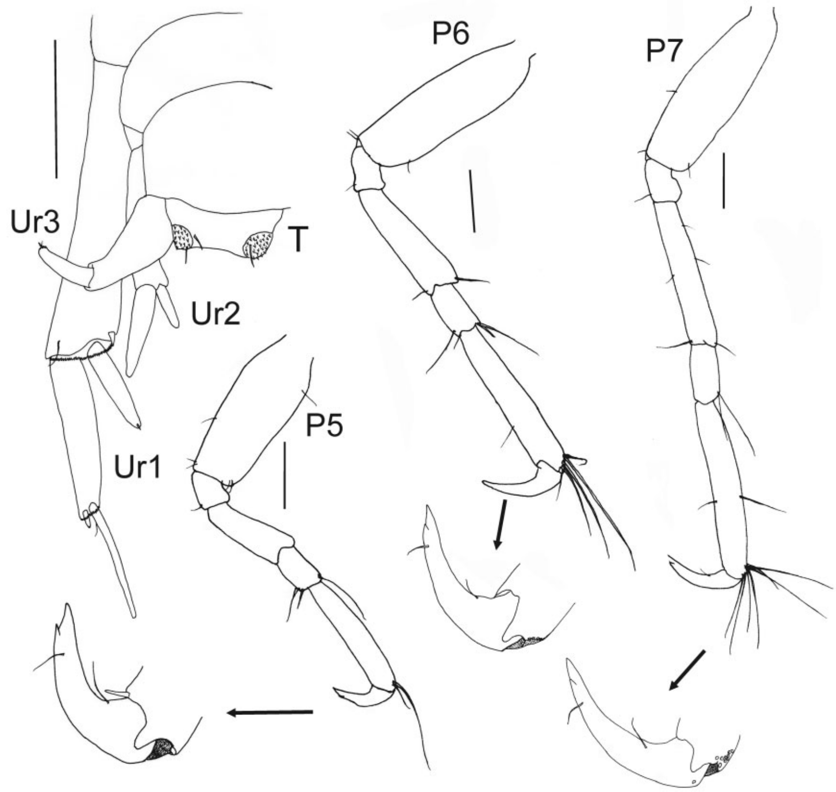

Figure 33. ***Pseudericthonius concavus*** **sp. nov.** Holotype, female (2.7 mm), OCEANPROF II BC, #50, 30 June 2003, 1050 m, MNRJ 21423.

inner ramus half as long as outer ramus; inner ramus naked. Uropod 3 peduncle without subapical setae; ramus without marginal robust setae, tip recurved, with two spines and two setae. Telson subrectangular; wider than long, with shallow excavation distally and two patches of spines on both sides of telson.

Tube
Composed of fine detritus and short sand grains.

Etymology
The specific name is derived from the Latin *concavus*, meaning concave. It refers to the excavation on the telson tip, which is unique within the genus.

Remarks
Pseudericthonius concavus sp. nov. is distinguished from all its congeners in having a sparsely setose coxa 5, the basis of pereopod 5 subrectangular, uropods 1 and 2 with the inner ramus reaching about midlength of the outer ramus, and lacking robust marginal setae. Also, both rami of uropod 2 lack distal setae, and the distal margin of the telson is concave, without an acute middle process.

Geographic distribution
South-western Atlantic: Campos Basin, Rio de Janeiro, Brazil.

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