

## *Atlantiphoxus wajapi* n. gen., n. sp. (Crustacea: Amphipoda: Phoxocephalidae), a new deep-sea amphipod from the southwestern Atlantic

Luiz F. Andrade<sup>1</sup>, André R. Senna<sup>2</sup>

<sup>1</sup> Universidade Federal Rural do Rio de Janeiro, Programa de Pós-graduação em Biologia Animal. Decanato de Pesquisa e Pós-Graduação, UFRRJ, Rod. BR 465, Km 7, Seropédica, RJ, CEP 23890-000, Brazil.

(LFA) (Corresponding author) E-mail: [lzflp.andrade@hotmail.com](mailto:lzflp.andrade@hotmail.com). ORCID-ID: <https://orcid.org/0000-0002-4868-737X>

<sup>2</sup> Universidade do Estado do Rio de Janeiro, Faculdade de Formação de Professores, Departamento de Ciências. Rua Dr. Francisco Portela, 1470, Patronato, São Gonçalo, RJ, CEP 24435-005, Brazil.

(ARS) E-mail: [senna.carcinologia@gmail.com](mailto:senna.carcinologia@gmail.com). ORCID-ID: <https://orcid.org/0000-0003-0976-849X>

**Summary:** A new genus and species of the family Phoxocephalidae is here described with material collected during the Mini Biological Trawl Project at 224 and 500 m depth off Brazil's southeastern coast in the states of Rio de Janeiro and São Paulo. *Atlantiphoxus wajapi* n. gen., n. sp. can be grouped in the subfamily Phoxocephalinae and seems to be morphologically close to *Fuegiphoxus* Barnard and Barnard, 1980 and *Parharpinia* Stebbing, 1899. However it can be easily distinguished within the phoxocephalids by the following characters: deep pereonites with small coxae; rostrum unstricted; eyes absent; mandible molar not tritulative, but as a small hump with 3 multicuspidate stout setae; pereopods 3-4 with stout dactylus; pereopod 5 basis strongly tapering distally; pereopod 7 basis anterodistal corner with a row of long plumose setae; dactylus elongate. Epimeral plate 3 posteroventral margin strongly produced.

**Keywords:** Amphipoda; taxonomy; SW Atlantic; Brazil; new species; new genus.

***Atlantiphoxus wajapi* n. gen., n. sp. (Crustacea: Amphipoda: Phoxocephalidae), un nuevo anfípodo de aguas profundas del Atlántico sudoccidental**

**Resumen:** Aquí se describe un nuevo género y especie de la familia Phoxocephalidae con material recolectado durante el Proyecto Mini Biological Trawl, frente a la costa sureste de Brasil en los estados de Río de Janeiro y São Paulo, a 224 y 500 metros de profundidad. *Atlantiphoxus wajapi* n. gen., n. sp. puede agruparse en la subfamilia Phoxocephalinae y parece estar morfológicamente cerca de *Fuegiphoxus* Barnard and Barnard, 1980 y *Parharpinia* Stebbing, 1899. Sin embargo, puede distinguirse fácilmente dentro de los fofocefálicos por los siguientes caracteres: pereonitos profundos con pequeñas coxas; rostro sin constricción; ojos ausentes; mandíbulas con molar no triturador, sino como una pequeña joroba con 3 setas largas multicuspidadas; pereiópodos 3-4 con fuerte dactilo; pereiópodo 5, base fuertemente afilada distalmente; pereiópodo 7, ángulo anterodistal de base con una fila de setas plumosas largas; dactilo alargado. Placa epimeral 3, margen posteroventral fuertemente producida.

**Palabras clave:** Amphipoda; taxonomía; Atlántico SO; Brasil; nueva especie; nuevo género.

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### INTRODUCTION

Phoxocephalidae Sars, 1891 is a marine benthic family living mostly buried within the substrate and

comprising about 365 species grouped into 80 genera (Barnard and Drummond 1978, Horton et al. 2019). It is widely distributed bathymetrically and most of its diversity can be found in the Southern Hemisphere deep

sea (Hartman 1955, Alonso de Pina et al. 2008, Senna 2010). The family is the fifth most speciose amphipod taxa (Arfianti et al. 2018) and can be distinguished by the following characters: head with visor-like rostrum, not cylindrical; antennae 1-2 of haustorioid form, with multiarticulate accessory flagellum; gnathopods 1-2 subchelate or chelate; pereopod 6 usually elongate; pereopod 7 short, with basis expanded posteroventrally, strongly distinct in size and shape from pereopod 6; uropod 3 biramous; and telson short to long, cleft (Barnard and Drummond 1978, 1982). Its external morphology is an adaptation to its ecological habits as burrowers, having characters like a broad rostrum and developed pereopods with stout setae (Alonso and Chiesa 2014).

In the past, the genera of Phoxocephalidae were grouped into nine subfamilies by Barnard and Drummond (1978). Over time, the status and establishment of new subfamilies were proposed and discussed to solve some questions regarding divergences between the genera (Gurjanova 1977, Barnard and Karaman 1991, Jarret and Bousfield 1994a, b). However, through cladistic analysis, Taylor and Poore (2001) failed to obtain support for the monophyly of the proposed subfamilies. According to Alonso de Pina et al. (2008), Barnard and Drummond's division of subfamilies must not be recognized until new phylogenetic studies are done.

The current classification of Phoxocephalidae is based on purely morphological criteria (De Broyer et al. 2007, Senna and Souza-Filho 2011, Lowry and Myers 2017), grouping all genera into two subfamilies: Harpiniinae Barnard and Drummond, 1978, diagnosed mainly by pereopod 5 with a narrow basis; and Phoxocephalinae Sars, 1891, characterized by pereopod 5 with a stout basis. Although we follow the most recent classification within the family, the World Amphipoda Database (Horton et al. 2019) continues to use the classical division using the old subfamilies. As recent authors have been accepting only two subfamilies (Andrade and Senna 2019a, b, 2020), it is suggested that the current classification should be updated in the database.

The establishment of a new genus can be somewhat problematic, especially in the family Phoxocephalidae. Taylor (2006) noticed this issue and highlighted the past works within the family when several new genera were established based on recombinations of known characters instead of newly or advanced ones, raising the number of monotypic genera. Furthermore, many species achieve the status of a genus or subfamily due to a few unusual characteristics, resulting in several paraphyletic taxa.

*Atlantiphoxus* n. gen. seems to be close to the genus *Fuegiphoxus* Barnard and Barnard, 1980, which was established with *Parharpinia fuegiensis* Schellenberg, 1931 as the type species. In the same work, the authors described *F. abjectus* Barnard and Barnard, 1980, *F. inutilis* Barnard and Barnard, 1980, and *Pontharpinia uncinata* Chevreux, 1912, which was provisionally assigned to the newly proposed genus and afterwards redescribed and confirmed as belonging to *Fuegiph-*

*oxus* (Chiesa and Alonso, 2011). Both the genera *Parharpinia* and *Pontharpinia*, plus *Protophoxus* K.H. Barnard, 1930, *Trichophoxus* K.H. Barnard, 1930 and *Metharpinia* Schellenberg, 1931, were considered a synonym of *Protophoxus* by J.L. Barnard (1960). Barnard and Drummond (1976) examined individuals of the type species belonging to the genera previously mentioned (except *Metharpinia*) and reconsidered their validity based on the analysis of 250 known characters and some new ones.

Considering the story of reallocations over the years between these phoxocephalid genera cited above, it is clear to see that *Parharpinia* and *Pontharpinia* were treated as close taxa, even being synonymized within *Paraphoxus*. Moreover, one species from each genus was removed from its current assigned genera to *Fuegiphoxus*, which was raised on the basis of the following divergences from *Paraphoxus*: antenna 2, article 4 with weak division of the stout setae rows and proximal position of the dorsal notch; mandibular molar with elongation of the third stout seta; maxilla 1, inner plate with 4 setae; maxilliped, inner plate with 1 apical stout seta; gnathopod 1, carpus elongate; gnathopod 2 significantly enlarged; gnathopod 2, carpus cryptic; pereopod 3-4, merus and carpus with well-developed facial setae; pereopod 7, apical digitation of propodus; and uropod 1-2, rami with lowered flexibility of the apical nail. To allocate *F. uncinatus*, Chiesa and Alonso (2011) made an emended diagnosis of the genus by adding the following character states: maxilliped, inner plate with 1 or 2 apical stout setae; gnathopod 2, carpus subcryptic to cryptic; epimeral plate 3, posteroventral corner rounded or with hook; telson bearing two or three apical stout setae.

Although one assumes the new genus has a relationship with *Fuegiphoxus* and *Parharpinia*, herein, we decided to establish a new genus instead of making an emended diagnosis of the morphologically closest taxon, especially because of many noteworthy combinations and exclusive characters that will be discussed below.

## MATERIALS AND METHODS

The material examined was collected between 1970 and 1971 by R/V *Prof. W. Besnard* at 224 and 500 m depth off Brazil's southeastern coast in the states of Rio de Janeiro and São Paulo. The campaign was organized by the Instituto Oceanográfico of the Universidade de São Paulo (IO - USP), within the Mini Biological Trawl (MBT) project. All specimens were preserved in 70% ethanol and deposited in the Crustacea Collection of the Universidade do Estado do Rio de Janeiro (UERJ). For the taxonomic study, the appendages were dissected and mounted in glycerin gel slides, drawn under an optical microscope with a Motic BA-310 camera lucida and digitized with CorelDRAW 2018. The setal/spine classification adopted in this paper follows Garm and Watling (2013). The nomenclature of the gnathopod palm is based on Poore and Lowry (1997).

## RESULTS

Order AMPHIPODA Latreille, 1816  
 Suborder Amphilochidea Boeck, 1871  
 Superfamily Haustorioidea Stebbing, 1906  
 Family **Phoxocephalidae** Sars, 1891

*Diagnosis* (after Barnard and Karaman, 1991). Rostrum visor-like or absent, not cylindrical; ventral cephalic cheek weak or absent. Article 3 of antenna 1 short; article 4 of antenna 2 with facial stout setae. When rostrum reduced or absent, facial stout setae occurring on article 4 of antenna 2 or articles 4-5 of pereopods 5-6. Right incisor broad and 3+ toothed; mandibular palp article 3 with up to 2 sets of outer setae closely contiguous on opposite faces, never in serial ranks, apex bevelled, all other setae dominantly apical; molar, if tritulative, of cup-shaped form, otherwise “spinose” or simple. Inner plate of maxilla 1 never pointed, never with more than 2 fully medial setae, other setae apical or absent. Coxae regular. Pereopod 5 with facial stout setae on articles 4-5. Pereopod 7 distinct from pereopods 5-6, much shorter than 6, article 2 broadly expanded in free, plate-like lobe. Epimeral plate 1 well developed. Peduncles of pleopods longer than wide. Rami of uropods 1-2 styliform. Uropod 3 biramous. Telson deeply cleft.

Subfamily **Phoxocephalinae** Sars, 1891

*Diagnosis*. Pereopod 5, basis broad, expanded.

*Composition of the subfamily*. The subfamily is composed of 270 species grouped in 70 genera (Horton et al. 2019) + 1 new genus: *Atlantiphoxus* n. gen. (1 species); *Baliphoxus* Ortiz and Lalana, 1999 (1 species); *Bathybirubius* Senna, 2010 (1 species); *Beringiaphoxus* Jarrett and Bousfield, 1994 (1 species); *Birubius* Barnard and Drummond, 1976 (48 species); *Booranus* Barnard and Drummond, 1978 (4 species); *Brolgus* Barnard and Drummond, 1978 (7 species); *Cephalophoxoides* Gurjanova, 1977 (10 species); *Cephalophoxus* Gurjanova, 1977 (1 species); *Cunmurra* Barnard and Drummond, 1978 (1 species); *Diogodias* Barnard and Drummond, 1978 (2 species); *Elpeddo* Barnard and Drummond, 1978 (1 species); *Eobrolgus* Barnard, 1979 (3 species); *Eusyrofoxus* Gurjanova, 1977 (1 species); *Eyakia* Barnard, 1979 (5 species); *Foxiphalus* Barnard, 1979 (12 species); *Fuegiphoxus* Barnard and Barnard, 1980 (4 species); *Ganba* Barnard and Drummond, 1978 (1 species); *Grandifoxus* Barnard, 1979 (15 species); *Griffithsius* Jarrett and Bousfield, 1994 (1 species); *Hopiphoxus* Barnard and Drummond, 1978 (1 species); *Indophoxus* Dang and Le, 2005 (1 species); *Japara* Barnard and Drummond, 1978 (1 species); *Jerildaria* Barnard and Drummond, 1978 (1 species); *Joubinella* Chevreux, 1908 (6 species); *Kondoleus* Barnard and Drummond, 1978 (1 species); *Kotla* Barnard and Drummond, 1978 (1 species); *Kulgaphoxus* Barnard and Drummond, 1978 (3 species); *Kuritus* Barnard and Drummond, 1978 (1 species); *Leongathus* Bar-

nard and Drummond, 1978 (2 species); *Leptophoxoides* Barnard, 1962 (2 species); *Leptophoxus* G. O. Sars, 1891 (1 species); *Limnoporeia* Fearn-Wannan, 1968 (10 species); *Linca* Alonso de Pina, 1993 (1 species); *Majoxiphalus* Jarrett and Bousfield, 1994 (1 species); *Mandibulophoxus* Barnard, 1957 (8 species); *Matong* Barnard and Drummond, 1978 (1 species); *Mesophoxus* Gurjanova, 1977 (1 species); *Metaphoxoides* Ledoyer, 1968 (3 species); *Metaphoxus* Bonnier, 1896 (8 species); *Metharpinia* Schellenberg, 1931 (10 species); *Microphoxus* Barnard, 1960 (5 species); *Palabriaphoxus* Gurjanova, 1977 (2 species); *Parafoxiphalus* Alonso de Pina, 2001 (1 species); *Parajoubinella* Gurjanova, 1977 (1 species); *Paramesophoxus* Gurjanova, 1977 (1 species); *Parametaphoxus* Gurjanova, 1977 (3 species); *Paraphoxus* G. O. Sars, 1891 (14 species); *Parharpinia* Stebbing, 1899 (4 species); *Phoxocephalus* Stebbing, 1888 (2 species); *Phoxorgia* Barnard and Barnard, 1980 (1 species); *Pontharpinia* Stebbing, 1897 (5 species); *Protophoxus* K.H. Barnard, 1930 (1 species); *Pseudfoxiphalus* Andres, 1991 (1 species); *Rhepoxynius* Barnard, 1979 (18 species); *Rikkarus* Barnard and Drummond, 1978 (1 species); *Ringaringa* Barnard and Karaman, 1991 (1 species); *Synphoxus* Gurjanova, 1980 (1 species); *Tickalerus* Barnard and Drummond, 1978 (1 species); *Tipimegus* Barnard and Drummond, 1978 (5 species); *Trichophoxus* K.H. Barnard, 1930 (2 species); *Uldanamia* Barnard and Drummond, 1978 (1 species); *Urophoxus* Gurjanova, 1977 (= *Pontharpinia* according to Barnard and Karaman, 1991); *Vasco* Barnard and Drummond, 1978 (1 species); *Vietophoxus* Dang and Le, 2005 (1 species); *Waipirophoxus* Gurjanova, 1980 (1 species); *Waitangi* Fincham, 1977 (3 species); *Wildus* Barnard and Drummond, 1978 (5 species); *Yammacoona* Barnard and Drummond, 1978 (1 species); *Yan* Barnard and Drummond, 1978 (2 species).

*Atlantiphoxus* n. gen.

*Diagnosis*. Body showing deep pereonites with small coxae. Head with rostrum unconstricted; eyes absent. Antenna 1, peduncle article 2 of medium length, ventral margin with setae spread medially and distally. Antenna 2, peduncle article 4 ventral margin with long stout pectinate setae distally, facial margin with one row of setae extending to dorsal apex. Mandible molar not tritulative, but as a small hump with 3 multicuspitate stout setae, incisor toothed, palpal hump small. Maxilla 1 palp 2-articulate. Maxilla 2 inner plate subequal to outer. Maxilliped palp article 4 narrow, apical nail medium. Gnathopods 1-2 anterior margin weakly setose; propodus with stout setae defining palm. Pereopods 3-4 with dactylus stout. Pereopod 5 basis broad, strongly tapering distally. Pereopod 7 basis expanded posteroventrally, anterodistal corner with a row of long plumose setae; dactylus elongate. Epimeral plate 3, posteroventral margin strongly produced and rounded. Uropod 3 outer ramus, article 2 elongate, with 2 long setae apically. Telson apex truncated, with long setae on each lobe.

Table 1. – Diagnostic characters of *Atlantiphoxus* n. gen. and its closest genera.

	<i>Atlantiphoxus</i> n. gen.	<i>Fuegiphoxus</i>	<i>Linca</i>	<i>Parharpinia</i>
Eyes	Absent	Present (dubious in <i>F. abjectus</i> )	Absent	Present
Antenna 2 article 4 stout facial setae	In one main row	Up to two rows	In three rows	In one main row (rarely in 2+ rows)
Maxilliped inner plate	With one stout seta apically	With 1–2 stout setae apically	With one stout seta apically	With 2–6 stout or thin setae apically
Pereopods 3–4 dactylus	Stout	Slender	Slender	Slender
Pereopod 5 basis	Strongly tapering distally	Weakly tapering distally	Not tapering	Weakly tapering distally
Pereopod 7 basis anterodistal lobe	Produced, bearing a row of long plumose setae	Not produced, without row of setae	Not produced, bearing a row of long setae	Not produced, without row of setae
Epimeral plate 3	Without setae	Bearing two or more setae	Bearing four or more setae	Bearing three or more setae
Uropod 2 peduncle dorsomedial margin	With a row of long stout pectinate setae	With a row of short to medium stout setae	With a row of short to medium stout setae	With a row of short setae
Telson apex	With three long setae	With two or three short to medium stout setae	With one short and one medium stout seta	With up to three short to medium stout setae

*Type species.* *Atlantiphoxus wajapi* n. sp. (by monotypy)

*Etymology.* The genus name *Atlantiphoxus* is a combination of the word “Atlantic” in reference to its geographical distribution, so far exclusive to the Atlantic Ocean, plus *phoxus* attributed to the family name Phoxocephalidae.

*Remarks.* *Atlantiphoxus* n. gen. shares the following characters with *Fuegiphoxus*: antennae 1–2 flagella not reduced; right mandible molar as a hump with 3 stout multicuspidate setae, incisor with 3 teeth, palpar hump small; maxilla 1 palp 2-articulate; gnathopods 1–2 weakly setose anteriorly, without eusirid attachment, propodus ovato-rectangular, palm acute; uropods 1–2 rami with apical nail immersed; telson with subtruncate apex and a weak lateral acclivity. However, the new genus differs from *Fuegiphoxus* by the following characteristics (characters of *Fuegiphoxus* in parentheses): eyes absent (present, but dubious in *F. abjectus*); antenna 2 article 4 stout facial setae in 1 row (up to 2 rows); pereopods 3–4 dactylus stout (slender); pereopod 7 basis with anterodistal lobe produced and bearing a row of long plumose setae (not produced, without setal row), dactylus elongate (ordinary); epimeral plate 3 strongly produced posteroventrally (not produced); uropod 1 outer ramus with 3 stout setae dorsally (1–2 setae); uropod 2 peduncle with a row of long pectinate setae (with stout and not pectinate setae); telson with 3 long setae apically on each lobe (1–2 setae).

The new genus shares the following characters with *Parharpinia* as well: antenna 1 article 2 ventral setae widely spread; mandibles, palpar hump small, apex of palp oblique; maxilla 1 inner plate with 4 setae; gnathopods similar, weakly setose anteriorly, without eusirid attachment, palm acute; pereopods 3–4 carpus with posteroproximal setae; pereopods 5–6 merus and carpus narrow; uropods 1–2 rami not continuously with stout setae to apex; uropod 3 showing one ramus longer than peduncle. However, the Brazilian genus differs from *Parharpinia* by the following characters (characters of *Parharpinia* in parentheses): antenna 2 article 4

facial setal row not stout (stout setae); mandibles molar with 3 stout setae (with 4+), incisor with 4 teeth (with 3 teeth); pereopods 3–4 propodus with thin armaments (with thick armaments); pereopod 5 basis strongly tapering distally (weakly tapering); epimeral plates 1–2 with facial plumose setae and naked posteriorly (with posterior setae); epimeral plate 3 naked (with 3+ long setae); uropod 1 without apicomedial major displaced stout seta (with); telson with 3 long setae apically on each lobe (without long setae).

*Atlantiphoxus* n. gen. also resembles to *Linca* Alonso de Pina, 1993, a monotypic genus described for Argentinean waters, by the following characters: eyes absent, or at least not apparent on *Linca* as stated by Alonso de Pina (1993); mandibles molar as a small hump with 3 stout setae, 1 being long and 2 shorter; maxilla 1 palp 2-articulate, inner plate with 4 setae; maxilliped dactyl elongate, nail medium; gnathopods small but dissimilar, carpus free, not cryptic, propodus ovate and weakly setose anteriorly; pereopod 6 basis with produced lobe posterodistally; pereopod 7 basis expanded, reaching the apex of merus, naked ventrally; epimeral plates 2–3, ventral margin with plumose setae, posterior margin naked; uropod 2 peduncle laterally combed distally. However, *Atlantiphoxus* n. gen. can be distinguished from *Linca* by the following characters (characters of *Linca* in parentheses): antenna 1 article 2 medium (elongate); antenna 2 article 4 facial setal row in 1 row (in 3 rows); pereopod 5 strongly tapering distally (not tapering); epimeral plate 1 posteroventral corner weakly produced into a small spine (rounded, not produced); epimeral plate 3 strongly produced and naked (not produced, with ventral and posterior setae); uropod 1 with 4 basofacial setae proximally (with 7 basofacial setae); telson with 3 long setae apically on each lobe (with 1 short and 1 medium stout setae).

The differences between *Atlantiphoxus* n. gen. and the closest genera are summarized in Table 1, showing the most important diagnostic characters. Although the new genus can be diagnosed by a new combination of characters, within a hypothetical clade formed by *Fuegiphoxus* and *Parharpinia*, the new taxon can be differentiated by the following exclusive features: deep

pereonites with small coxae; antenna 2, article 4, stout facial setae in 1 row extending to dorsal apex; maxilliped, inner plate with 3 blunt projections apically; pereopods 3-4 with stout dactylus; pereopod 5, basis strongly tapering; pereopod 6, basis with produced posterodistal lobe; pereopod 7, basis with anterodistal lobe produced bearing a row of long plumose setae; epimeral plate 3, posteroventral corner naked, rounded and strongly produced; telson, apex truncated, with 3 long setae on each lobe apically.

*Atlantiphoxus wajapi* n. sp.  
(Figs 1-5)

*Material examined:* Holotype: female, 2.6 mm, dissected and drawn, MBT 144, 23°53'S 42°28'W, 500 m depth, Rio de Janeiro state, 03 September 1970, UERJ 401. Paratypes: 1 female, dissected and drawn, MBT 180, 25°55'S 45°46'W, 224 m depth, São Paulo state, 29 May 1971, UERJ 402; 1 female, in 70% ethanol, MBT 180, 25°55'S 45°46'W, 224 m depth, São Paulo state, 29 May 1971, UERJ 403.

*Diagnosis.* Same as the genus.

*Etymology.* Named after the *Wajāpi*, as a tribute to the indigenous people living in the north of South America, who have been constantly and violently threatened but are resisting in an area explored by illegal miners and mining companies.

*Description.* Based on holotype. Habitus as in Figure 1. Head (Fig. 2A-B) with rostrum entire and un-constricted; eyes absent. Antenna 1 (Fig. 2C) peduncle article 1 about 1.9× longer than wide, ventral margin with 3 long plumose and 4 brush setae distally, dorsal margin with setules and 2 setae distally; article 2 medium, about 50% the length of article 1, ventral margin with 6 setae, facial margin with 2 setae distally; article 3 about 40% the length of article 2, ventral margin with 3 setae; primary flagellum 8-articulate; accessory

flagellum 6-articulate. Antenna 2 (Fig. 2D) peduncle article 3, facial margin with 1 long seta, dorsal margin with 1 seta distally; article 4, ventral margin with 7 long stout pectinate setae, facial margin with 1 brush setae and one row of setae extending to dorsal apex, dorsal margin with 3 setae proximally; article 5, ventral margin with 8 long stout setae, dorsal margin with 2 stout setae medially; flagellum 8-articulate. Upper lip (Fig. 2G) naked, produced apically as a sub-rounded lobe. Left mandible (Fig. 2I) molar as a small hump with 3 multicuspidate stout setae, incisor with 4 teeth, lacinia mobilis elongate, with 3 teeth, 1 being minute in the middle, accessory setal row with 10 multicuspidate stout setae, palpar hump small; palp 3-articulate, article 1 short; article 2, with 3 setae; article 3 slightly longer than article 2, apex oblique, with 8 medium to long setae; Right mandible (Fig. 2J) molar as a small hump with 3 multicuspidate stout setae, incisor with 3 teeth, lacinia mobilis with 4 teeth, 1 being longer and multicuspitate, accessory setal row with 7 multicuspidate stout setae, palpar hump small; palp 3-articulate, article 1 short; article 2, with 4 setae; article 3, slightly longer than article 2, apex oblique, with 7 medium to long setae. Maxilla 1 (Fig. 2E) inner plate medial margin with 1 simple and 1 plumose seta, apical margin with setules and 2 setae; outer plate, with 11 multicuspidate stout setae; palp 2-articulate, with 9 setae apically and subapically, medial and lateral margins with setules. Maxilla 2 (Fig. 2F) inner plate slightly shorter than outer, medial margin covered with setules, subapical margin with 3 stout plumose setae, apical margin with 6 plumose setae; outer plate, lateral margin covered with setules, apical margin with simple and plumose setae. Maxilliped (Fig. 2H) inner plate medial margin with 3 setae, apical margin with 3 blunt projections and 1 stout and 3 long setae; outer plate medial margin with 5 stout and 2 long setae, apical margin with 2 long plumose and 2 stout setae, lateral margin covered with

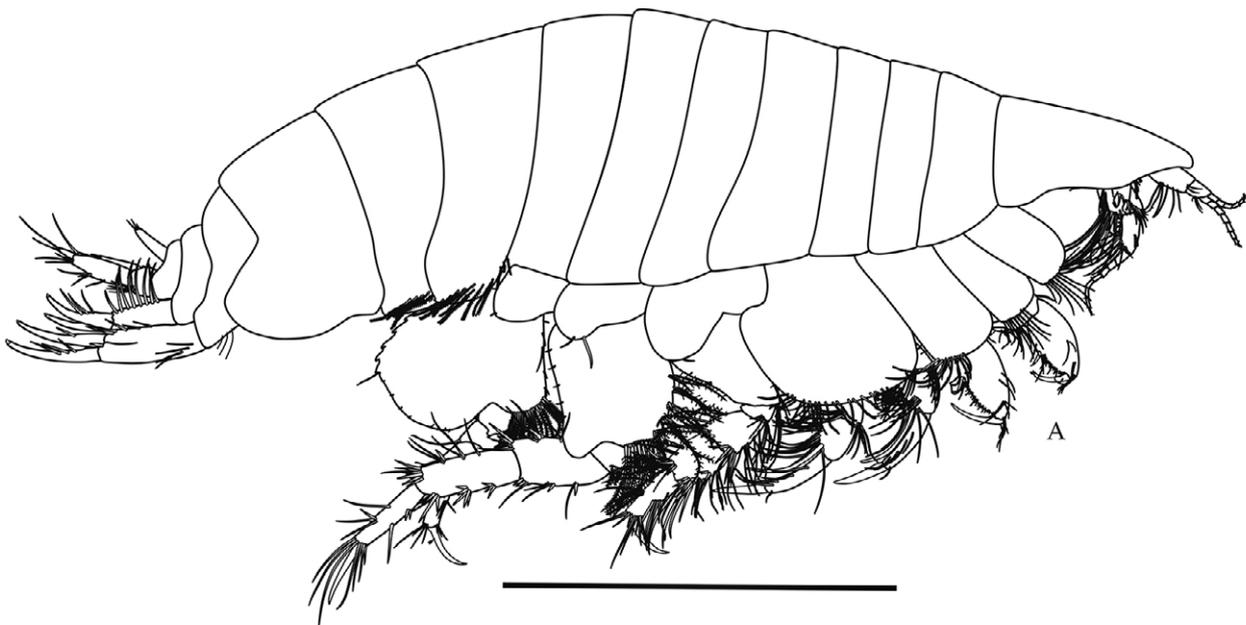


Fig. 1. – *Atlantiphoxus wajapi* n. sp. paratype female (UERJ 402). Habitus. Scale bar: 1.0 mm.

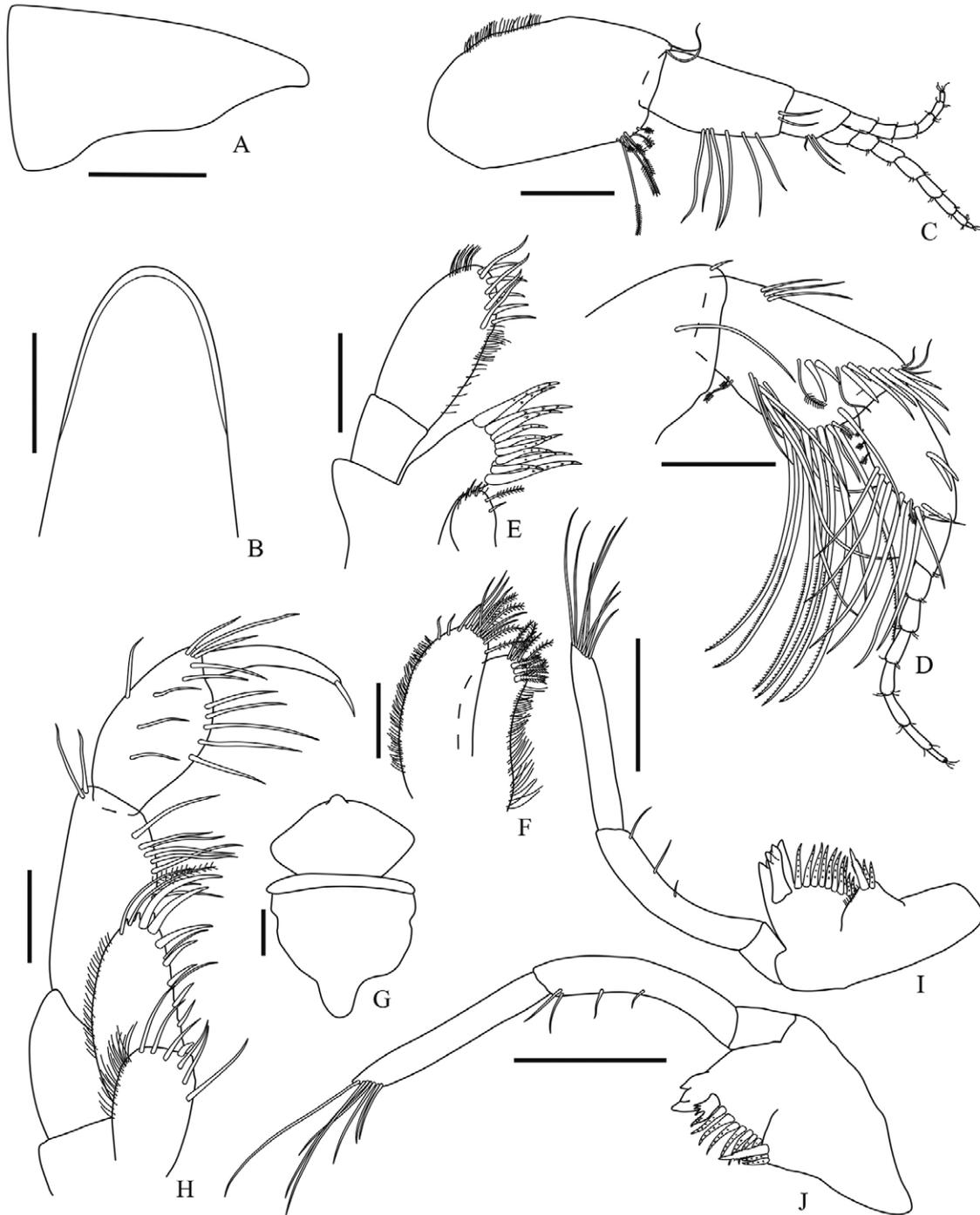


Fig. 2. – *Atlantiphoxus wajapi* n. sp. holotype female (UERJ 401). A, head in lateral view; B, head in dorsal view; C, antenna 1; D, antenna 2; E, maxilla 1; F, maxilla 2; G, upper lip; H, maxilliped; I, left mandible; J, right mandible. Scale bars: A-D and I-J: 0.2 mm, E-H: 0.1 mm.

setules; palp article 2 weakly setose medially, article 3 with few setae on its margins, article 4 slender and elongate, with 1 medium apical nail.

Gnathopod 1 (Fig. 3A) weakly setose; coxa sub-rectangular, ventral margin with 10 long setae; basis about 3.4× longer than wide, anterior margin with 1 long and 1 medium setae distally, posterior margin with setae medially, posteroventral corner with 5 setae; ischium short and sub-rectangular, posteroventral corner with 3 setae; merus posterior margin with 5

setae, facial margin with 3 setae; carpus anterior margin with 2 setae, posterior margin with 12 setae, facial margin with 1 seta; propodus anterior margin with 3 setae distally, posterior margin with 1 seta medially, with 1 stout seta defining palm; palm acute, weakly sinuous, with few setae on its margin; dactylus slightly longer than palm, outer margin with 1 setule proximally and 1 spatulate seta distally. Gnathopod 2 (Fig. 3B) weakly setose; coxa sub-rectangular, ventral margin with 9 long setae; basis about 3.2× longer than

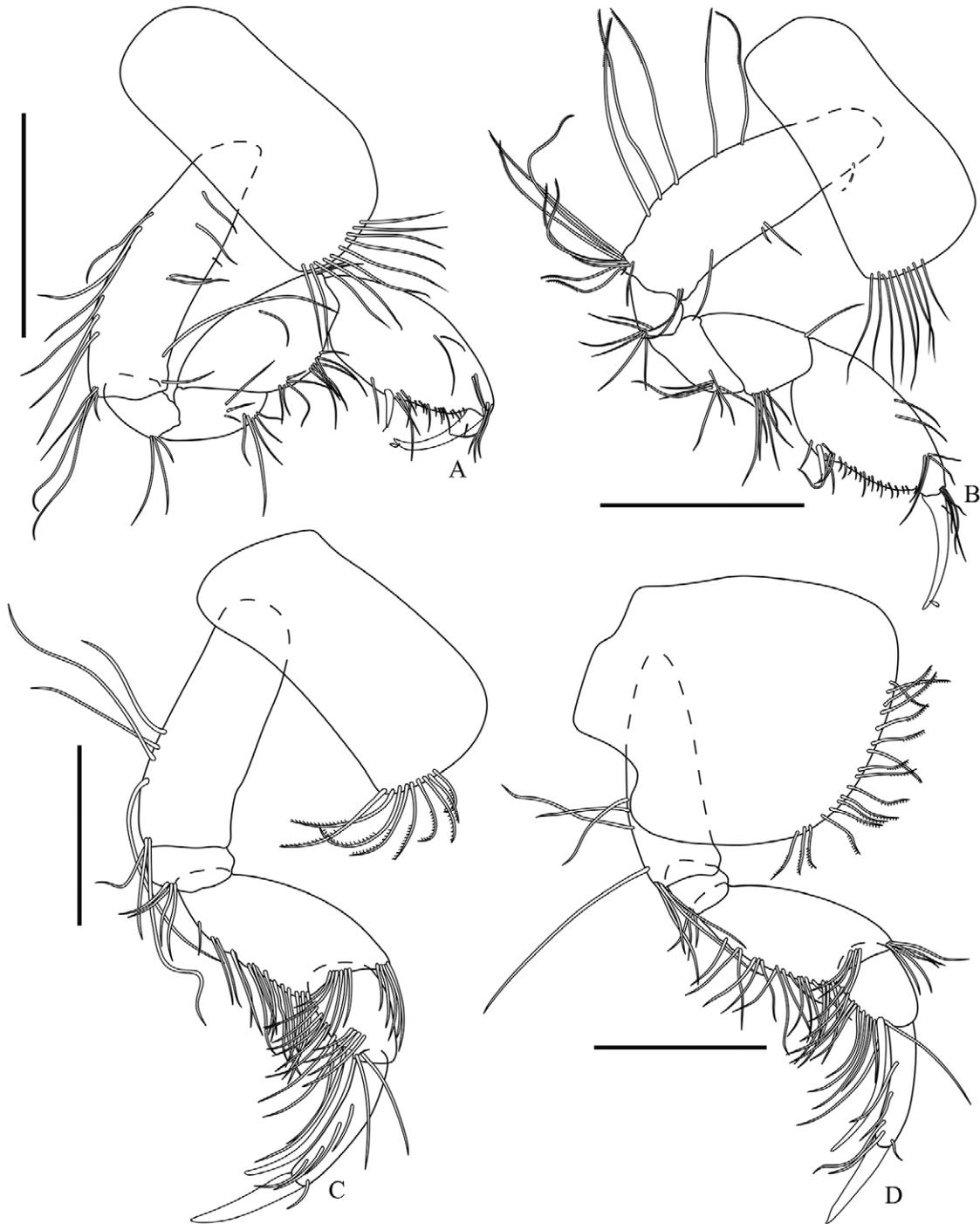


Fig. 3. – *Atlantiphoxus wajapi* n. sp. holotype female (UERJ 401). A, gnathopod 1; B, gnathopod 2; C, pereopod 3; D, pereopod 4. Scale bars: A-B: 0.2 mm, C-D: 0.5 mm.

wide, anterior margin with few setae, posterior margin with 5 long pectinate setae medially, posterodistal corner with a tuft of long pectinate setae; ischium small and subrectangular, posterodistal corner with 6 setae; merus posterior margin with 6 setae, facial margin with 1 seta; carpus anterior margin with 1 seta distally, posterior margin with 7 setae; propodus anterior margin with 4 setae distally, posterior margin with 1 seta medially, with 1 stout seta defining palm; palm acute, weakly sinuous, with few setae on its margin;

dactylus subequal to palm, outer margin with 1 setule proximally and 1 spatulate seta distally. Pereopod 3 (Fig. 3C) coxa sub-rectangular, posterior margin weakly concave, ventral margin with 9 pectinate setae; basis about 2.8× longer than wide, posterior margin with 4 setae medially, posterodistal corner with 3 setae; ischium small and sub-rectangular, posterodistal corner with 4 setae; merus anterior margin with 5 setae distally, posterior margin moderately setose, facial margin with a row of 6 setae distally; carpus



Fig. 4. – *Atlantiphoxus wajapi* n. sp. holotype female (UERJ 401). A, pereopod 5; B, pereopod 6; C, pereopod 7. Scale bars: 0.5 mm.

posterior margin moderately setose, with 1 thicker stout seta distally, almost reaching half of dactylus; propodus anterior margin with 1 short seta distally, posterior margin with 4 setae; dactylus stout, about 75% the length of propodus. Pereopod 4 (Fig. 3D) coxa weakly expanded anteriorly, posterodorsal margin excavate, ventral margin with 17 pectinate setae; basis about 2.9× longer than wide, posterior margin and posterodistal corner with 4 setae each; ischium small and sub-rectangular, posterodistal corner with 3 setae; merus anterior margin with 5 setae distally, posterior margin moderately setose; carpus posterior margin moderately setose, with 1 thicker stout seta distally, almost reaching half of dactylus; propodus anterior margin with 1 short seta distally, posterior margin with 4 long setae; dactylus stout, about 75% the length of propodus. Pereopod 5 (Fig. 4A) coxa bilobate, posteroventral margin weakly expanded, with 1 short seta; basis about 1.4× longer than wide, strongly tapering distally, anterior margin with 2 setae proximally and 5 distally, posterior margin with

1 seta medially; ischium small and sub-rectangular, facial margin with row of 5 setae extending to anterodistal corner; merus anterior margin moderately setose, with a row of 5 setae distally, posterior margin with 5 papposerrate and 5 stout setae; carpus facial setal formula: 3-5-4-3, anterior margin with 8 long setae, posterior margin with papposerrate and simple setae; propodus anterior and posterior margins weakly setose, distal apex with 9 setae; dactylus elongate, about 70% the length of propodus. Pereopod 6 (Fig. 4B) coxa sub-rounded, posteroventral margin weakly expanded, with 2 setae; basis about 1.2× longer than wide, anterior margin with long plumose and stout setae medially, anterodistal corner with a row of 8 long plumose setae, posterior margin with setules; ischium small and subquadrate, anterior margin with 4 plumose setae; merus anterior margin with 4 stout and 4 long setae, posterior margin with 3 stout and 8 long setae; carpus facial setal formula: 3-5-3-6, posterior margin with 1 stout and 5 long setae; propodus anterior margin with 1 long and 2 stout setae,

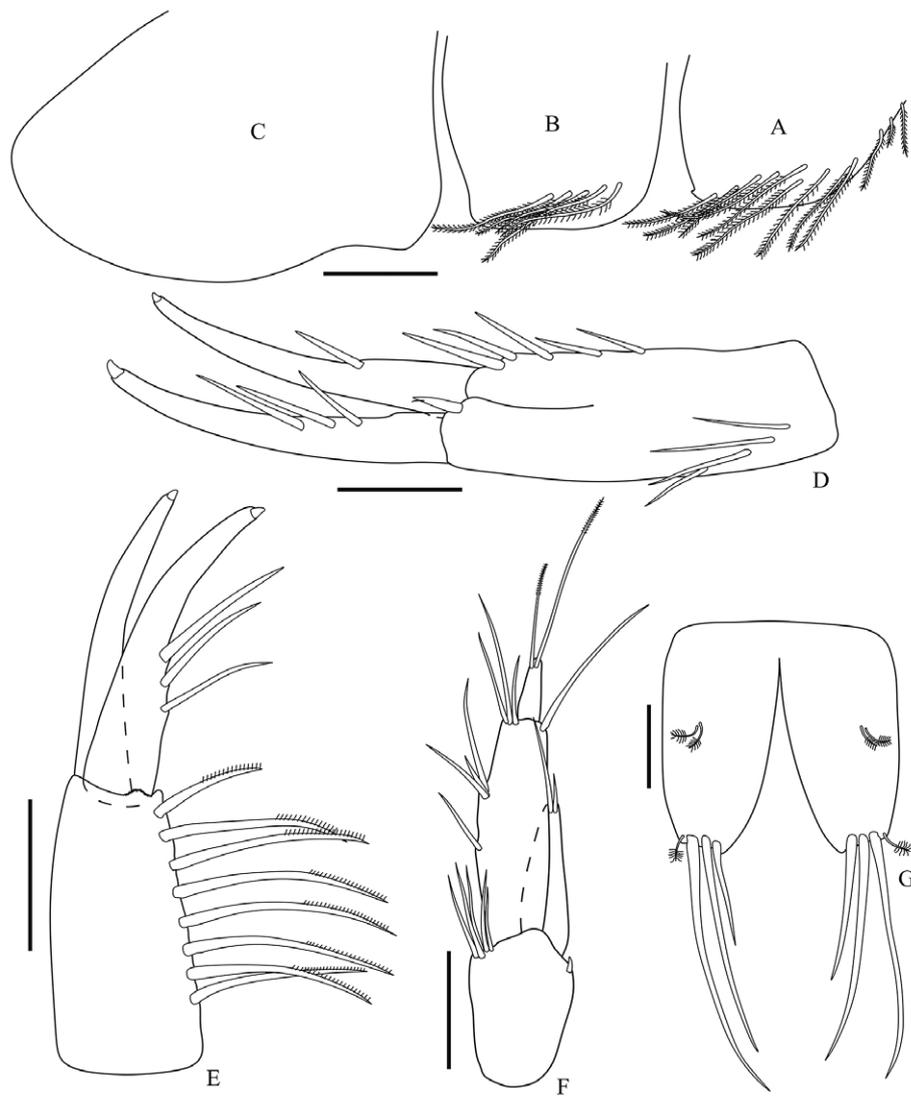


Fig. 5. – *Atlantiphoxus wajapi* n. sp. holotype female (UERJ 401). A, epimeral plate 1; B, epimeral plate 2; C, epimeral plate 3; D, uropod 1; E, uropod 2; F, uropod 3; G, telson. Scale bars: A-F: 0.2 mm, G: 0.1 mm.

posterior margin with 1 stout and 3 long setae, distal apex with 1 stout and 6 setae; dactylus elongate, about 70% the length of propodus. Pereopod 7 (Fig. 4C) coxa sub-rounded, posteroventral margin with 1 short seta; basis slightly wider than long, expanded posteroventrally, almost reaching the apex of merus, anterior margin with 5 setae proximally, anterodistal lobe produced with a row of 16 long plumose setae, posterior margin with 6 serrations, with setules and 1 long seta, ventral margin smooth; ischium small and sub-rectangular, distal lobe produced, anterior margin with 5 plumose setae, posterior margin with setules; merus anterior margin with 6 setae, posterior margin with 1 seta distally; carpus anterior and posterior margins weakly setose; propodus anterior margin with 6 setae, posterior margin with 7 setae; dactylus elongate, about 80% the length of propodus, outer margin with 1 short plumose seta proximally.

Epimeral plate 1 (Fig. 5A) anterior and ventral margins almost straight, with facial row of long plumose

setae, anteroventral corner rounded, posteroventral corner weakly produced into a small spine, posterior margin convex. Epimeral plate 2 (Fig. 5B) anterior and ventral margins almost straight, with facial row of 5 long plumose setae, anteroventral and posteroventral corners rounded, posterior margin convex. Epimeral plate 3 (Fig. 5C) anterior margin weakly concave, anteroventral corner rounded, ventral margin weakly concave proximally, posteroventral corner rounded and strongly produced. Uropod 1 (Fig. 5D) peduncle 2.9× longer than wide, with 4 basofacial setae proximally, dorsolateral corner with 1 stout setae, dorsomedial margin with 5 setae; outer ramus dorsal margin with 3 stout setae, bearing 1 apical nail; inner ramus subequal to outer, dorsal margin with 1 stout seta, bearing apical nail. Uropod 2 (Fig. 5E) peduncle 2× longer than wide, dorsolateral corner weakly projected and laterally combed distally, dorsomedial margin with 8 long stout pectinate setae; outer ramus dorsal margin with 3 stout setae, bearing 1 apical nail; inner ramus

subequal to outer, naked, bearing 1 apical nail. Uropod 3 (Fig. 5F) peduncle 1.5× longer than wide, ventral margin with 5 long setae distally, dorsal margin with 1 short seta; outer ramus about 1.9× longer than inner, article 1 ventral margin with 4 setae medially and 3 distally, dorsal margin with 1 long seta distally, article 2 elongate, with 2 long pectinate setae apically; inner ramus with 2 setae apically. Telson (Fig. 5G) about 85% cleft, apex truncate, with 3 long setae and 1 short seta on each lobe, dorsal margin with 2 short plumose setae medially.

*Type locality.* Rio de Janeiro state coast (23°53'S 42°28'W).

*Ecological data.* *Atlantiphoxus wajapi* n. gen., n. sp. was collected with a rectangular dredge on a sediment bottom covered with *Globigerina* ooze and dark grey mud (station MBT 144). There is no sediment information for station MBT 180.

*Geographic distribution:* The species is known for the coast of the Brazilian states of Rio de Janeiro (23°53'S 42°28'W) and São Paulo (25°55'S 45°46'W) (Fig. 6).

## DISCUSSION

*Atlantiphoxus wajapi* n. sp. has the following new combination of noteworthy characters: Body with deep pereonites and small coxae. Head with rostrum unstricted; eyes absent; maxilliped, inner plate apical margin with 3 blunt projections and 1 stout seta apically; palp apical nail medium. Gnathopods 1–2 propodus with 1 stout seta defining palm; palm weakly sinuous; dactylus outer margin with 1 spatulate seta distally. Pereopods 3–4 carpus ventral margin with main stout distal setae exceeding the apex of propodus. Pereopod 5 basis proximally broad and strongly tapering distally. Pereopod 6 posterodistal lobe produced, anterodistal margin with a row of long plumose setae extending to facial margin. Pereopod 7 basis expanded posteroventrally, almost reaching the apex of merus, posterior margin serrate, anterodistal lobe produced and with a row of long plumose setae; dactylus elongate. Epimeral plates 1–2 facial margin with long plumose setae. Epimeral plate 3 naked, posteroventral margin strongly produced and rounded. Uropods 1–2 rami not continuously with stout setae to apex, bearing apical nail. Uropod 2 peduncle dorsal margin with

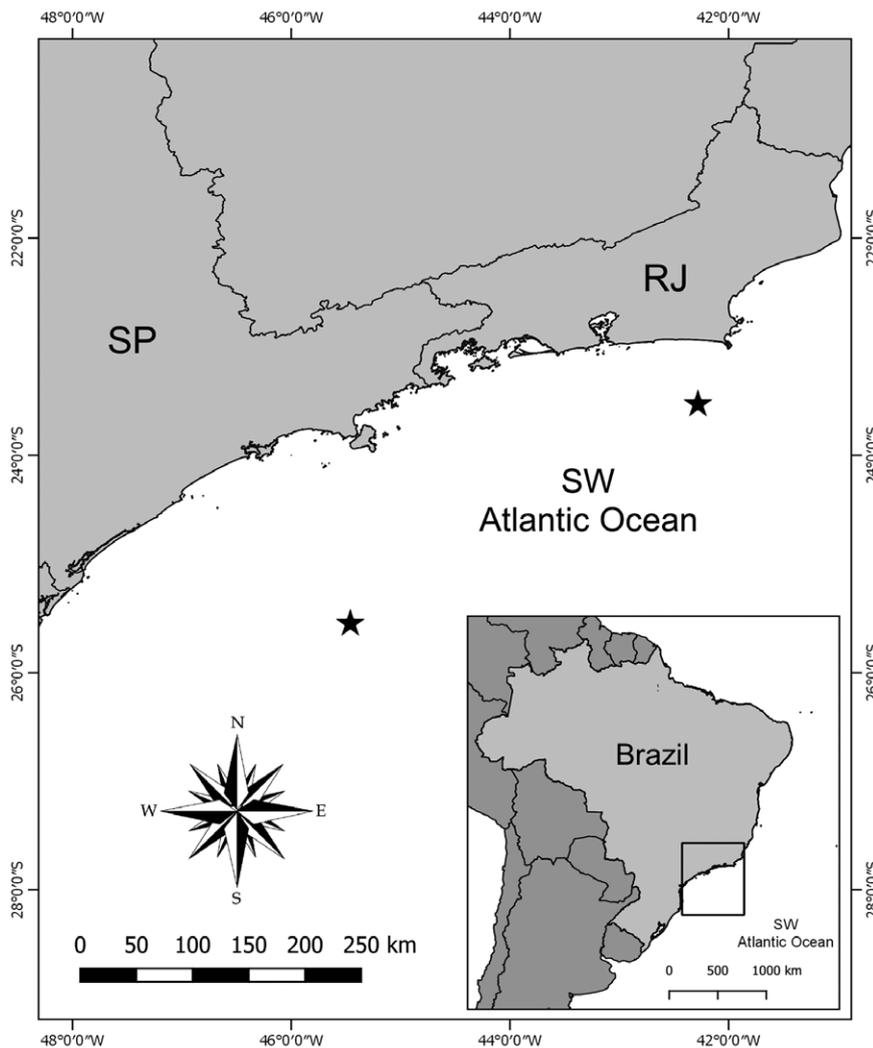


Fig. 6. – Distribution of *Atlantiphoxus wajapi* n. sp.

a row of long pectinate setae. Telson apex truncated, with 1 short plumose and 3 long setae on each lobe, dorsal margin with 2 plumose setae.

Considering the statements by Barnard and Drummond (1978), the ancestor of the phoxocephalids would have an enlarged second gnathopod. Thus, the new genus can be hypothesized as more advanced and derived from *Fuegiphoxus* based on the reduction in size of gnathopod 2 and the elongation of its propodus. It was assumed by the same authors that the phoxocephalids used the Magellanic region, which has 17 phoxocephalid species grouped into 11 genera (Alonso de Pina et al. 2008), as a main stopover during the migratory processes from Australia. The Australian waters are considered a main centre of origin for Phoxocephalidae, since it retains *Pontharpinia*, treated as the most primitive genus within the family (Barnard and Karaman 1983). These centres are taken as hotspots where successful taxa are able to leave and spread around prosperous regions (Briggs 2003). Barnard and Drummond (1978) proposed a theory for the migration process of the subfamily Harpiniinae, and this hypothesis can be extended to the Phoxocephalinae as well, assuming that the new genus is an outcome of the migratory phoxocephalid pathway towards northern waters through the deep sea, since *Fuegiphoxus* is currently recorded for the western Antarctic, sub-Antarctic and Magellan region at depths of 0 to 1031 m (Alonso de Pina et al. 2008, Chiesa and Alonso 2011). This explanation agrees with the statement by Myers and Lowry (2009) regarding the Trans-Pacific tracks of other benthic amphipods of the superfamily Haustorioidea, such as Phoxocephalopsidae Barnard and Drummond, 1982, Urohaustoriidae Barnard and Drummond, 1982 and Zobrachoidae Barnard and Drummond, 1982.

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#### REFERENCES

Alonso de Pina G.M. 1993. *Linca pinita*, a new phoxocephalid genus and species (Crustacea: Amphipoda) from the Argentine continental shelf. *Proc. Biol. Soc. Wash.* 106: 497-507.

Alonso de Pina G.M., Rauschert M., De Broyer C. 2008. A catalogue of the Antarctic and sub-Antarctic Phoxocephalidae (Crustacea: Amphipoda: Gammaridea) with taxonomic, distribution and ecological data. *Zootaxa* 1752: 1-40. <https://doi.org/10.11646/zootaxa.1752.1.1>

Alonso G.M., Chiesa I.L. 2014. Phoxocephalidae. In: Roig-Juñent S., Claps L.E., Morrone J.J. (eds), *Biodiversidad de Artropodos Argentinos - Vol. 3*. INSUE-UNT, San Tucuman, Argentina, pp. 205-213.

Andrade L.F., Senna A.R. 2019a. Two new species of *Cephalophoxoides* Gurjanova, 1977 (Crustacea: Amphipoda: Phoxocephalidae) from southeastern Brazil, with comments on the taxonomic status of the genus. *Zootaxa* 4712: 531-551. <https://doi.org/10.11646/zootaxa.4712.4.3>

Andrade L.F., Senna A.R. 2019b. First record of the genus *Limnoporeia* Fearn-Wannan, 1968 (Crustacea: Amphipoda: Phoxocephalidae) from the Atlantic Ocean, with description of a new species. *J. Nat. Hist.* 53: 2517-2531. <https://doi.org/10.1080/00222933.2019.1705931>

Andrade L.F., Senna A.R. 2020. A novel species of *Heterophoxus* Shoemaker, 1925 (Crustacea, Amphipoda, Phoxocephalidae) from southeast and southern Brazil, with an identification key to world species of the genus. *Eur. J. Taxon.* 592: 1-16. <https://doi.org/10.5852/ejt.2020.592>

Arifianto T., Wilson S., Costello M.J. 2018. Progress in the discovery of amphipod crustaceans. *PeerJ* 6: e5187. <https://doi.org/10.7717/peerj.5187>

Barnard J.L., Drummond M.M. 1976. Classification of five genera of Phoxocephalidae (Marine Amphipoda). *Proc. Biol. Soc. Wash.* 88: 515-548.

Barnard J.L., Drummond M.M. 1978. Gammaridean Amphipoda of Australia, part III: The Phoxocephalidae. *Smith. Contrib. Zool.* 245: 1-551. <https://doi.org/10.5479/si.00810282.245>

Barnard J.L., Drummond M.M. 1982. Gammaridean Amphipoda of Australia, Part V: Superfamily Haustorioidea. *Smith. Contrib. Zool.* 360: 1-148. <https://doi.org/10.5479/si.00810282.360>

Barnard J.L., Karaman G.S. 1983. Australia as a major evolutionary centre for Amphipoda (Crustacea). *Mem. Aus. Mus.* 18: 45-61. <https://doi.org/10.3853/j.0067-1967.18.1984.371>

Barnard J.L., Karaman G. 1991. The families and genera of marine gammaridean Amphipoda (except marine Gammaroidea). Part 2. *Rec. Aust. Mus.* 13: 419-866. <https://doi.org/10.3853/j.0812-7387.13.1991.367>

Briggs J.C. 2003. Marine centres of origin as evolutionary engines. *J. Biogeogr.* 30: 1-18. <https://doi.org/10.1046/j.1365-2699.2003.00810.x>

Chiesa I.L., Alonso G.M. 2011. Redescription and generic assignment of *Fuegiphoxus uncinatus* (Chevreux, 1912) (Crustacea, Amphipoda, Phoxocephalidae). *Zoosystema* 33: 219-233. <https://doi.org/10.5252/z2011n2a5>

De Broyer C., Lowry J.K., Jazdzewski K., et al. 2007. Census of Antarctic Marine Life. Synopsis of the Amphipoda of the Southern Ocean. Part 1. Catalogue of the Gammaridean and Corophiidean Amphipoda (Crustacea) of the Southern Ocean with distribution and ecological data. *Bull. Inst. R. Sci. Nat. Belg.* 77: 1-325.

Garm A., Watling L. 2013. The crustacean integument: setae, setules, and other ornamentation. In: Watling T., Thiel M., (eds) *The Natural History of the Crustacea. Functional Morphology and Diversity*. Oxford Univ. Press, Oxford, pp. 167-198. <https://doi.org/10.1093/acprof:osobl/9780195398038.003.0006>

Gurjanova E.F. 1977. Some new data in taxonomy of family Phoxocephalidae sensu lato (Amphipoda, Gammaridea). *Report I. Proc USSR Acad Sci.* 21: 67-87.

Hartman O. 1955. Quantitative survey of the benthos of San Pedro Basin, Southern California. Part I. Preliminary results. *Allan Hancock Pac Exped.* 19: 1-185.

Horton T., Lowry J.K., De Broyer C., et al. 2019. World Amphipoda Database. Phoxocephalidae G.O. Sars, 1891. Accessed through: *World Register of Marine Species* on 26/9/2019 at: <http://www.marinespecies.org/aphia.php?p=taxdetails&id=101403>

Jarret N.E., Bousfield E.L. 1994a. The amphipod superfamily Phoxocephaloidea on the Pacific coast of North America. Family Phoxocephalidae. Part I. Metharpiiniinae, new subfamily. *Amphipacifica* 1: 58-140.

Jarret N.E., Bousfield E.L. 1994b. The amphipod superfamily Phoxocephaloidea on the Pacific coast of North America. Family Phoxocephalidae. Part II. Subfamilies Pontharpiiniinae, Paharpiiniinae, Brolginiinae, Phoxocephaliniinae, and Harpiniiniinae. Systematics and distributional ecology. *Amphipacifica* 3: 71-150.

Lowry J.K., Myers A.A. 2017. A Phylogeny and Classification of the Amphipoda with the establishment of the new order Ingolfiellida (Crustacea: Peracarida). *Zootaxa* 4265: 1-89. <https://doi.org/10.11646/zootaxa.4265.1.1>

Myers A.A., Lowry J.K. 2009. The biogeography of Indo-West Pacific tropical amphipods with particular reference to Australia.

- In: Lowry J.K., Myers A.A., (eds). Benthic Amphipoda (Crustacea: Peracarida) of the Great Barrier Reef, Magnolia Press, Australia. Auckland, pp. 109-127.  
<https://doi.org/10.11646/zootaxa.2260.1.4>
- Poore A.G.B., Lowry J.K. 1997. New amphithoid amphipods from Port Jackson, New South Wales, Australia (Crustacea: Amphipoda: Amphithoidae). *Invertebr. Taxon.* 11: 897-941.  
<https://doi.org/10.1071/IT95045>
- Senna A.R. 2010. A new genus and five new species of Phoxocephalidae (Crustacea: Amphipoda) from the south-east Brazilian deep sea. *J. Nat. Hist.* 44: 2075-2118.  
<https://doi.org/10.1080/00222933.2010.486081>
- Senna A.R., Souza-Filho J.F. 2011. A new species of *Pseudharpinia* (Amphipoda: Haustorioidea: Phoxocephalidae) from South-eastern Brazilian continental shelf. *Nauplius* 19: 7-16.  
<https://doi.org/10.1590/S0104-64972011000100002>
- Taylor J. 2006. A new species of *Leongathus* from the Tasman Sea collected during the 2003 NORFANZ Expedition (Crustacea: Amphipoda: Phoxocephalidae). *Mem. Mus. Vic.* 63: 207-213.  
<https://doi.org/10.24199/j.mmv.2006.63.16>
- Taylor J., Poore G.C.B. 2001. Descriptions of new species of *Birubius* (Amphipoda: Phoxocephalidae) from Australia and Papua New Guinea with comments on the *Birubius-Kulgaphoxus-Tickalerus-Yan* complex. *Mem. Mus. Vic.* 58: 255-295.  
<https://doi.org/10.24199/j.mmv.2001.58.15>