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Monograph

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New insights gained from museum collections: new deep-sea species of *Typhlotanais* (Tanaidacea, Typhlotanaidae) from Brazil

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Abstract. Benthic samples collected along the Brazilian central continental margin from Espírito Santo State to Rio de Janeiro State (19° S to 24° S) during the last 20 years and at depths of 50–2200 m yielded the description of six new species of *Typhlotanais* in the deep-sea (> 200 m): *Typhlotanais andradeorum* sp. nov., *T. bolarticulus* sp. nov., *T. ischnochela* sp. nov., *T. longiseta* sp. nov., *T. priscilae* sp. nov. and *T. spinibasis* sp. nov. Within these species, we found members of four *Typhlotanais* morpho-groups as '*cornutus*' group, '*greenwichensis*' group, '*spinicauda*' and '*trispinosus*' group. *Typhlotanais ischnochela* sp. nov. exhibited the greatest bathymetric range, occurring from the continental shelf until the lower slope (46–1898.7 m depth). The bathymetric distribution of the other five species of *Typhlotanais* herein described were restricted to the slope. Tables of diagnostic characters of the *Typhlotanais* morpho-groups and an identification key to the species of Typhlotanaidae found in Brazil are provided. This work brings the total number of Tanaidacea known for Brazilian coast to 64 species, and the family Typhlotanaidae from Brazil is now represented by 11 species in five known genera.

Keywords. Continental slope, diversity, Peracarida, SW Atlantic, Tanaidomorpha, taxonomy.

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Introduction

Tanaidaceans are small peracarid crustaceans which represent an essential component in marine regions (Larsen 2005; Błażewicz-Paszkowycz *et al.* 2012; Brzana *et al.* 2019; Kakui & Fujiwara 2020), but regardless of their ecological importance, they are one of the least recognized crustaceans. Species from the continental shelf have got much more attention of the researchers (at a global scale), while remotely located deep-sea regions were much less investigated (De Leo *et al.* 2020). In the last decades,

there has been an increase of economic interest in the exploitation of deep-sea mineral and biological resources, an activity of enormous negative pressure on our existing marine ecosystems (Rogers *et al.* 2015; Ramirez-Llodra *et al.* 2020).

In the last 20 years, important projects coordinated by the energy company Petrobras provided a large amount of benthic biological material from offshore Brazil, including tanaidaceans, that is in the process of being studied. With the booming oil industry in the country, in conjunction with environmental laws that charge for impact studies in drilling regions, the Petrobras Company has supported the scientific study of the biodiversity of the deep-sea fauna in key areas such as Campos Basin and Espírito Santo Basin (Falcão *et al.* 2017). As tanaidaceans turn out to be very common and diverse in deep-sea macrofauna samples, they are considered an important component of this environment (Lavrado *et al.* 2017). For this reason, especially in Brazil, more efforts in taxonomic studies of this group are needed.

In Brazil, three main institutions house comprehensive Tanaidacea collections, including material to be described as well as type material: Museu Nacional/Universidade Federal do Rio de Janeiro (MNRJ), Museu Zoologia/Universidade de São Paulo (MZUSP) and Museu de Oceanografia Petrônio Alves Coelho/Universidade Federal de Pernambuco (MOUFPE). At the Museu Nacional, the first Tanaidacea materials were incorporated in the 70's (Brum 1971, 1973) and nowadays there are nearly 2350 registered individuals. Unfortunately, the Museu Nacional/UFRJ Carcinology Lab was destroyed by the huge fire that happened in September 2018 (Zamudio *et al.* 2018), together with part of the collection that was within the building, which shows neglect and lack of investment in this field. Natural history collections are the baseline of reliable taxonomic and systematic data, as a source of information on the distribution of species, or at least where species once were due to rapid environmental change, and therefore specimens deposited in museums are fundamental to conservation assessments (Giangrande 2003; McGhie 2019; Segadilha & Rodrigues 2020).

Typhlotanaidae Sieg, 1984 is one of the largest families of Tanaidacea, which comprises the diverse genus *Typhlotanais* Sars, 1882, currently with 48 species (Anderson 2020; WoRMS 2021). *Typhlotanais* is recordered in all oceans, from shallow waters to abyssal zones (12–6065 m), with most records in the deep sea below 200 m (Kudinova-Pasternak 1966a; Shiino 1970; OBIS 2021). Furthermore, most species have been described from the Northern Hemisphere (e.g., Hansen 1913; Kudinova-Pasternak 1966b, 1970, 1984; Błażewicz-Paszkowycz *et al.* 2011), except for a gap in the distribution of the group in the tropical and warm temperate southwestern Atlantic Provinces.

Recent efforts in the studying typhlotanaid Brazilian fauna have yielded the description of the genus *Aremus* Segadilha, Gellert & Błażewicz, 2018 (Segadilha *et al.* 2018) and four species belonging to three genera: *Hamatipeda prolata* Segadilha & Błażewicz, 2019*, Meromonakantha mauri* Segadilha & Błażewicz, 2019, *Paratyphlotanais apletos* Segadilha & Błażewicz, 2019 and *P. bessai* Segadilha & Błażewicz, 2019 (Segadilha *et al.* 2019). Despite recent efforts on studying the taxonomy of Typhlotanaidae from the Brazilian continental shelf and slope, there are still many undescribed species in this region based on preliminary examinations of our local museum collections.

The present work describes six new species of *Typhlotanais* from Brazilian region of Campos Basin and Espírito Santos Basin (19° S to 24° S) provided from different projects over the last 20 years. Also, a key to species of Typhlotanaidae occurring along the Brazilian coast is given.

Material and methods

Typhlotanaid specimens were collected between the years 1998 and 2016 during six scientific projects carried out along the Brazilian Central continental margin (19° S to 24° S; Fig. 1). A total of 172 benthic samples were obtained from depths of 50 to 2500 m from different projects as follows: REVIZEE

(Evaluation of the Sustainable Potential of Living Resources of the Exclusive Economic Zone) from 1997 to 2003 (Amaral & Rossi-Wongtschowski 2004); OCEANPROF (Environmental Characterization of Deep Waters of the Campos Basin) from 2002 to 2003 (Lavrado *et al.* 2010); HABITATS (Assessment of the environmental heterogeneity of Campos Basin) from 2008 to 2009 (Falcão *et al.* 2017; Ribeiro-Ferreira *et al.* 2017); AMBES (Environmental heterogeneity in the Espírito Santo Basin and northern region of the Campos Basin) from 2010 to 2013; and three smaller cruises made in Campos Basin area: BCA 185-15 P-27 (September 2014); and Peregrino (January 2016). Geographical coordinates of each sample were recorded with a GPS (Table 1).

Sediment samples were taken using a Van Veen grab, box corer or dredge, and depth, date and sediment type of each station are presented in Table 1. Biological samples collected from the continental shelf were washed through a 500-µm and a 300-µm-mesh sieve. The material retained were fixed in 4% borax-buffered formalin and subsequently preserved in 70% ethanol, and then tanaidaceans were sorted and identified. The material was deposited in the Crustacea Collections of Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ); Museu de Oceanografia Petrônio Alves Coelho, Universidade Federal de Pernambuco (MOUFPE) and Museu de Zoologia, Universidade de São Paulo (MZUSP).

Drawings were made using a compound microscope Zeiss with a camera lucida and digitalized with a WACOM Tablet using the program Adobe Illustrator. Body length (BL) was measured from the tip of the rostrum to the tip of the pleotelson. The appendages were dissected using chemically sharpened tungsten-wire needles. The length/width ratio was calculated from the measure made in the middle length and width of an article. To simplify species descriptions, the expression 'Nx' replaces 'Nx as long as'. The morphological terminology follows Błażewicz-Paszkowycz (2007). The articulated protrusions on the distal edge of the maxillipedal endites are called "gustatory cusps" as proposed by Segadilha *et al.* (2018). Scanning electron microscopy (SEM) pictures were made on Phenom ProX in the Laboratory of Polar Biology and Oceanobiology, University of Łódź, Poland. The map showing the sampling localities was prepared using Quantum GIS® ver. 2.10 Software (Fig. 1).

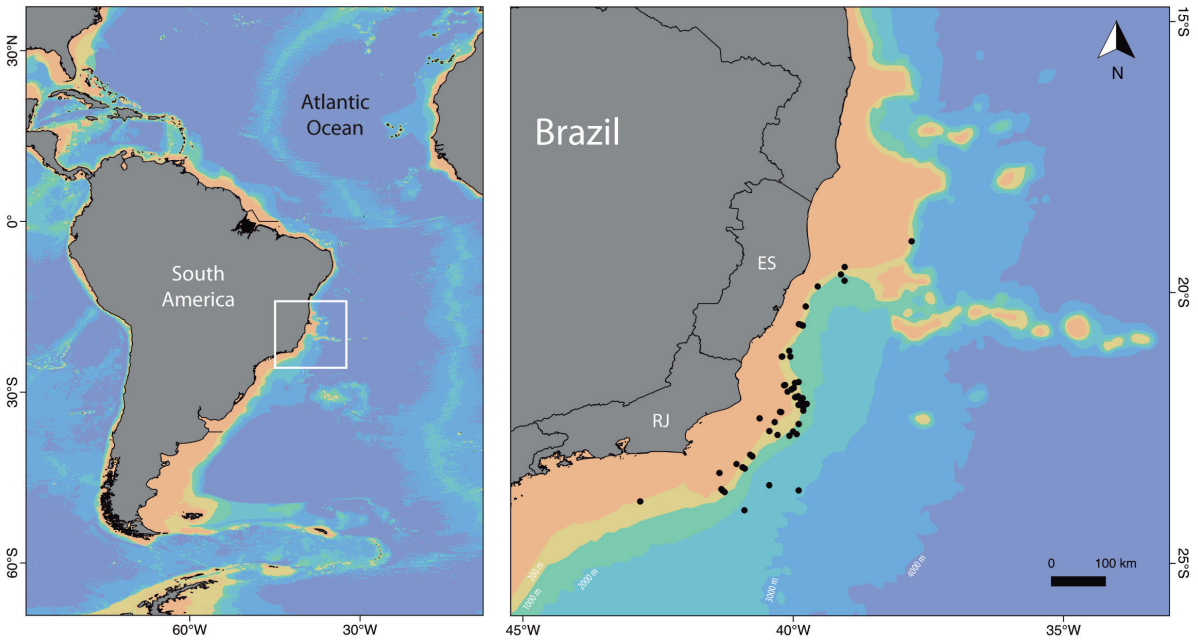

Fig. 1. Map showing sampling localities during scientific expeditions carried out along the Brazilian continental shelf and slope area from 1999 to 2016. Abbreviations: ES = Espírito Santo; RJ = Rio de Janeiro.

Table 1. List of benthic samples obtained during six scientific projects carried out along the Brazilian continental margin (19° S to 24° S). The OCEANPROF Project includes three campaigns: Albacar (AC), Oceanprof (OP) and Roncador (RC). Abbreviations: see Material and methods.

project	station	depth (m)	latitude (S)	longitude (W)	date	sampler	ship	sediment type
Ambes	AMB 3 E6	1035	19.6685°	39.1214°	13 Dec. 2011	Box Corer	Seward Johnson	mud
Ambes	AMB 5 A7	1294	21.0793°	40.0752°	21 Dec. 2011	Box Corer	Seward Johnson	mud
Ambes	AMB 5 B5	406	20.5873°	39.8966°	8 Jan. 2012	Box Corer	Seward Johnson	mud
Ambes	AMB 5 B7	1340	20.6121°	39.8239°	8 Jan. 2012	Box Corer	Seward Johnson	mud
Ambes	AMB 5 C6	1041	20.2595°	39.7707°	9 Jan. 2012	Box Corer	Seward Johnson	mud+sand
Ambes	AMB 6 CAMWN 6	1023	19.8914°	39.5487°	13 Jan. 2012	Box Corer	Seward Johnson	mud
Ambes	AMB 8 E7	1258	19.7850°	39.0533°	28 Jan. 2012	Box Corer	Seward Johnson	mud
Ambes	AMB 8 G7	1308	19.0575°	37.8118°	30 Jan. 2012	Box Corer	Seward Johnson	mud
Ambes	AMB 11 B6	998	20.6000°	39.8596°	8 Jan. 2012	Box Corer	Seward Johnson	mud
Ambes	AMB 11 C6	1040	20.2598°	39.7713°	9 Jan. 2012	Box Corer	Seward Johnson	mud
Ambes	AMB 12 CAND 4	171	19.5308°	39.0512°	9 Dec. 2011	Van Veen	Seward Johnson	mud+sand
Ambes	AMB 12 E7	1242	19.7841°	39.0533°	26 Jun. 2013	Box Corer	Seward Johnson	mud
BCA 185-15	P-27 #07	535	22.3860°	37.8466°	Sep. 2014	Box Corer	Seward Johnson	sand
Habitats	HAB 3 A8	986	23.6849°	41.2706°	3 May 2008	Box Corer	Gyre	mud
Habitats	HAB 3 B8	986.4	23.2298^	40.9323°	8 May 2008	Box Corer	Gyre	mud
Habitats	HAB 3 B9	1302.3	23.2520°	40.8982°	9 May 2008	Box Corer	Gyre	mud
Habitats	HAB 3 C8	975	23.0257°	40.7565°	10 May 2008	Box Corer	Gyre	mud
Habitats	HAB 3 H9	1293.2	21.6555°	39.8993°	13 May 2008	Box Corer	Gyre	mud
Habitats	HAB 3 H10	1898.7	23.6849°	41.2706°	14 May 2008	Box Corer	Gyre	mud
Habitats	HAB 4 A11	2486	24.0219°	40.9043°	18 May 2008	Box Corer	Gyre	mud
Habitats	HAB 4 F9	1288.5	22.4289°	39.9013°	29 May 2008	Box Corer	Gyre	mud
Habitats	HAB 4 G9	1299.8	22.1214°	39.8177°	28 May 2008	Box Corer	Gyre	mud
Habitats	HAB 4 CANG 7	705.2	21.9354°	39.9643°	28 May 2008	Box Corer	Gyre	mud

Table 1. continued.

project	station	depth (m)	latitude (S)	longitude (W)	date	sampler	ship	sediment type
Habitats	HAB 4 CANG 8	1002.4	21.9175°	39.9102°	28 May 2008	Box Corer	Gyre	mud
Habitats	HAB 6 A7	693.7	23.6557°	41.3078°	23 Jun. 2008	Box Corer	Emma McCall	mud
Habitats	HAB 6 C7	710.1	22.9977°	40.7952°	24 Jun. 2008	Box Corer	Emma McCall	mud
Habitats	HAB 6 I9	807	21.1843°	40.2049°	29 Jun. 2008	Box Corer	Emma McCall	mud
Habitats	HAB 6 CANAC 6	466.8	21.8327°	40.1056°	28 Jun. 2008	Box Corer	Emma McCall	mud
Habitats	HAB 6 CANAC 7	758.2	21.7908°	40.0370°	28 Jun. 2008	Box Corer	Emma McCall	mud
Habitats	HAB 6 CANAC 8	1035	21.7638°	39.9924°	27 Jun. 2008	Box Corer	Emma McCall	mud
Habitats	HAB 7 A6	388.9	23.6330°	41.3290°	3 Jul. 2008	Box Corer	Emma McCall	mud
Habitats	HAB 7 D6	396.2	23.5588°	40.4460°	9 Jul. 2008	Box Corer	Emma McCall	gravel
Habitats	HAB 7 F7	703.9	22.3317°	40.0357°	7 Jul. 2008	Box Corer	Emma McCall	sand
Habitats	HAB 7 I7	790.2	21.1842°	40.2053°	5 Jul. 2008	Box Corer	Emma McCall	mud
Habitats	HAB 8 B9	1228.5	23.2532°	40.8981°	14 Jan. 2009	Box Corer	Gyre	mud
Habitats	HAB 8 D7	695.5	22.6070°	40.3752°	29 Jan. 2009	Box Corer	Gyre	mud
Habitats	HAB 9 G7	680	22.1277°	39.9042°	8 Feb. 2009	Box Corer	Emma McCall	sand
Habitats	HAB 9 H8	1005.8	21.6713°	39.9684°	6 Feb. 2009	Box Corer	Emma McCall	mud
Habitats	HAB 9 I7	680	21.1867°	40.2145°	4 Feb. 2009	Box Corer	Emma McCall	mud
Habitats	HAB 9 CANAC 7	780	21.7907°	40.0320°	6 Feb. 2009	Box Corer	Emma McCall	mud
Habitats	HAB 9 CANAC 8	1030	21.7652°	39.9909°	6 Feb. 2009	Box Corer	Emma McCall	mud
Habitats	HAB 9 CANG 7	720	21.9367°	39.9625°	7 Feb. 2009	Box Corer	Emma McCall	mud
Habitats	HAB 11 C4	92	22.8660°	40.9597°	22 Feb. 2009	Van Veen	Emma McCall	mud
Habitats	HAB 11 E5	153	22.3942°	40.3447°	23 Feb. 2009	Van Veen	Emma McCall	sand
Habitats	HAB 11 F4	99	22.2091°	40.2236°	25 Feb. 2009	Van Veen	Emma McCall	sand
Habitats	HAB 11 G4	91	22.0694°	40.1183°	25 Feb. 2009	Van Veen	Emma McCall	gravel
Habitats	HAB 13 D3	75	22.3260°	40.6220°	15 Mar. 2009	Van Veen	Emma McCall	sand

Table 1. continued.

project	station	depth (m)	latitude (S)	longitude (W)	date	sampler	ship	sediment type
Habitats	HAB 13 H4	98	21.7150°	40.1712°	9 Mar. 2009	Van Veen	Emma McCall	sand
Habitats	HAB 13 H5	147	21.7092°	40.1517°	9 Mar. 2009	Van Veen	Emma McCall	sand
Habitats	HAB 13 Foz 43	97	22.2050°	40.2440°	15 Mar. 2009	Van Veen	Emma McCall	sand
Habitats	HAB 16 B4	107	23.1681°	41.0518°	2 Jul. 2009	Van Veen	Emma McCall	sand
Habitats	HAB 16 E4	103	22.2951°	40.4499°	4 Jul. 2009	Van Veen	Emma McCall	gravel
Habitats	HAB 16 E5	149	22.3942°	40.3450°	4 Jul. 2009	Van Veen	Emma McCall	mud
Habitats	HAB 16 G4	89	22.0607°	40.1165°	6 Jul. 2009	Van Veen	Emma McCall	gravel
Oceanprof	AC #19	1230	22.0828°	39.8351°	9 May 2002	Box Corer	Astro Garoupa	mud
Oceanprof	AC #22	1350	22.0795°	39.8192°	9 May 2002	Box Corer	Astro Garoupa	mud
Oceanprof	AC #23	1350	22.0417°	39.8281°	8 May 2002	Box Corer	Astro Garoupa	mud
Oceanprof	AC #24	1730	22.0578°	39.7520°	8 May 2002	Box Corer	Astro Garoupa	mud
Oceanprof	AC #25	1730	22.0959°	39.7654°	9 May 2002	Box Corer	Astro Garoupa	mud
Oceanprof	AC #32	900	22.6319°	40.2920°	18 May 2002	Box Corer	Astro Garoupa	mud
Oceanprof	AC #41C	1000	21.2167°	40.2167°	20 Jul. 2001	Box Corer	Astro Garoupa	mud
Oceanprof	OP #46	1350	22.1821°	39.8168°	10 Dec. 2002	Box Corer	Astro Garoupa	mud
Oceanprof	OP #49	750	22.0758°	39.9032°	30 Jun. 2003	Box Corer	Astro Garoupa	mud
Oceanprof	OP #54	750	21.9549°	39.9336°	12 Dec. 2002	Box Corer	Astro Garoupa	mud
Oceanprof	OP #56	1350	21.9543°	39.8271°	4 Dec. 2002	Box Corer	Astro Garoupa	mud
Oceanprof	OP #71	1350	22.6480°	40.0712°	14 Jun. 2003	Box Corer	Astro Garoupa	mud
Oceanprof	OP #76	1350	22.5681°	40.0035°	15 Jun. 2003	Box Corer	Astro Garoupa	mud
Oceanprof	OP #78G	1950	22.6175°	39.9389°	13 Jun. 2003	Box Corer	Astro Garoupa	mud
Oceanprof	OP #54	750	21.9549°	39.9336°	12 Dec. 2002	Box Corer	Astro Garoupa	sand
Oceanprof	RC #10	1700	21.9756°	39.8646°	8 Oct. 2001	Box Corer	Astro Garoupa	mud
Peregrino	A #8	120	23.3462°	41.3055°	15 Jan. 2016	Van Veen	–	sand

Table 1. continued.

project	station	depth (m)	latitude (S)	longitude (W)	date	sampler	ship	sediment type
Peregrino	A #10	120	23.3326°	41.3018°	15 Jan. 2016	Van Veen	–	sand
Peregrino	B #1	120	23.2828°	41.2041°	15 Jan. 2016	Van Veen	–	sand
Peregrino	B #2	120	23.2907°	41.2063°	15 Jan. 2016	Van Veen	–	sand
Peregrino	B #3	120	23.2925°	41.2092°	15 Jan. 2016	Van Veen	–	sand
Peregrino	B #4	120	23.2942°	41.2073°	15 Jan. 2016	Van Veen	–	sand
Peregrino	B #7	120	23.3012°	41.2092°	15 Jan. 2016	Van Veen	–	sand
Peregrino	B #14	120	23.2946°	41.2135°	15 Jan. 2016	Van Veen	–	sand
Revizee	RZEE #1	83	20.8333°	39.2333°	15 Jun. 2002	Box Corer	Astro Garoupa	mud
Revizee	RZEE #1 C6	100	19.7600°	39.5181°	21 Jun. 2002	Box Corer	Astro Garoupa	mud
Revizee	RZEE #Y3	46	21.1653°	40.3286°	16 Jun. 2002	Box Corer	Astro Garoupa	mud
Revizee	RZEE #6744	254	23.8583°	42.8317°	15 Feb. 1998	Dredge	Antares	mud
Revizee	RZEE #6750	162	23.6680°	42.5300°	16 Feb. 1998	Dredge	Antares	mud
Revizee	RZEE #6759	110	23.3333°	41.3667°	28 Feb. 1998	Dredge	Antares	gravel
Revizee	RZEE #6762	145	23.4367°	41.2637°	28 Feb. 1998	Dredge	Antares	sand

Part of the material examined in the present study from MZUSP, MOUFPE and MNRJ was stored at the main building of the Museu Nacional/UFRJ at the time of the fire (Zamudio *et al.* 2018). Fortunately, during the fire, we had the opportunity to take out some vials from the laboratory, including some Tanaidacea material. So, the examined material includes samples lost in the fire (as additional material), as well as material preserved from the MNRJ and MZUSP collections, which includes all the type-material that is available for future analysis.

Abbreviations of institutions and projects

AC = Albacar
AMB = AMBES
HAB = HABITATS
MNRJ = Museu Nacional/Universidade Federal do Rio de Janeiro, Brazil
MOUFPE = Museu de Oceanografia Petrônio Alves Coelho/Universidade Federal de Pernambuco, Brazil
MZUSP = Museu de Zoologia/Universidade de São Paulo, Brazil
OP = Oceanprof
RC = Roncador
RZEE = REVIZEE

Abbreviations of morphological measurements

L:W = as long as wide
Nx = number (N) of times (x)
TBL = total body length
TL = total length

Results

Taxonomy

Order Tanaidacea Dana, 1849
Suborder Tanaidomorpha Sieg, 1980
Superfamily Paratanaoidea Lang, 1949
Family Typhlotanaidae Sieg, 1984

Genus ***Typhlotanais*** Sars, 1882

Type species

Typhlotanais aequiremis (Lilljeborg, 1864).

Diagnosis

See Błażewicz-Paszkowycz (2007).

Remarks

Błażewicz-Paszkowycz (2007) revised the family in a large monograph, which described five new genera and 13 new species, as well as grouped species sharing a set of unique characters in seven 'morpho-groups' within *Typhlotanais*, e.g. '*greenwichensis*' group, 'mixtus' group, '*spinicauda*' group, '*cornutus*' group, 'plicatus' group, 'eximius' group, and '*trispinosus*' group. Characters of each 'morpho-group' are mentioned when comparing to new species described herein. It is assumed that the 'morpho-groups' may constitute new genera, but this must be further analyzed with a phylogenetic

study. However, some typhlotanaids were neither classified under any previously established genera nor included in the morpho-groups created.

According to Błażewicz-Paszkowycz (2007), *Typhlotanais* sensu stricto comprises only the type species *T. aequiremis* (Lilljeborg, 1864) and all other species temporarily classified as *Typhlotanais* sensu lato, showing large variation in characters as the pereonite-1 ratio (length to width), the number of setae on cheliped carpus dorsal margin setation, the form of mandible molar process form, and the shape of pereopods 1–3 basis shape. *Typhlotanais* is the most speciose genus of the family with 48 described species and a recent unpublished morphological phylogeny encompassing the family Typhlotanaidae suggests it is a polyphyletic group (Segadilha 2019) that badly needs a revision.

Typhlotanais andradeorum sp. nov.
urn:lsid:zoobank.org:act:02865676-2AB5-4DA7-AC67-1F11317DA7F8
Figs 2–4, 21

Diagnosis

Carapace elongate, 1.5× L:W; antenna, mandibles and maxillule densely covered with microtrichia; maxilliped endites with two very large gustatory cusps (covering almost the entire distal margin of the endites); cheliped fixed finger with two rod setae ventrally and two rod (one long and one short) and one simple setae on cutting edge; pereopod-1 merus elongate (2.6× L:W); pereopods 2–3 coxae with very long setae reaching half-length of basis; pereopods 4–5 propodus dorsodistal seta shorter than dactylus and unguis combined; pereopod-6 propodus with three dorsodistal setae (one longer and two shorter than dactylus and unguis combined); and uropod with both rami two-articled, exopod about half length of endopod.

Etymology

This species is dedicated to first author's parents from the family name Andrade, in recognition of their ever-lasting support and love. Gender of specific name: masculine.

Material examined

Holotype

BRAZIL – **Rio de Janeiro State** • neuter, length 1.2 mm; Campos Basin, stn HAB 8 B9 R1; 23.2532° S, 40.8981° W; depth 1228.5 m; 14 Jan. 2009; MZUSP 38967.

Paratypes

BRAZIL – **Rio de Janeiro State** • 3 neuters (1 dissected), length 1.3 mm; Campos Basin, stn HAB 3 B9 R3; 23.2520° S, 40.8982° W; depth 1302.3 m; 9 May 2008; MZUSP 32839 • 1 neuter; Campos Basin, stn HAB 3 B8 R2; 23.2298° S, 40.9323° W; depth 986.4 m; 8 May 2008; MZUSP 34415. – **Espírito Santo State** • 1 neuter; Espírito Santo Basin, stn AMB 5 B7 R2; 21.0793° S, 40.0752° W; depth 1294 m; 31 Dec. 2011; MZUSP 38978.

Additional material (lost in the fire)

BRAZIL – **Rio de Janeiro State** • 2 neuters; Campos Basin, stn HAB 4 CANG 8 R3; 21.9175° S, 39.9102° W; depth 1002.4 m; 28 May 2008; MZUSP 32845 • 1 neuter; Campos Basin, stn HAB 4 G9 R3; 22.1214° S, 39.8177° W; depth 1299.8 m; 28 May 2008; MZUSP 32846 • 2 neuters; Campos Basin, stn HAB 3 C8 R1; 23.0257S, 40.756° W; depth 975 m; 10 May 2008; MZUSP 32849 • 4 neuters; Campos Basin, stn HAB 4 CANG 8 R3; 21.9175° S, 39.9102° W; depth 1002.4 m; 28 May 2008; MZUSP 32853 • 2 neuters; Campos Basin, stn HAB 4 F9 R3; 22.4289° S, 39.901° W; depth 1288.5 m; 29 May 2008; MZUSP 32855 • 2 neuters; Campos Basin, stn HAB 4 CANG 8 R3; 21.9175° S,

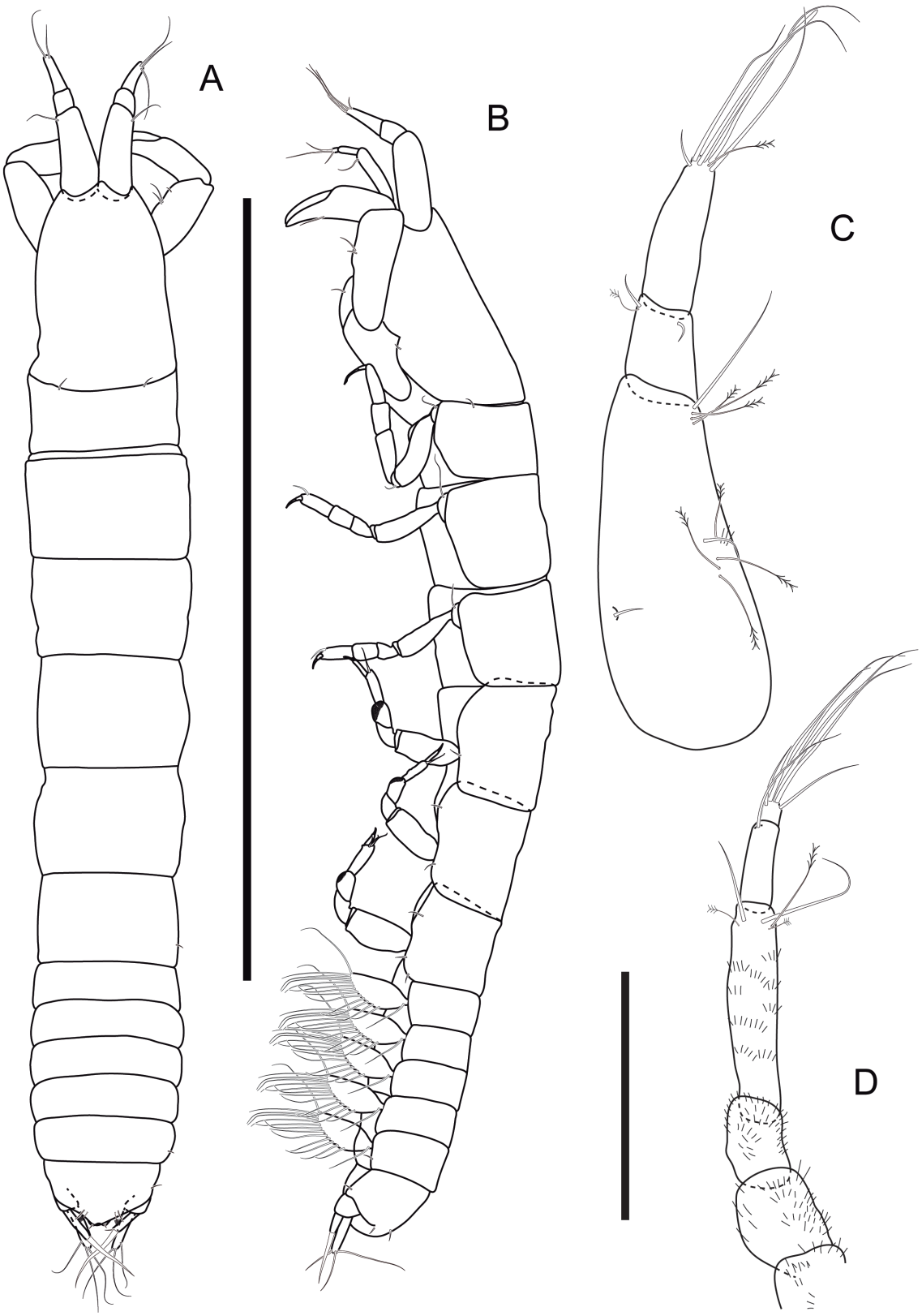

Fig. 2. *Typhlotanais andradeorum* sp. nov. **A**. ♀ (MNRJ 18207), dorsal view. **B–D**. Paratype (MZUSP 32839), ♀, dissected. **B**. Lateral view. **C**. Antennule. **D**. Antenna. Scale bars: A–B = 1 mm; C–D = 0.1 mm.

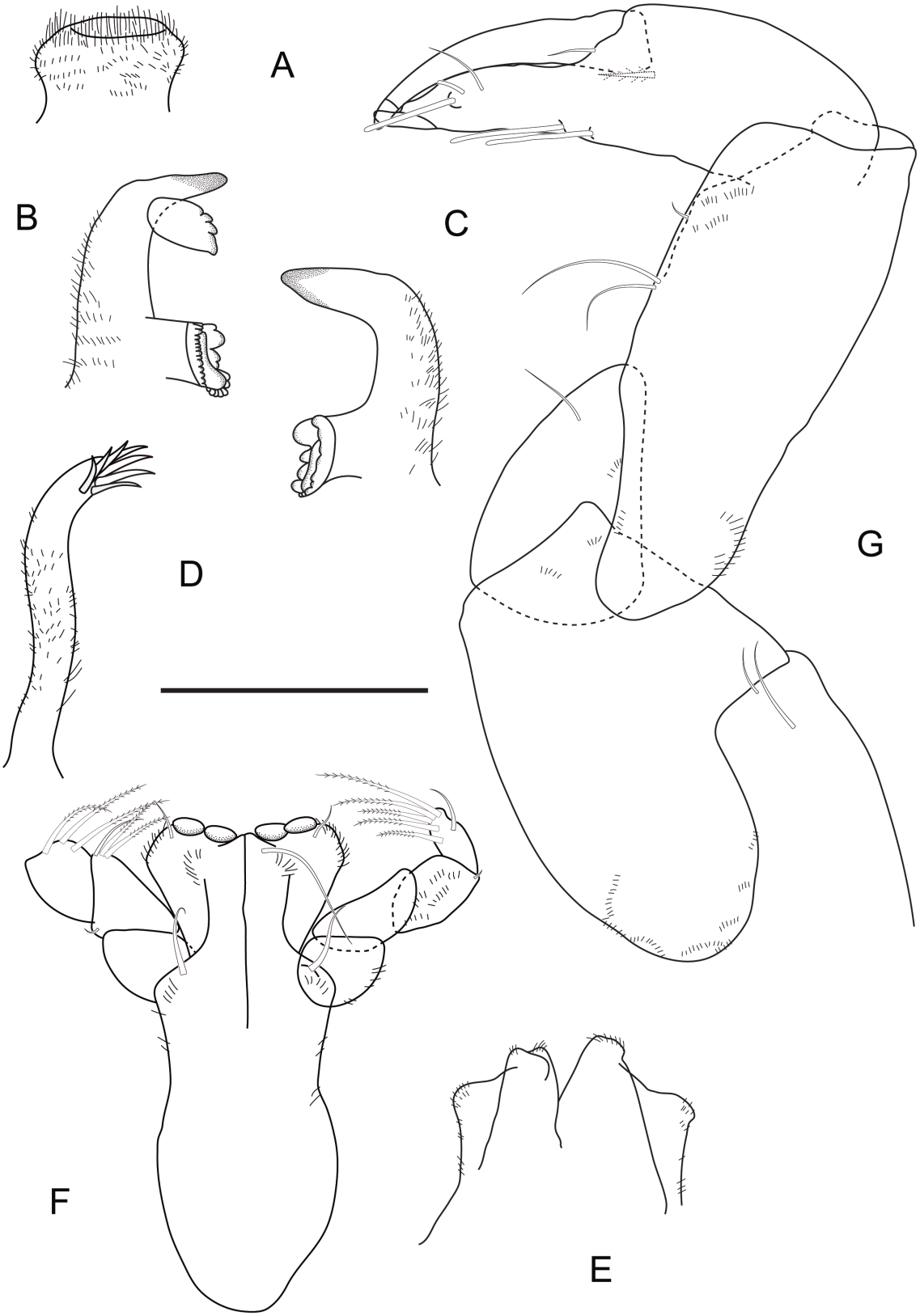

Fig. 3. *Typhlotanais andradeorum* sp. nov., paratype (MZUSP 32839), ♀, dissected. **A**. Labrum. **B**. Left mandible. **C**. Right mandible. **D**. Maxillule. **E**. Labium. **F**. Maxilliped. **G**. Cheliped. Scale bar = 0.1 mm.

39.9102° W; depth 1002.4 m; 28 May 2008; MZUSP 32864 • 1 neuter; Campos Basin, stn HAB 6 CANAC 8; 21.7638° S, 39.9924° W; depth 1035 m; 27 Jun. 2008; MZUSP 34413 • 1 neuter; Campos Basin, stn HAB 4 A11; 24.0219° S, 40.9043° W; depth 2486 m; 18 May 2008; MZUSP 34421 • 1 neuter; Campos Basin, stn HAB 3 H9; 21.6555° S, 39.8993° W; depth 1293.2 m; 13 May 2008; MZUSP 34437 • 1 neuter, 1 juvenile; Campos Basin, stn HAB 4 G9 R3; 22.1214° S, 39.8177° W; depth 1299.8 m; 28 May 2008; MZUSP 42600 • 1 neuter; Campos Basin, stn HAB 9 H8 R3; 21.6713° S, 39.9684° W; depth 1005.8 m; 6 Feb. 2009; MZUSP 38010 • 1 neuter; Campos Basin, stn HAB 9 CANAC 7 R2; 21.7907° S, 40.0320° W; depth 780 m; 6 Feb. 2009; MZUSP 38011 • 1 neuter; Campos Basin, stn AC #32; 22.6319° S, 40.2920° W; depth 900 m; 18 May 2002; MNRJ 18207 • 1 neuter; Campos Basin, stn AC #19; 22.0828° S, 39.8351° W; depth 1230 m; 9 May 2002; MNRJ 18255 • 1 neuter; Campos Basin, stn AC #22; 22.0795° S, 39.8192° W; depth 1350 m; 9 May 2002; MNRJ 18276 • 1 neuter; Campos Basin, stn AC #23; 22.0417° S, 39.8281° W; depth 1350 m; 8 May 2002; MNRJ 18287 • 1 neuter; Campos Basin, stn OP #46; 22.1821° S, 39.8168° W; depth 1350 m; 10 Dec. 2002; MNRJ 20484 • 1 neuter; Campos Basin, stn OP #78G; 22.6175° S, 39.9389° W; depth 1950 m; 13 Jun. 2003; MNRJ 20678 • 1 neuter; Campos Basin, stn OP #71; 22.6480° S, 40.0712° W; depth 1350 m; 14 Jun. 2003; MNRJ 20706 • 1 neuter; Campos Basin, stn OP #76; 22.5681° S, 40.0035° W; depth 1350 m; 15 Jun. 2003; MNRJ 20686 • 1 neuter; Campos Basin, stn OP #56; 21.9543° S, 39.8271° W; depth 1350 m; 14 Dec. 2002; MNRJ 27355. – **Espírito Santo State** • 1 neuter; Espírito Santo Basin, stn AMB 11 C6 R1; 20.2598° S, 39.7713° W; depth 1040 m; 9 Jan. 2012; MZUSP 37682.

Description

Paratypes (MNRJ 18207; MZUSP 32839 dissected)

Body (Fig. 2A–B). Slender, 6.4 × L:W. Cephalothorax elongate 1.5 × L:W, 3.2 × as long as pereonite-1, naked; eyes absent.

Pereonites 1–6. All pereonites rectangular, wider than long, with lateral margins gently convex; pereonite-1 shortest, 0.4 × L:W, with short seta on proximal margin; pereonite-2 0.6 × L:W; pereonite-3 0.6 × L:W; pereonite-4 0.7 × L:W, with minute seta on lateral margin; pereonite-5 0.7 × L:W, with two minute setae on lateral margin; pereonite-6 0.6 × L:W, with three minute setae on lateral margin.

Pleon (Fig. 2A–B). 0.25 × TBL, with five subequal pleonites, together about as long as carapace and pereonite-1 combined; last pleonite with minute seta on lateral margin. Pleotelson trapezoidal 0.6 × L:W, with seta on lateral margin and three pairs of setae distally.

Antennule (Fig. 2C). 0.7 × as long as cephalothorax, with three articles; article-1 0.6 × TL, 2.5 × L:W, with two simple and four penicillate middle setae, and one simple and three penicillate setae distally; article-2 1.2 × L:W, 0.2 × as long as article-1, with two simple and one penicillate distal setae; article-3 3.2 × L:W, 2.0 × as long as article-2, with aestethasc, five simple and one penicillate terminal setae.

Antenna (Fig. 2D). With six articles, article-1 with microtrichia, fused with body; article-2 1.2 × L:W, with microtrichia; article-3 0.9 × L:W, with microtrichia; article-4 4.0 × L:W, 2.7 × as long as article-3, with microtrichia and two simple and three penicillate setae distally; article-5 2.8 × L:W, 0.4 × as long as article-4, with distal seta; article-6 minute with six simple terminal setae.

Labrum (Fig. 3A). Rounded, hood-shaped, covered by minute setae. Mandible (Fig. 3B–C) molar broad with many prominent nodules, which are small and regular on one side and large and irregular on the other. Left mandible (Fig. 3B) with microtrichia on outer margin, incisor smooth, lacinia mobilis well developed, with four lobes; right mandible (Fig. 3C) as left, but without lacinia mobilis. Maxillule (Fig. 3D) endite with seven to eight terminal spines; palp broken off during dissection. Labium (Fig. 3E) with distal corner finely setose; outer lobe membranous and finely setose on outer margins. Maxilliped

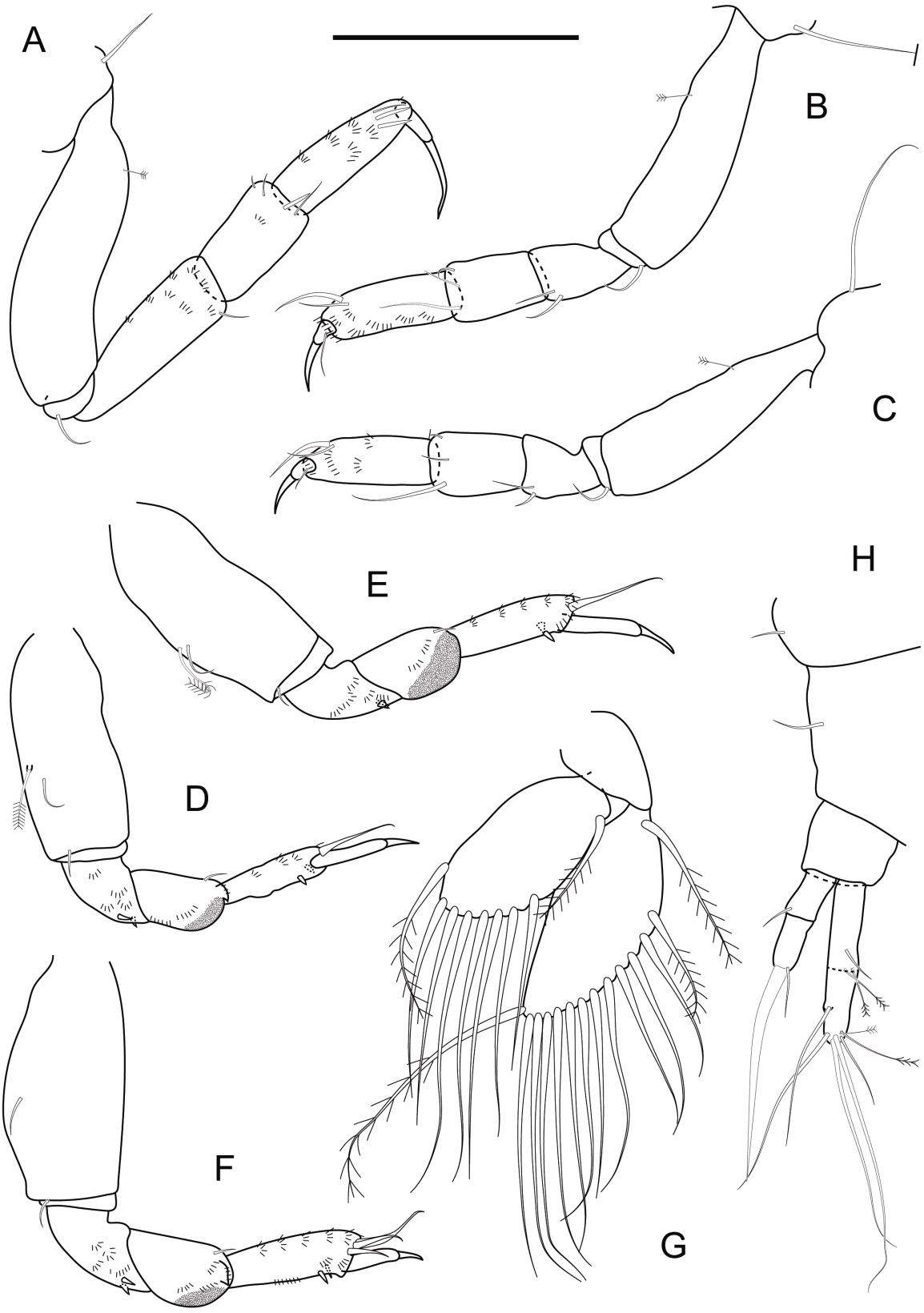

Fig. 4. *Typhlotanais andradeorum* sp. nov., paratype (MZUSP 32839), ♀, dissected. **A–F**. Pereopods 1–6. **G**. Pleopod. **H**. Uropod. Scale bar = 0.1 mm.

(Fig. 3F) sparsely setose; basis with simple seta not reaching distal margin of endites; endites unfused, with long medial seta, two very large gustatory cusps (covering almost all distal margin of the endites) and short seta on distal edge and microtrichia on outer corner; palp with four articles; article-1 naked; article-2 with three inner setae (one simple and two serrated) and minute seta on outer margin; article-3 with three serrated inner setae; article-4 with five serrated inner setae and one simple subdistal outer seta. Maxilla not observed. Epignath not observed.

Cheliped (Fig. 3G) basis not reaching pereonite-1, distally rounded, with microtrichia; 2.1 × L:W; merus subtriangular, with ventral seta; carpus stout 1.9 × L:W, with three ventral setae and microtrichia; propodus 1.8 × as long as carpus, 2.6 × L:W, with two setae near dactylus insertion (one on inner and one on outer side); fixed finger with two rod setae ventrally; cutting edge with two rod (one long and one short) and one simple setae; dactylus as long as fixed finger.

Pereopod-1 (Fig. 4A). Walking type, slender; coxa with seta; basis elongate 3.5 × L:W, with penicillate dorsal seta; ischium with seta; merus elongate 2.6 × L:W, with ventrodistal seta and microtrichia; carpus 1.7 × L:W, 0.6 × as long as merus, with two dorsodistal setae and seta and spine ventrodistally; propodus 3.2 × L:W, 1.4 × as long as carpus, with two spines and seta dorsodistally; dactylus 0.6 × as long as unguis; unguis with tip enlarged (not thin); dactylus and unguis together 0.8 × as long as propodus.

Pereopod-2 (Fig. 4B). Walking type; coxa with long seta (longer than half length of basis); basis 3.5 × L:W, with penicillate dorsal seta; ischium with seta; merus about 1.4 × L:W, with two ventrodistal setae; carpus 1.6 × L:W, with two dorsodistal and one long ventrodistal setae (longer than half length of propodus); propodus 2.6 × L:W, 0.7 × as long as merus and carpus combined, with two dorsodistal setae and microtrichia; dactylus twice as long as unguis, with seta shorter than unguis; dactylus and unguis together 0.6 × as long as propodus.

Pereopod-3 (Fig. 4C). As pereopod-2.

Pereopod-4 (Fig. 4D). Clinging type; coxa absent; basis robust 2.4 × L:W, with penicillate and simple setae ventrally; ischium with seta; merus triangular 1.4 × L:W, with two ventrodistal spines and microtrichia; carpus 1.6 × L:W, with strong distal spur and simple dorsodistal seta and prickly tubercles about as long as half length of carpus; propodus about 3.8 × L:W, with robust dorsodistal seta longer than unguis, two ventrodistal spines and microtrichia; dactylus 1.9 × as long as unguis, both combined as long as propodus.

Pereopod-5 (Fig. 4E). Similar to pereopod-4, except propodus about 1.8 × L:W.

Pereopod-6 (Fig. 4F). Similar to pereopod-5, except basis twice L:W, with simple ventral seta; propodus with three robust dorsodistal setae (one longer and two shorter than unguis).

Pleopod (Fig. 4G). All pleopods similar; basal article naked; exopod with eight plumose setae on outer margin and with plumose seta on inner margin; endopod with 14 plumose setae on outer margin. Large gap between proximal seta and others in both rami.

Uropod (Fig. 4H). As long as pleotelson; basis 0.8 × L:W, naked; exopod two-articled, 0.6 × as long as endopod, with simple medial seta and tipped by stout and simple setae; endopod two-articled; 5.5 × L:W, with one simple and two penicillate medial setae, simple seta subdistally, tipped by four simple and two penicillate setae.

Distribution

Brazil: Campos Basin, Rio de Janeiro and Espírito Santo Basin, Espírito Santo. Occurring on the lower slope and the São Paulo plateau area, from the depth range 780 to 2500 m (Fig. 21).

Remarks

Typhlotanais andradeorum sp. nov. is characterized by three diagnostic characters as pereopods 2–3 coxae with very long setae reaching half-length of basis, cheliped fixed finger with two rod (one long and one short) plus one simple setae on cutting edge and the mandible outer margin covered with several microtrichia. This last character is unique and is not seen in any of other species of *Typhlotanais*. Futhermore, *T. andradeorum* sp. nov. shows both rami of uropod two-articled, characters shared with *Typhlotanais* species as *T. messinensis* Sars, 1882, *T. mimosis* Błażewicz-Paszkowycz, 2007, *T. mixtus* Hansen, 1913, *T. spinicauda* Hansen, 1913, *T. squamiger* Błażewicz-Paszkowycz, 2007 and *T. andeepae* Błażewicz-Paszkowycz, 2007. However the new species can be immediately distinguished by: (1) pereopods 2–3 coxae with very long setae (half-length of basis); and (2) cheliped fixed finger with two rod and one simple setae on cutting edge (which the second rod seta is shorter than the first and also than the simple seta).

Typhlotanais longiseta sp. nov.
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Figs 5–7, 21

Diagnosis

Cheliped basis with ventral transversal grooves; propodus 1.7× L:W, calcified on cutting edge; pereopod-1 coxa with very long seta reaching half-length of basis; basis with many small penicillate dorsal setae; pereopods 2–3 propodus with many small penicillate ventral setae; uropod as long as pleotelson, endopod two-articled, exopod one-articled, as long as endopod article-1.

Etymology

From the Latin '*longus*', meaning 'long' and referring to the long seta on pereopod-1 coxa that reaches half-length of basis. It is a compound Latin noun in the nominative case used in apposition.

Material examined

Holotype

BRAZIL – **Espírito Santo State** • neuter, length 1.3 mm; Espírito Santo Basin, stn AMB 5 A7 R1; 21.0793° S, 40.0752° W; depth 1294 m; 31 Dec. 2011; MZUSP 38969.

Paratypes

BRAZIL – **Rio de Janeiro State** • 5 neuters (1 dissected), length 2.3 mm; Campos Basin, stn HAB 9 CANAC 7 R2; 21.7907° S, 40.0320° W; depth 780 m; 6 Feb. 2009; MZUSP 38015 • 2 neuters; Campos Basin, stn HAB 7 I7 R2; 21.1842° S, 40.2053° W; depth 790.2 m; 5 Jul. 2008; MZUSP 22851. – **Espírito Santo State** • 1 neuter; Espírito Santo Basin, stn AMB 12 E7 R3; 19.7841° S, 39.0533° W; depth 1242 m; 26 Jun. 2013; MZUSP 38960 • 1 neuter; Espírito Santo Basin, stn AMB 11 C6 R1; 20.2598° S, 39.7713° W; depth 1040 m; 9 Jan. 2012; MZUSP 38964.

Additional material (lost in the fire)

BRAZIL – **Rio de Janeiro State** • 4 neuters; Campos Basin, stn HAB 6 CANAC 7 R1; 21.7908° S, 40.0370° W; depth 758.2 m; 28 Jun. 2008; MZUSP 22850 • 1 neuter; Campos Basin, stn HAB 6 A7

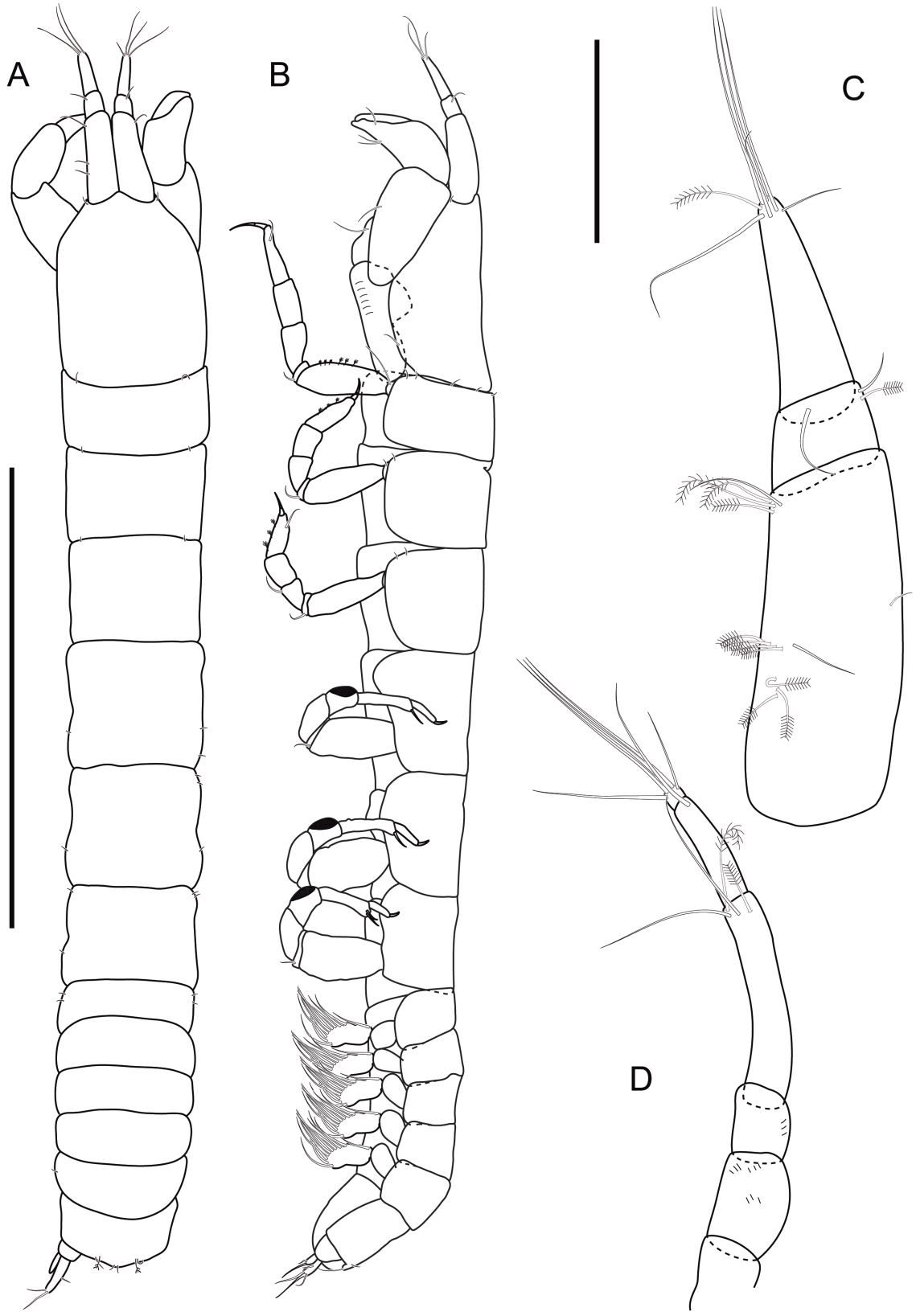

Fig. 5. *Typhlotanais longiseta* sp. nov., paratype (MZUSP 38015), ♀, dissected. **A**. Dorsal view. **B**. Lateral view. **C**. Antennule. **D**. Antenna. Scale bars: A–B = 1 mm; C–D = 0.1 mm.

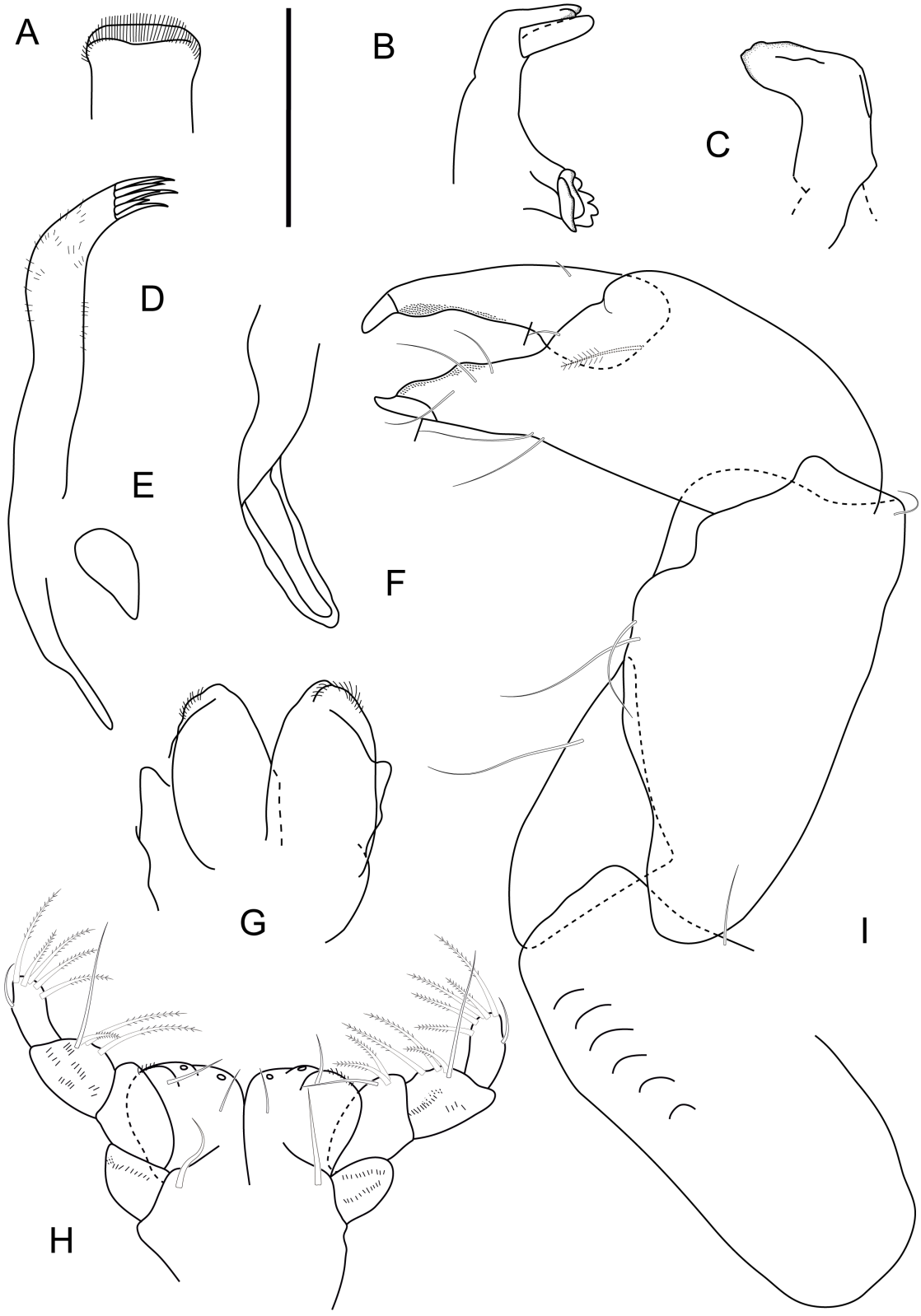

Fig. 6. *Typhlotanais longiseta* sp. nov., paratype (MZUSP 38015), ♀, dissected. **A**. Labrum. **B**. Left mandible. **C**. Right mandible. **D**. Maxillule. **E**. Maxilla. **F**. Epignath. **G**. Labium. **H**. Maxilliped. **I**. Cheliped. Scale bar = 0.1 mm.

R2; 23.6557° S, 41.3078° W; depth 693.7 m; 23 Jun. 2008; MZUSP 22852 • 3 neuters; Campos Basin, stn HAB 6 C7 R1; 22.9977° S, 40.7952° W; depth 710.1 m; 24 Jun. 2008; MZUSP 32840 • 1 neuter, 4 juveniles; Campos Basin, stn HAB 6 A7 R1; 23.6557° S, 41.3078° W; depth 693.7 m; 23 Jun. 2008; MZUSP 32847 • 2 neuters; Campos Basin, stn HAB 4 G9 R3; 22.1214° S, 39.8177° W; depth 1299.8 m; 28 May 2008; MZUSP 32856 • 2 juveniles; Campos Basin, stn HAB 6 I9 R2; 21.1843° S, 40.2049° W; depth 807 m; 29 Jun. 2008; MZUSP 32866 • 16 neuters; Campos Basin, stn HAB 6 A7 R2; 23.6557° S, 41.3078° W; depth 693.7 m; 23 Jun. 2008; MZUSP 38016 • 1 neuter; Campos Basin, stn AC #24; 22.0578° S, 39.7520° W; depth 1730 m; 8 May 2002; MNRJ 26500 • 1 neuter; Campos Basin, stn OP #49; 22.0758° S, 39.9032° W; depth 750 m; 30 Jun. 2003; MNRJ 27375.

Description

Paratype (MZUSP 38015 dissected)

Body (Fig. 5A–B). Slender, 7.3 × L:W. Cephalothorax 1.3 × L:W, 2.8 × as long as pereonite-1, naked; eyes absent.

Pereonites 1–6. All pereonites rectangular, wider than long; pereonite-1 shortest, 0.5 × L:W; pereonite-2 0.6 × L:W; pereonite-3 0.8 × L:W; pereonite-4 0.9 × L:W; pereonite-5 0.9 × L:W; pereonite-6 0.7 × L:W; pereonites 1–3 with setae on proximal margin, pereonites 4–6 with lateral setae.

Pleon (Fig. 5A–B). 0.3 × TBL, with five subequal pleonites, pleonite-5 with lateral seta. Pleotelson trapezoidal, with three pairs of setae distally.

Antennule (Fig. 5C). 0.8 × as long as cephalothorax, with three articles; article-1 0.6 × TL, about 2.7 × L:W, with two simple and six penicillate middle setae, and one simple and three penicillate distal setae; article-2 0.7 × L:W, 0.2 × as long as article-1, with two simple and penicillate distal setae; article-3 3.1 × L:W, 2.9 × as long as article-2, with five simple and one penicillate terminal setae.

Antenna (Fig. 5D). Of six articles, article-1 naked, fused with body; article-2 about 1.2 × L:W, naked; article-3 about 1.2 × L:W, 0.7 × as long as article-2, naked; article-4 5.1 × L:W, 2.7 × as long as article-3, with two simple and two penicillate distal setae; article-5 3.8 × L:W, 0.6 × as long as article-4, with distal seta; article-6 minute with four simple terminal setae.

Labrum (Fig. 6A). Rounded, hood-shaped, distally covered by minute setae. Mandible (Fig. 6B–C) molar broad with prominent irregular nodules on distal margin. Left mandible (Fig. 6B) incisor with two lobe, lacinia mobilis well developed, not crenulated; right mandible broken during dissection, incisor almost smooth (Fig. 6C), without lacinia mobilis. Maxillule (Fig. 6D) endite with seven to eight terminal spines and microtrichia; palp seta broken during dissection. Maxilla (Fig. 6E) semi-triangular (drop form). Labium (Fig. 6F) with distolateral corner finely setose; outer lobe membranous. Epignath (Fig. 6G) elongate, linguiform, naked. Maxilliped (Fig. 6H) sparsely setose; basis with seta almost reaching distal margin of endites; endites with subdistal seta, two small gustatory cusps and seta on distal margin and microtrichia on outer corner; palp with four articles; article-1 triangular, naked; article-2 with two serrated and one simple inner setae; article-3 with three serrated and one simple long inner setae; article-4 with five inner setae (at least four serrated) and subdistal outer seta.

Cheliped (Fig. 6I). Basis elongate, distally rounded, 2.5 × L:W, with dorsodistal seta and ventral grooves; merus subtriangular, with ventral seta; carpus stout 1.5 × L:W, with two ventral setae and one dorsodistal seta; propodus stout, as long as carpus, 1.7 × L:W, with two setae near dactylus insertion (one on inner and one on outer side); fixed finger with two ventral setae; cutting edge very calcified, with subdistal protrusions and three setae; dactylus slightly curved, as long as fixed finger, with dorsoproximal seta.

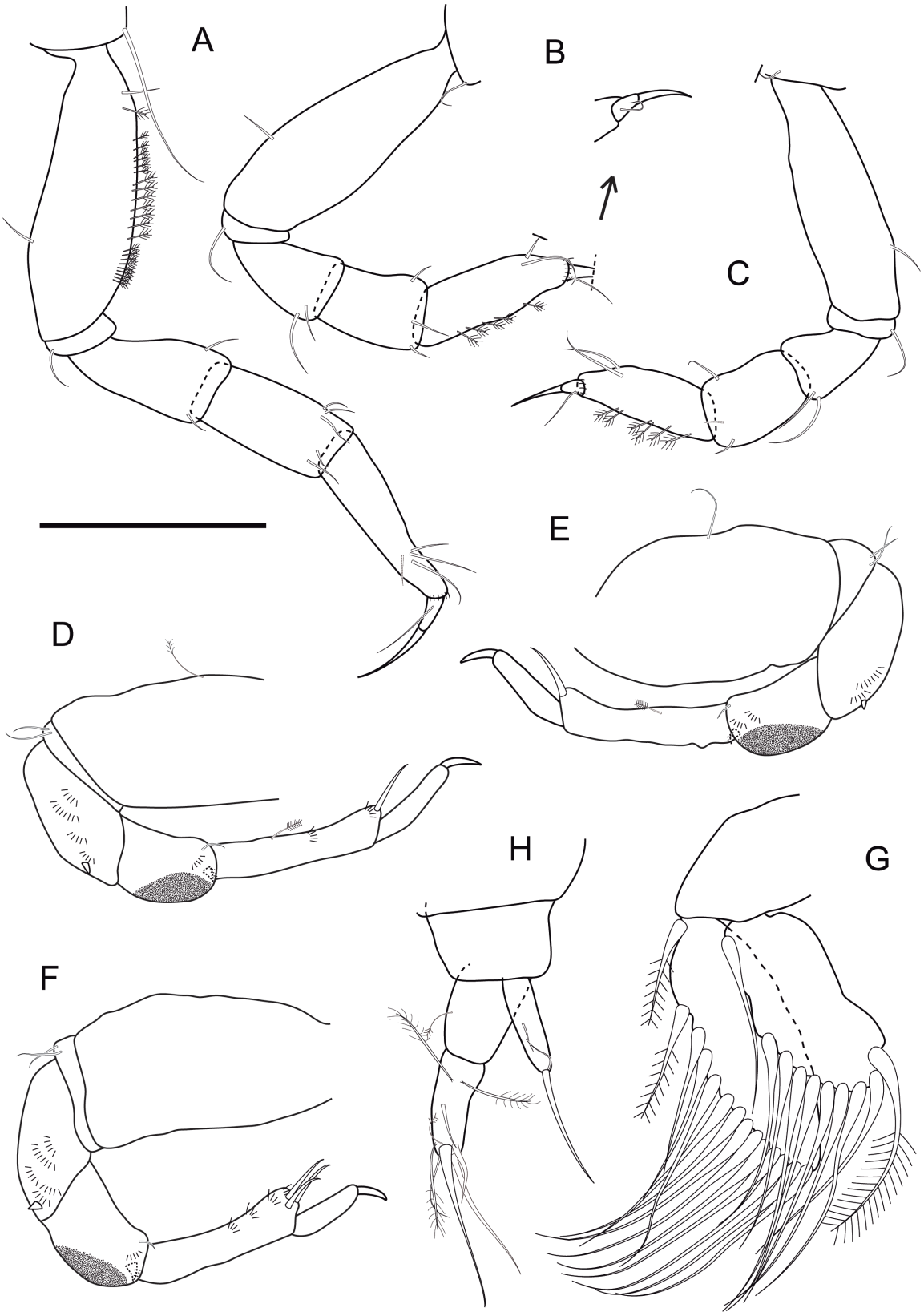

Fig. 7. *Typhlotanais longiseta* sp. nov., paratype (MZUSP 38015), ♀, dissected. **A–F**. Pereopods 1–6. **G**. Pleopod. **H**. Uropod. Scale bar = 0.1 mm.

Pereopod-1 (Fig. 7A). Walking type; slender; coxa with long seta reaching half of basis; basis elongate, almost 3.0× L:W, with ventral seta and one simple and many penicillate dorsal setae; ischium with ventral seta; merus 1.7× L:W, about as long as carpus, with two dorsodistal and one ventrodistal setae; carpus 1.9× L:W, with three dorsodistal and two ventrodistal setae; propodus 3.9× L:W, 1.3× as long carpus, with three simple dorsodistal and one ventrodistal setae; dactylus just 0.4× as long as unguis; dactylus and unguis together 0.6× as long as propodus.

Pereopod-2 (Fig. 7B). Walking type; coxa broken during dissection; basis elongate 2.8× L:W, with ventral seta; ischium with ventral seta; merus 1.6× L:W, as long as carpus, with two ventrodistal setae; carpus 1.4× L:W, with three distal setae; propodus about 2.7× L:W, 0.8× as long as merus and carpus combined, with two dorsodistal setae and four penicillate ventral setae; dactylus 0.5× as long as unguis, with dorsoproximal seta shorter than unguis.

Pereopod-3 (Fig. 7C). Similar to pereopod-2, except basis 2.0× as long as wide; merus with ventrodistal seta; propodus with six penicillate ventral setae; dactylus 0.5× as long as unguis.

Pereopod-4 (Fig. 7D). Clinging type; coxa absent; basis 2.2× L:W, naked; ischium with two setae; merus triangular about 1.3× L:W, with ventrodistal spine and microtrichia; carpus 1.7× L:W, with dorsodistal seta, distal spine and ventral prickly tubercles almost as long as carpus; propodus 5.3× L:W, with penicillate middorsal seta and dorsodistal seta shorter than dactylus; dactylus 2.5× as long as unguis, both combined 0.8× as long as propodus.

Pereopod-5 (Fig. 7E). Similar to pereopod-4, except basis 1.8× L:W, with ventral seta; merus 1.6× L:W; carpus 1.4× L:W; propodus 4.6 L:W.

Pereopod-6 (Fig. 7F). Similar to pereopod-5, except basis naked; propodus with three dorsodistal setae shorter than dactylus.

Pleopod (Fig. 7G). All pleopods similar; basal article naked; exopod with nine plumose setae on outer margin and with plumose seta on inner margin; endopod with fourteen plumose setae on outer margin; gap between proximal seta and others in both rami.

Uropod (Fig. 7H). Stout, as long as pleotelson; basis about as long as wide, naked; exopod one-articled, as long as endopod article-1, with stout and simple setae distally; endopod two-articled; 4.1× L:W, first article with penicillate medial seta; second article with simple and two penicillate setae medially, one stout, one simple and three penicillate setae distally.

Distribution

Brazil: Campos Basin, Rio de Janeiro and Espírito Santo Basin, Espírito Santo. Occurring on the middle and lower slope, from the depth range 692 to 1730 m (Fig. 21).

Remarks

The main unique and conspicuous characters of *Typhlotanais longiseta* sp. nov. are the pereopod-1 coxa with very long seta reaching half of basis length, distal part of cheliped basis (basal lobe) long and basis with several small penicillate dorsal setae. The first character is found only in *Paratyphlotanais armatus* (Vanhöffen, 1914)*, Typhlotanais greenwichensis* and *T. plebejus* Hansen, 1913. The new species can be distinguished from *T. greenwichensis* by its (1) body stout, 6.0× L:W (versus almost 7.0× L:W in *T. greenwichensis*); (2) cheliped carpus dorsal margin with seta (versus seven minute setae in *T. greenwichensis*); (3) pereopods 1–3 coxa without spur; (4) pereopods 4–6 carpus prickly tubercles not surrounded by spines; (5) uropod endopod two-articled.

Typhlotanais longiseta sp. nov. resembles *T. plebejus* in habitus and cheliped basis with ventral grooves. However, the new species can be distinguished by (1) pereonite-4 form (*T. longiseta* 0.7× L:W and *T. plebejus* as long as wide); (2) pereopod-1 basis with several small penicillate ventral setae; and (3) pereopods 2–3 propodus with several small penicillate ventral setae.

"*cornutus*" group

Species included

Typhlotanais adipatus Tzareva, 1982; *T. andeepae* Błażewicz-Paszkowycz, 2007a; *T.* (= *Paratanais*) *cornutus* (Sars, 1879); *T. crassus* Dojiri & Sieg, 1997; *T. bolarticulus* sp. nov.

Typhlotanais bolarticulus sp. nov.

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Figs. 8–10, 21

Diagnosis

Body short, about 5.0× L:W; antennule with all setae stout; antenna article-2 globose, 1.6× wider than article-3; conspicuous spines on pereopod-2 basis and less conspicuous on pereopod-1 and pereopod-3 basis; pereopods 2–3 dactylus with very long seta, more than 3.0× as long as unguis; pereopods 4–6 propodus with distal setae longer than dactylus and unguis combined; unguis simple; pereopod-6 propodus with several small spines along the article.

Etymology

From the Latin '*bola*' (Latin), meaning 'ball', 'globe'. The name reflects the antenna article-2, which is globose and enlarged dorsally.

Material examined

Holotype

BRAZIL – **Rio de Janeiro State** • neuter, length 1.7 mm; Campos Basin, stn HAB 3 H9; 21.6555° S, 39.899° W; depth 1293.2 m; 13 May 2008; MZUSP 38973.

Paratypes

BRAZIL – **Rio de Janeiro State** • 2 neuters (1 dissected), length 1.3 mm; Campos Basin, stn HAB 3 A8 R1; 23.6849° S, 41.2706° W; depth 986 m; 3 May 2008; MZUSP 32878. – **Espírito Santo State** • 1 neuter; Espírito Santo Basin, stn AMB 11 B6 R2; 20.6000° S, 39.8596° W; depth 998 m; 8 Jan 2012; MZUSP 38963 • 1 neuter; Espírito Santo Basin, stn AMB 8 G7 R2; 19.0575° S, 37.8118° W; depth 1308 m; 30 Jan. 2012; MZUSP 38970 • 2 neuters; Espírito Santo Basin, stn AMB 3 E6 R1; 19.6685° S, 39.1214° W; depth 1035 m; 13 Dec. 2011; MZUSP 38975 • 1 neuter; Espírito Santo Basin, stn AMB 5 B7 R2; 21.0793° S, 40.0752° W; depth 1294 m; 31 Dec. 2011; MZUSP 38979.

Additional material (lost in the fire)

BRAZIL – **Rio de Janeiro State** • 1 neuter; Campos Basin, stn HAB 3 H9; 21.6555° S, 39.899° W; depth 1293.2 m; 13 May 2008; MZUSP 34471 • 1 neuter; Campos Basin, stn RC #10; 21.9756° S, 39.8646° W; depth 1700 m; 8 Oct. 2001; MNRJ 18328.

Description

Paratype (MZUSP 32878 dissected)

Body (Fig. 8A–B). Short, about 5.0× L:W. Cephalothorax rounded L:W, 4.6× as long as pereonite-1, naked; eyes absent.

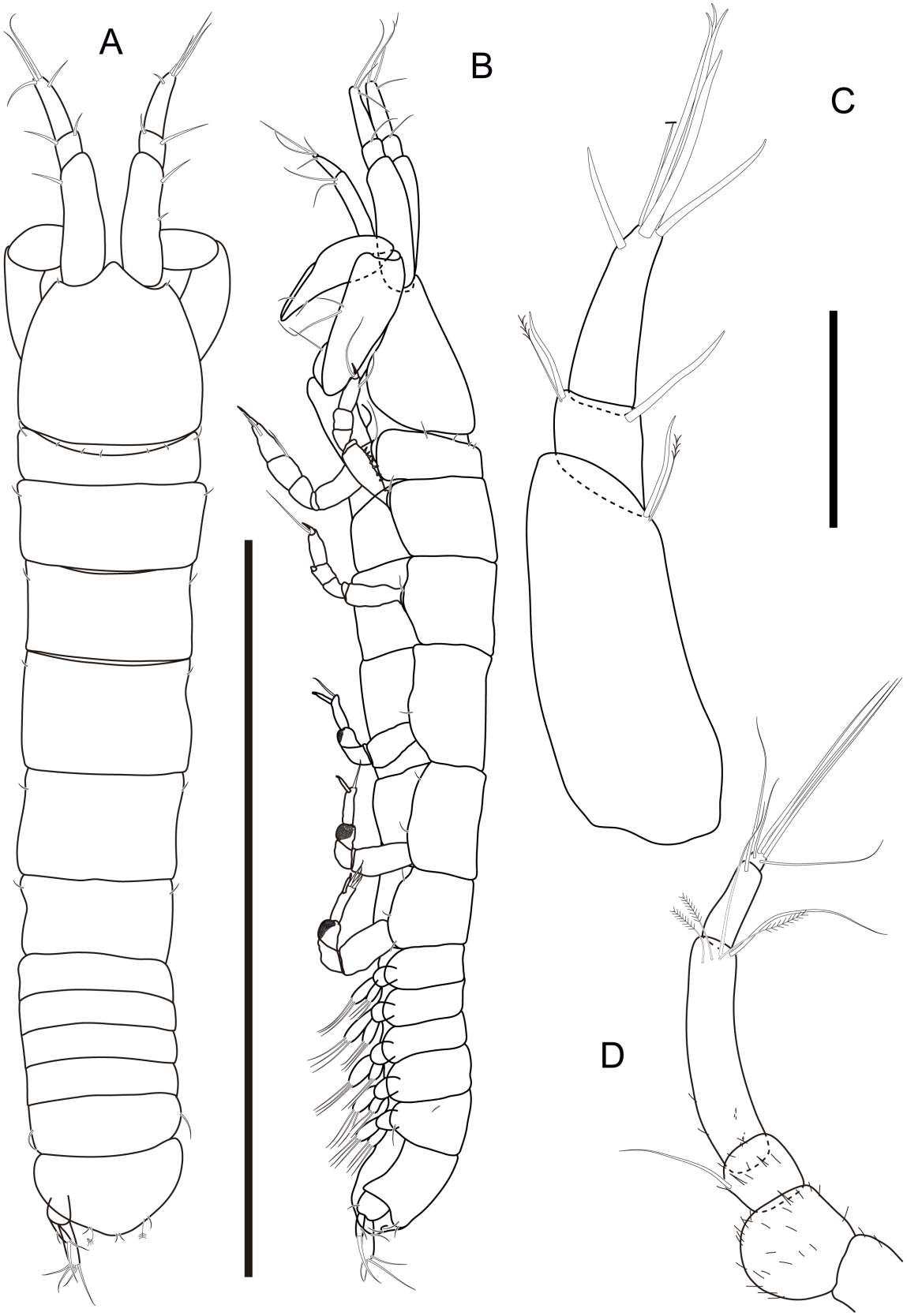

Fig. 8. *Typhlotanais bolarticulus* sp. nov. **A**. ♀ (MNRJ 18328), dorsal view. **B–D**. Paratype (MZUSP 32878), ♀, dissected. **B**. Lateral view. **C**. Antennule. **D**. Antenna. Scale bars: A–B = 1 mm; C–D = 0.1 mm.

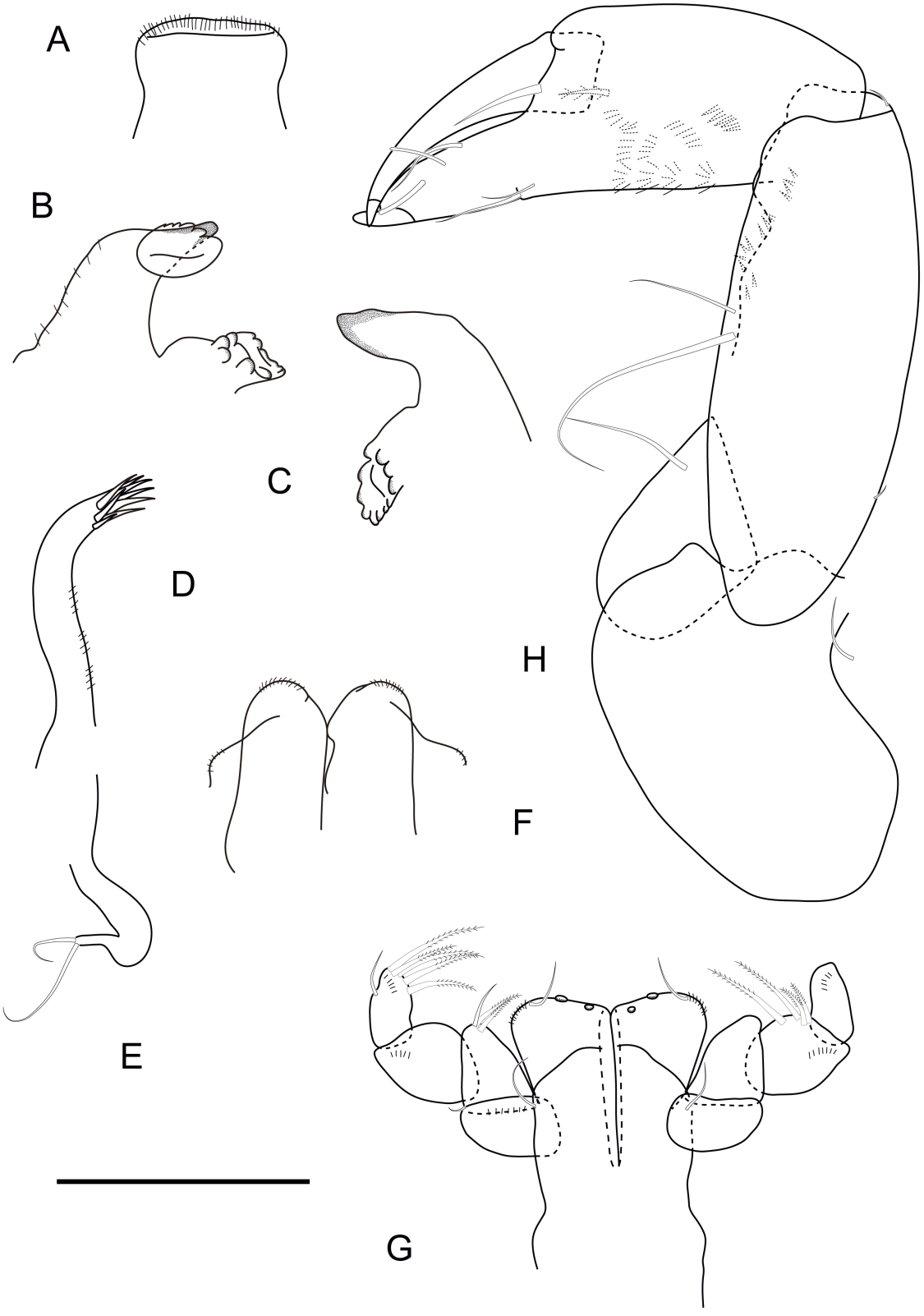

Fig. 9. *Typhlotanais bolarticulus* sp. nov., paratype (MZUSP 32878), ♀, dissected. **A**. Labrum. **B**. Left mandible. **C**. Right mandible. **D**. Maxillule. **E**. Maxillule palp. **F**. Labium. **G**. Maxilliped. **H**. Cheliped. Scale bar = 0.1 mm.

Pereonites 1–6. All pereonites rectangular, wider than long, with setae on lateral margin; pereonite-1 shortest, 0.2 × L:W, with three pairs of setae on proximal margin; pereonite-2 0.5 × L:W; pereonite-3 0.5 × L:W; pereonite-4 0.7 × L:W; pereonite-5 0.7 × L:W; pereonite-6 0.5 × L:W.

Pleon (Fig. 8A–B). 0.3 × TBL, with four subequal pleonites, the last one slightly longer than others. Pleotelson trapezoidal 0.5 × L:W, with three pairs of setae distally.

Antennule (Fig. 8C). 1.2 × as long as cephalothorax, with three articles; article-1 0.6 × TL, 2.5 × L:W, with stout and penicillate setae distally; article-2 0.7 × L:W, 0.2 × as long as article-1, with two stout and penicillate distal setae; article-3 3.4 × L:W, 2.8 × as long as article-2, with seven to eight stout terminal setae.

Antenna (Fig. 8D). Of six articles, article-1 with microtrichia, fused with body; article-2 once L:W, with a globose shape and numerous microtrichia, 1.6 × wider than article-3; article-3 about as long as wide, with long seta and numerous microtrichia; article-4 4.3 × L:W, 3.3 × as long as article-3, with two simple and three penicillate setae distally; article-5 2.4 × L:W, 0.4 × as long as article-4, with distal seta; article-6 minute with five simple terminal setae.

Labrum (Fig. 9A) rounded, hood-shaped, distally covered by minute setae. Mandible (Fig. 9B–C) molar broad with prominent regular nodules. Left mandible (Fig. 9B) with microtrichia along the outer margin, incisor smooth, lacinia mobilis well developed, crenulate, with six lobes; right mandible (Fig. 9C) as left, but without microtrichia and lacinia mobilis. Maxillule (Fig. 9D) endite with eight terminal spines (one short); palp (Fig. 9E) with two distal setae. Labium (Fig. 9F) with distolateral corner finely setose; outer lobe membranous, finely setose. Maxilliped (Fig. 9G) sparsely setose; basis with simple seta not reaching distal margin of endites; endites unfused, with two small gustatory cusps and seta on distal edge and microtrichia on outer corner; palp with four articles; article-1 naked; article-2 with three inner setae (one simple, two serrated) and minute seta on outer margin; article-3 with four serrated inner setae; article-4 with five serrated inner setae and simple subdistal outer seta. Maxilla not observed. Epignath not observed.

Cheliped (Fig. 9H). Basis distally rounded, stout, 1.7 × L:W, with simple seta dorsally; merus subtriangular, with ventral seta; carpus stout 2.2 × L:W, with two simple ventral setae and microtrichia and two minute dorsal setae; propodus about as long as carpus, 2.4 × L:W, with two setae near dactylus insertion (one on inner and one on outer side) and microtrichia; fixed finger with two simple setae ventrally; cutting edge with two rod (similar size) and one simple setae; dactylus as long as fixed finger.

Pereopod-1 (Fig. 10A). Walking type; coxa with seta shorter than half length of basis; basis 3.1 × L:W, with simple dorsal seta and numerous microtrichia; ischium with minute seta; merus stout, about as long as wide, with dorsodistal and ventrodistal setae; carpus 1.3 × L:W, longer than merus, with four simple distal setae (one longer than half length of propodus) and numerous microtrichia; propodus twice L:W, 1.3 × as long as carpus, with three dorsodistal, one ventrodistal setae and numerous microtrichia; dactylus 0.6 × as long as unguis, with seta as long as unguis; dactylus and unguis together 0.7 × as long as propodus.

Pereopod-2 (Fig. 10B). Walking type; coxa with seta; basis stout 2.8 × L:W, with two penicillate dorsoproximal setae and eleven small dorsal spines; ischium with small dorsal spine and ventral seta; merus about as long as wide, with dorsodistal and ventrodistal setae; carpus about as long as wide, with dorsodistal simple spine and ventrodistal subrounded spine; propodus 2.4 × L:W, as long as merus and carpus combined, with two dorsodistal (one longer than unguis) and minute ventrodistal spine; dactylus 0.7 × as long as unguis, with robust seta 4.0 × as long as dactylus and unguis combined; dactylus and unguis together 0.5 × as long as propodus.

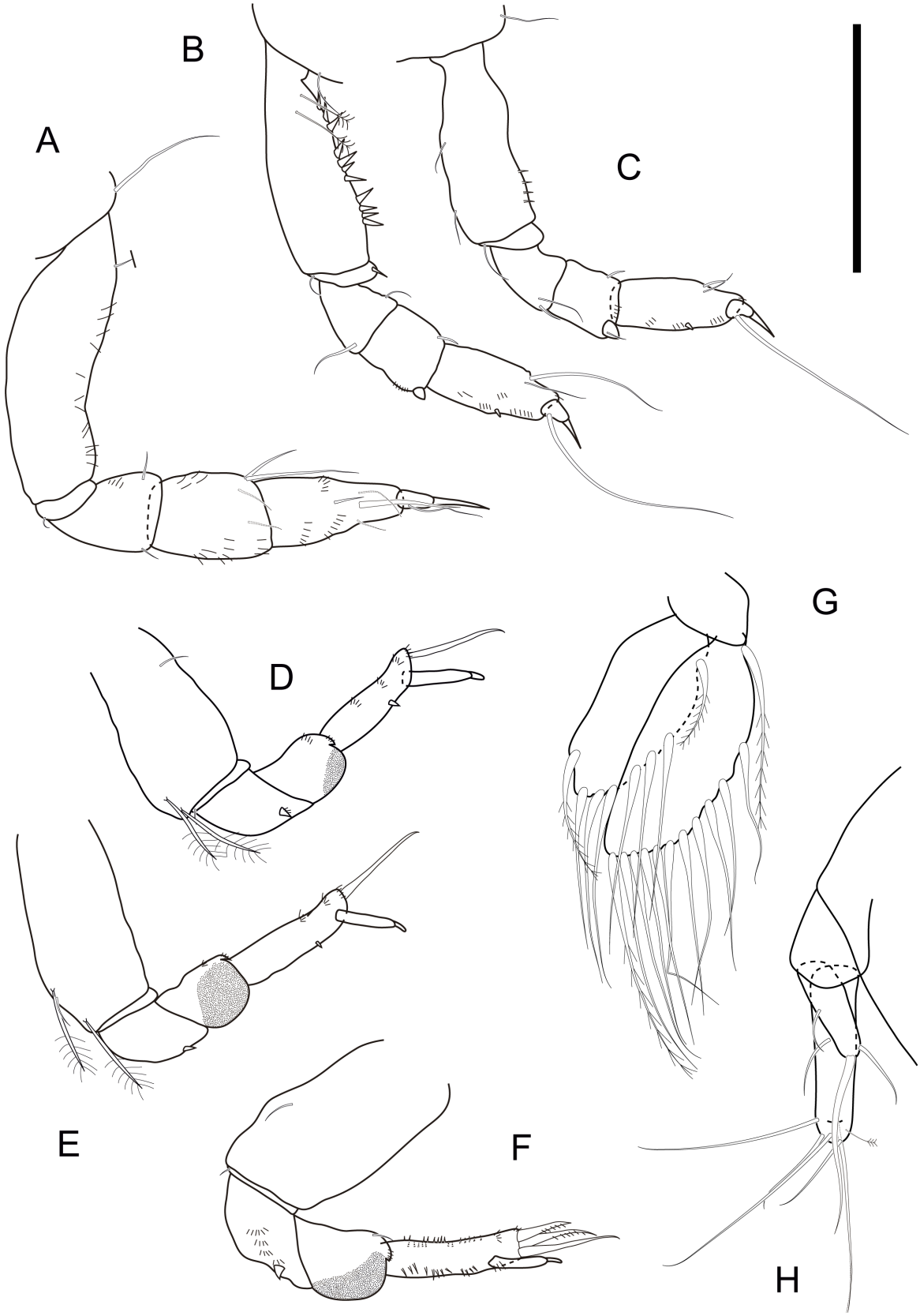

Fig. 10. *Typhlotanais bolarticulus* sp. nov., paratype (MZUSP 32878), ♀, dissected. **A–F**. Pereopods 1–6. **G**. Pleopod. **H**. Uropod. Scale bar = 0.1 mm.

Pereopod-3 (Fig. 10C). Similar to pereopod-2, except basis with two simple ventral setae and strong microtrichia on dorsal margin; ischium with ventral seta; merus with two ventrodistal setae; carpus with ventrodistal subrounded spine (bigger than in pereopod-2) and one ventrodistal seta; propodus with simple spine and short seta dorsodistally.

Pereopod-4 (Fig. 10D). Clinging type; coxa absent; basis robust 1.5 × L:W, with two long ventroproximal penicillate setae and simple dorsal seta; ischium with minute seta; merus triangular about as long as wide, with two spines ventrodistally (only one illustrated); carpus about 1.2 × L:W, with robust spine dorsodistally and prickly tubercles more than half length of carpus; propodus 3.4 × L:W, with one dorsodistal seta longer than unguis and two ventrodistal spines (only one illustrated); dactylus 4.7 × as long as unguis, both combined 0.7 × as long as propodus.

Pereopod-5 (Fig. 10E). Similar to pereopod-4, except basis twice L:W, with simple and two long penicillate ventral setae.

Pereopod-6 (Fig. 10F). Similar to pereopod-4, except basis 1.6 × L:W, with only simple ventral seta; merus and carpus slightly longer than wide; carpus with dorsodistal seta; propodus 3.9 × L:W, with numerous strong microtrichia on ventral and dorsal margins and three dorsodistal setae longer than unguis (one simple and two pectinate).

Pleopod (Fig. 10G). All pleopods similar; basal article naked; exopod with seven plumose setae on outer margin and with plumose seta on inner margin; endopod with twelve plumose setae on outer margin. Large gap between proximal seta and others in both rami.

Uropod (Fig. 10H). 0.7 × as long as pleotelson; basis 1.3 × L:W, naked; exopod one-articled, 0.6 × as long as endopod, with simple medial seta and tipped by stout and simple setae; endopod one-articled; 4.5 × L:W, with two medial, one subdistal, and tipped by three simple and one penicillate setae.

Distribution

Brazil: Campos Basin, Rio de Janeiro and Espírito Santo Basin, Espírito Santo. Occurring on the lower slope, depth range from 986 to 1700 m (Fig. 21).

Remarks

Typhlotanais bolarticulus sp. nov. is part of the *Typhlotanais* '*cornutus*' group by the presence of short body (about 5.0 × L:W), compact chelae (carpus about twice L:W) and the presence of pereopods 4–6 propodus distal setae longer than dactylus and unguis combined. The new species is similar to species of *Larsenotanais* Błażewicz-Paszkowycz, 2007 by having a short body and simple unguis on pereopods 4–6, but it can be differentiated by the presence of short setae on the propodus of pereopods 4–6. Furthermore, the new species can be distinguished easily by its conspicuous spines by pereopod-2 basis and less conspicuous on pereopod-1 and pereopod-3 basis (Table 2).

Among the family Typhlotanaidae, only *Typhlotanais spinipes* Kudinova-Pasternak, 1982 has spines on pereopods 2–6 basis and *T. plicatus* Kudinova-Pasternak, 1993 has on pereopods 4–6 basis. *Typhlotanais bolarticulus* sp. nov. differs from the first by (1) antennule longer than carapace, with short apical setae (*T. spinipes* has antennule as long as carapace, with long setae as long as antennule); (2) pereopods 4–6 basis without spines and (3) uropods rami one-articled (two-articled in *T. spinipes*); and from the second by pereonites 1–3 smooth, without corrugation. Other than these differences, *Typhlotanais bolarticulus* sp. nov. also has very long seta on dactylus of pereopods 2–3 (more than 3.0 × longer than unguis) and antenna article-2 presents a characteristic globose shape, 1.6 × wider than article-3.

Table 2. Diagnostic characters of species of the *Typhlotanais* '*cornutus*' group (based on females). Abbreviations: A2 = antenna; P = pereopod; Uro = uropod; ? = character state unknown.

species	*T. bolarticulus* sp. nov.	*T. adipatus* Tzareva, 1982	*T. andeepae* Błażewicz-Paszkowycz, 2007	*T. cornutus* (Sars, 1879)	*T. crassus* Dojiri & Sieg, 1997
type locality	Brazil (South Atlantic)	Anverse Island (Antarctica)	Weddell Sea (Antarctica)	Norway (North Atlantic)	USA (North Atlantic)
depth (m)	986–1700	51–285	1030–4931	109–183	77–80
A2 article-2 shape	globose	rectangular	rectangular	rectangular	?
A2 article-2 width/ article-3 width	1.6×	as wide as	as wide as	1.5×	?
P1–3 basis spines	present (more conspicuous in P2)	absent	absent	absent	absent
P2–3 dactylus seta	present (4× longer than unguis)	?	present (shorter than unguis)	?	?
P4–6 unguis	simple	bifurcated	bifurcated	bifurcated	bifurcated
Uro. exopod	1-articled	1-articled	2-articled	2-articled	1-articled
Uro. endopod	1-articled	1-articled	2-articled	2-articled	1-articled

"*greenwichensis*" group

Species included

Typhlotanais greenwichensis Shiino, 1970; *T. herthio* Błażewicz-Paszkowycz & Bamber, 2012; *T. messinensis* Sars, 1882; *T. ischnochela* sp. nov.

Typhlotanais ischnochela sp. nov.

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Figs. 11–13, 21

Diagnosis

Antennule longer than carapace; article-1 slender, about 6.0× L:W; article-3 long, about 6.0× L:W. Antenna article-4 slender, about 9.2× L:W. Cheliped carpus elongate, more than 4.0× L:W. Cheliped propodus about 4.0× L:W. Pereopods 4–6 carpus with prickly tubercles half length of carpus, surrounded by spines. Uropod exopod one-articled, 0.7× as long as endopod, with row of minute spines along inner margin; endopod one-articled; 6.6× L:W.

Etymology

From the Greek '*ischnos*' ('thin') and the Latin '*chela*' ('claw'), alluding to the slender cheliped. It is a compound Greek+Latin noun in the nominative case used in apposition.

Material examined

Holotype

BRAZIL – **Espírito Santo State** • neuter, length 2.6 mm; Espírito Santo Basin, stn AMB 12 CAND 4 R1; 19.5308° S, 39.0512° W; depth 171 m; 9 Dec. 2011; MZUSP 37681.

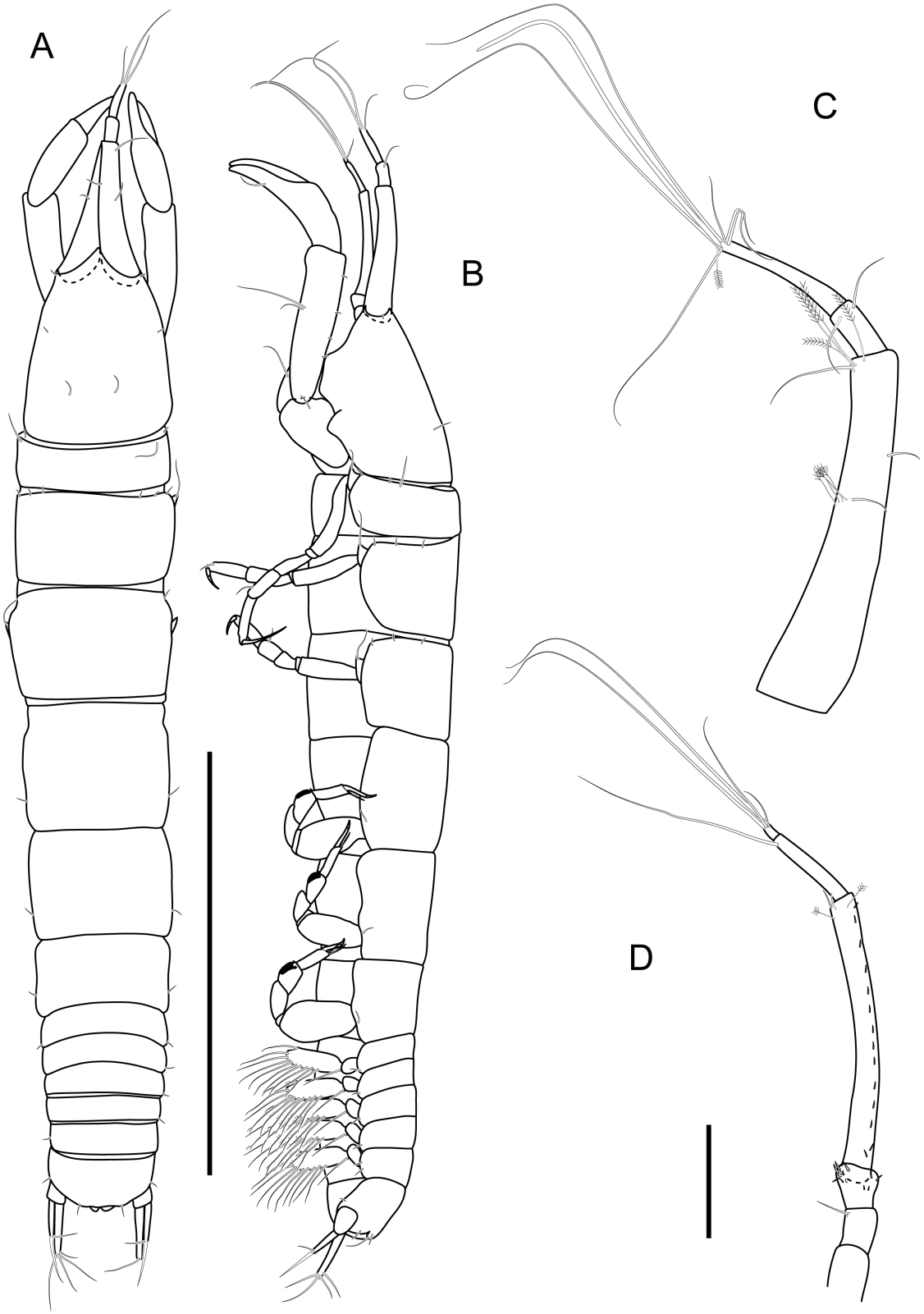

Fig. 11. *Typhlotanais ischnochela* sp. nov. **A–B**. ♀ (MZUSP 34444). **A**. Dorsal view. **B**. Lateral view. **C–D**. Paratype (MZUSP 34428), ♀, dissected. **C**. Antennule. **D**. Antenna. Scale bars: A–B = 1 mm; C–D = 0.1 mm.

Paratypes

BRAZIL – **Rio de Janeiro State** • 1 neuter (dissected), length 2.3 mm; Campos Basin, stn HAB 7 D6 R3; 23.5588° S, 40.4460° W; depth 396.2 m; 9 Jul. 2008; MZUSP 34428 • 1 neuter; Campos Basin, stn HAB 4 CANG 7 R2; 21.9367° S, 39.9625° W; depth 720 m; 7 Feb. 2009; MZUSP 32851 • 1 neuter; Campos Basin, stn HAB 7 A6 R1; 23.6330° S, 41.3290° W; depth 388.9 m; 3 Jul. 2008; MZUSP 32859 • 2 neuters; Campos Basin, stn HAB 7 F7 R2; 22.3317° S, 40.0357° W; depth 703.9 m; 7 Jul. 2008; MZUSP 32860 • 1 neuter; Campos Basin, stn HAB 3 H10 R1; 23.6849° S, 41.2706° W; depth 1898.7 m; 14 May 2008; MZUSP 32880 • 1 neuter; Campos Basin, stn HAB 11 E5 R2; 22.3942° S, 40.3447° W; depth 153 m; 23 Feb. 2009; MZUSP 32888 • 1 neuter; Campos Basin, stn HAB 11 F4 R2; 22.2091° S, 40.2236° W; depth 99 m; 25 Feb. 2009; MZUSP 32889 • 2 neuters; Campos Basin, stn HAB 11 G4 R2; 22.0694° S, 40.1183° W; depth 91 m; 25 Feb. 2009; MZUSP 32890 • 3 neuters; Campos Basin, stn HAB 4 CANG 7 R1; 21.9367° S, 39.9625° W; depth 720 m; 7 Feb. 2009; MZUSP 32891 • 1 neuter; Campos Basin, stn HAB 9 G7 R1; 22.1277° S, 39.9042° W; depth 680 m; 8 Feb. 2009; MZUSP 32907 • 1 neuter; Campos Basin, stn HAB 11 C4; 22.8660° S, 40.9597° W; depth 92 m; 22 Feb. 2009; MZUSP 34427 • 1 neuter; Campos Basin, stn HAB 11 G4; 22.0694° S, 40.1183° W; depth 91 m; 25 Feb. 2009; MZUSP 34430 • 5 neuters; Campos Basin, stn HAB 16 B4; 23.1681° S, 41.0518° W; depth 107 m; 2 Jul. 2009; MZUSP 34431 • 1 neuter; Campos Basin, stn HAB 9 CANG 7; 21.9367° S, 39.9625° W; depth 720 m; 7 Feb. 2009; MZUSP 34432 • 1 neuter; Campos Basin, stn HAB 8 D7; 22.6070° S, 40.3752° W; depth 695.5 m; 29 Jan. 2009; MZUSP 34434 • 1 neuter; Campos Basin, stn HAB 16 E4; 22.2951° S, 40.4499° W; depth 103 m; 4 Jul. 2009; MZUSP 34445 • 2 neuters; Campos Basin, stn HAB 13 D3; 22.3260° S, 40.6220° W; depth 75 m; 15 Mar. 2009; MZUSP 34450 • 1 neuter; Campos Basin, stn HAB 16 E5; 22.3942° S, 40.3450° W; depth 149 m; 4 Jul. 2009; MZUSP 34451 • 4 neuters; Campos Basin, stn RZEE #6750; 23.6680° S, 42.5300° W; depth 162 m; 16 Feb. 1998; MNRJ 19883 • 3 neuters; Campos Basin, stn RZEE #6762; 23.4367° S, 42.2637° W; depth 145 m; 28 Feb. 1998; MNRJ 19887 • 1 neuter; Campos Basin, stn RZEE #1; 20.8333° S, 39.2333° W; depth 83 m; 15 Jun. 2002; MNRJ 26488 • 2 neuters; Campos Basin, stn AC #25; 22.0959° S, 39.7654° W; depth 1730 m; 9 May 2002; MNRJ 26499 • 1 neuter; Campos Basin, stn OP #54; 21.9549° S, 39.9336° W; depth 750 m; 12 Dec. 2002; MNRJ 27358 • 1 neuter; Campos Basin, stn P-27 #07 R2; 22.3860° S, 37.8466° W; depth 535 m; Set. 2014; MNRJ 30137. – **Espírito Santo State** • 3 neuters; Espírito Santo Basin, stn RZEE #1 C6 R2; 19.7600° S, 39.5181° W; depth 100 m; 21 Jun. 2002; MNRJ 26481 • 1 neuter; Espírito Santo Basin, stn RZEE #Y3; 21.1653° S, 40.3286° W; depth 46 m; 16 Jun. 2002; MNRJ 26487 • 1 neuter; Espírito Santo Basin, stn AC #41C; 21.2167° S, 40.2167° W; depth 1000 m; 20 Jul. 2001; MNRJ 18360.

Additional material (lost in the fire)

BRAZIL – **Rio de Janeiro State** • 3 neuters; Campos Basin, stn HAB 13 H4 R2; 21.7150° S, 40.1712° W; depth 98 m; 9 Mar. 2009; MZUSP 22881 • 2 neuters; 2 juveniles; Campos Basin, stn HAB 11 E5 R2; 22.3942° S, 40.3447° W; depth 153 m; 23 Feb. 2009; MZUSP 22899 • 1 neuter; Campos Basin, stn HAB 7 D6 R2; 23.5588° S, 40.4460° W; depth 396.2 m; 9 Jul. 2008; MZUSP 32871 • 3 juveniles; stn HAB 9 CANG 7 R1; 21.9367° S, 39.9625° W; depth 720 m; 7 Feb. 2009; MZUSP 32905 • 1 neuter; Campos Basin, stn HAB 16 B4 R2; 23.1681° S, 41.0518° W; depth 107 m; 2 Jul. 2009; MZUSP 34425 • 1 neuter; Campos Basin, stn HAB 13 D3; 22.3260° S, 40.6220° W; depth 75 m; 15 Mar. 2009; MZUSP 34433 • 1 neuter; Campos Basin, stn HAB 13 Foz 43; 22.2050° S, 40.2440° W; depth 97 m; 15 Mar. 2009; MZUSP 34435 • 1 neuter; Campos Basin, stn HAB 13 H5; 21.7092° S, 40.1517° W; depth 147 m; 9 Mar. 2009; MZUSP 34440 • 1 juvenile; Campos Basin, stn HAB 6 A7 R2; 23.6557° S, 41.3078° W; depth 693.7 m; 23 Jun. 2008; MZUSP 34441 • 1 neuter; Campos Basin, stn HAB 7 D6 R2; 23.5588° S, 40.4460° W; depth 396.2 m; 9 Jul. 2008; MZUSP 34444 • 1 neuter; Campos Basin, stn HAB 7 A6 R3; 23.6330° S, 41.3290° W; depth 388.9 m; 3 Jul. 2008; MZUSP 34452 • 2 neuters; 1 juvenile; Campos Basin, stn HAB 9 I7 R2; 21.1867° S, 40.2145° W; depth 680 m; 4 Feb. 2009; MZUSP 38014 • 1 neuter; Campos Basin, stn A #10 R1; 23.3326° S, 41.3018° W; depth 120 m; 15 Jan. 2016; MOUFPE 15879 • 1 neuter; Campos Basin, stn B #1 R1; 23.2828° S, 41.2041° W; depth 120 m; 15 Jan. 2016; MOUFPE

15881 • 1 neuter; Campos Basin, stn B #7 R1; 23.3012° S, 41.2092° W; depth 120 m; 15 Jan. 2016; MOUFPE 15882 • 7 neuters; Campos Basin, stn B #3 R3; 23.2925° S, 41.2092° W; depth 120 m; 15 Jan. 2016; MOUFPE 15889 • 1 neuter; Campos Basin, stn B #2 R1; 23.2907° S, 41.2063° W; depth 120 m; 15 Jan. 2016; MOUFPE 15895 • 1 neuter; Campos Basin, stn B #3 R1; 23.2925° S, 41.2092° W; depth 120 m; 15 Jan. 2016; MOUFPE 15899 • 1 neuter; Campos Basin, stn A #8 R2; 23.3462° S, 41.3055° W; depth 120 m; 15 Jan. 2016; MOUFPE 15902 • 2 neuters; Campos Basin, stn B #1 R1; 23.2828° S, 41.2041° W; depth 120 m; 15 Jan. 2016; MOUFPE 15905 • 2 neuters; Campos Basin, stn B #4 R2; 23.2942° S, 41.2073° W; depth 120 m; 15 Jan. 2016; MOUFPE 15906 • 2 neuters; Campos Basin, stn B #14 R1; 23.2946° S, 41.2135° W; depth 120 m; 15 Jan. 2016; MOUFPE 15907 • 2 neuters; Campos Basin, stn RZEE #6759; 23.3333° S, 41.3667° W; depth 110 m; 28 Feb. 1998; MNRJ 19878 • 1 neuter; Campos Basin, stn RZEE #6744; 23.8583° S, 42.8317° W; depth 254 m; 15 Feb. 1998; MNRJ 19892. – **Espírito Santo State** • 2 neuters; Espírito Santo Basin, stn AMB 12 CAND 4 R1; 19.5308° S, 39.0512° W; depth 171 m; 9 Dec. 2011; MZUSP 38965.

Description

Paratypes (MZUSP 34444, MZUSP 34428 dissected)

Body (Fig. 11A–B). Slender, about 7.6× L:W. Cephalothorax tappering forward, with rounded lateral margins, 1.3× L:W, 3.9× as long as pereonite-1, naked; eyes absent.

Pereonites 1–6. All pereonites rectangular, wider than long, with lateral margin gently convex; pereonites 1–3 with setae on proximal margin, pereonites 4–6 with lateral setae; pereonite-1 shortest, 0.3× L:W; pereonite-2 0.6× L:W; pereonite-3 0.7× L:W; pereonite-4 longest, about 0.9× L:W; pereonite-5 0.7× L:W; pereonite-6 0.5× L:W.

Pleon (Fig. 11A–B). 0.2× TBL, with five subequal pleonites, together as long as carapace, with lateral setae. Pleotelson distally rounded, about 0.5× L:W, with one pair of setae distally and lateral seta on each side.

Antennule (Fig. 11C). As long as cephalothorax, with three articles; article-1 slender, about 0.6× TL, 6.1× L:W, with two simple middle setae and four penicillate setae, and with two simple and four penicillate setae distally; article-2 twice L:W, 0.2× as long as article-1, with simple and penicillate distal setae; article-3 long, about 5.8× L:W, 2.3× as long as article-2, with six simple (two very long, almost as long as antennule TL) and penicillate terminal setae and aestethasc.

Antenna (Fig. 11D). Of six articles, article-1 naked, fused with body; article-2 slightly longer than wide, with simple distal seta; article-3× L:W, 1.2× as long as article-2, with small distal spines; article-4 slender, about 9.2× L:W, 5.8× as long as article-3, with two simple and four penicillate setae distally; article-5 5.0× L:W, 0.3× as long as article-4, with distal seta; article-6 minute, with four terminal setae.

Labrum (Fig. 12A). Rounded, hood-shaped, distally covered by minute setae. Mandible (Fig. 12B–C) molar broad with blunt teeth and two spines. Left mandible (Fig. 12B) lacinia mobilis well developed, gently undulated; right mandible (Fig. 12C) as left, but without lacinia mobilis. Maxillule (Fig. 12D) endite with seven to eight terminal spines and microtrichia; palp with serrate seta (broken off during dissection). Epignath (Fig. 12E) elongate, linguiform, naked. Labium (Fig. 12F) with distolateral corner finely setose; outer lobe membranous, finely setose. Maxilliped (Fig. 12G) sparsely setose; basis with simple seta not reaching distal margin of endites; endites unfused, with two simple setae, one large gustatory cusp on distal edge and microtrichia on outer corner; palp with four articles; article-1 triangular, naked; article-2 with two simple and one robust serrated setae on inner margin, and simple setae on outer margin; article-3 with four simple inner setae; article-4 with five robust serrated inner setae and simple subdistal outer seta.

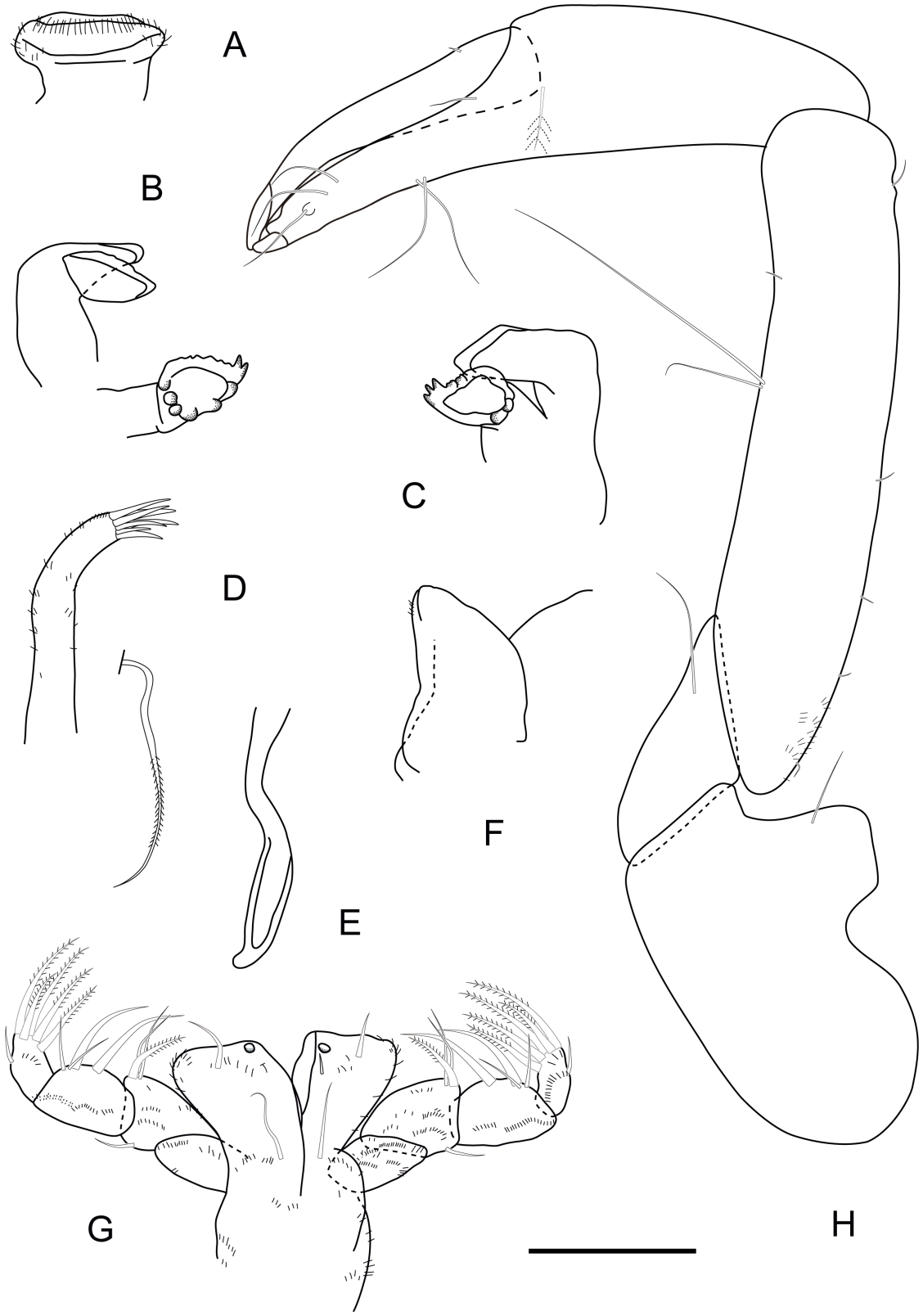

Fig. 12. *Typhlotanais ischnochela* sp. nov., paratype (MZUSP 34428), ♀, dissected. **A**. Labrum. **B**. Left mandible. **C**. Right mandible. **D**. Maxillule. **E**. Epignath. **F**. Labium. **G**. Maxilliped. **H**. Cheliped. Scale bar = 0.1 mm.

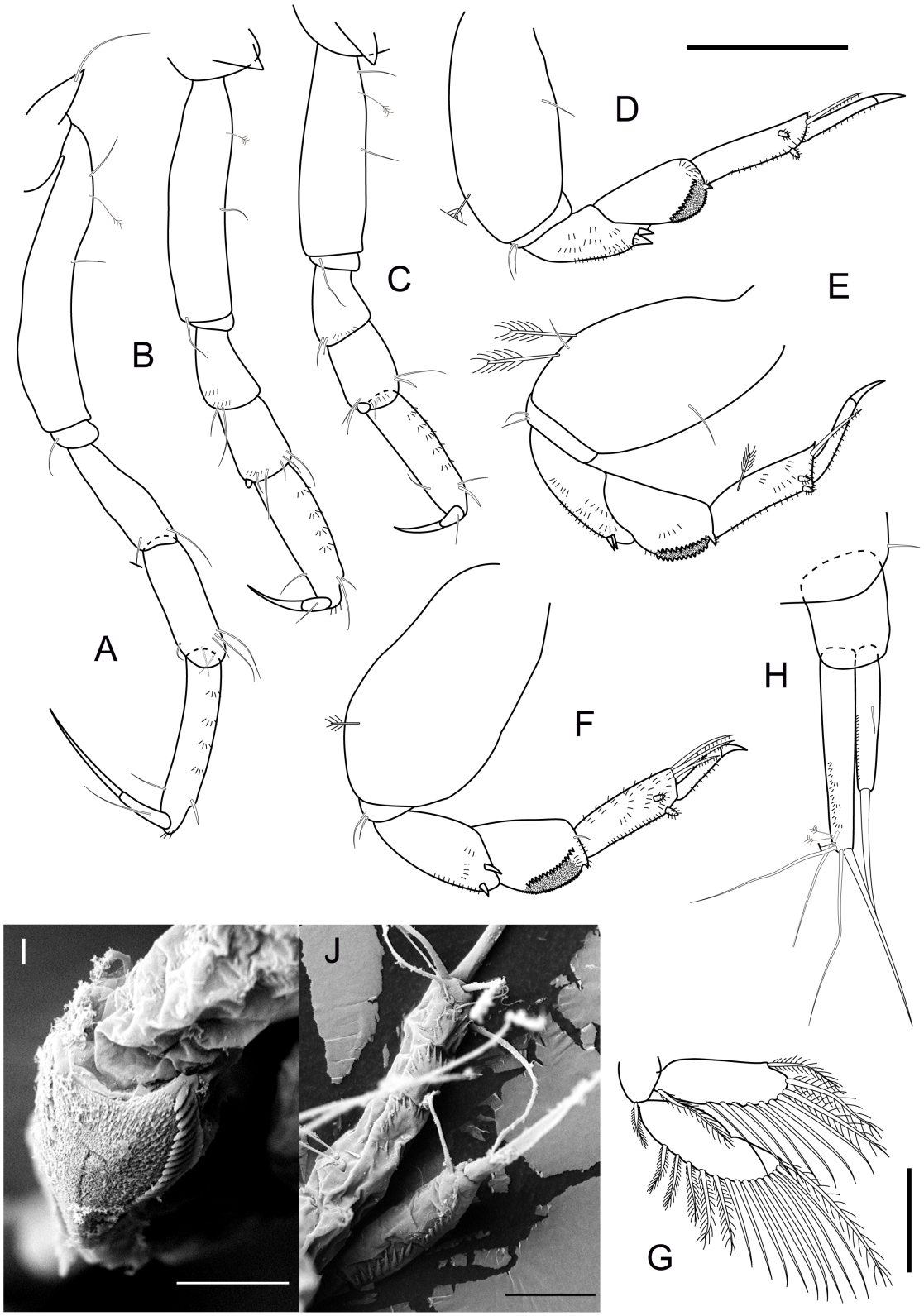

Fig. 13. *Typhlotanais ischnochela* sp. nov. **A–H**. Paratype (MZUSP 34428), ♀, dissected. **A–F**. Pereopods 1–6. **G**. Pleopod. **H**. Uropod. **I–J**. Additional material, ♀ (MZUSP 38014). **I**. Detail of pereopod prickly tubercles surrounded by spines. **J**. Detail of uropod microtrichia. Scale bars: A–H = 0.1 mm; I = 0.01 mm; J = 0.02 mm.

Cheliped (Fig. 12H). Basis distally rounded, 2.1× L:W, with simple dorsoproximal seta; merus subtriangular, with ventral seta; carpus 4.3× L:W, with two long (one almost 3.0× longer than the other) and minute ventral setae; and five minute setae along dorsal margin; propodus about as long as carpus, 3.9× L:W, with penicillate and simple setae near dactylus insertion (one on inner and one on outer side); fixed finger with two simple ventral setae; cutting edge with three setae and margin undulated distally; dactylus as long as fixed finger, with minute dorsoproximal seta.

Pereopod-1 (Fig. 13A). Walking type; slender, longer than others; coxa with apophysis and seta; basis elongate, 5.6× L:W, with simple and penicillate dorsoproximal and simple middorsal setae; ischium with simple ventral seta; merus 3.3× L:W, with simple ventrodistal seta; carpus 3.1× L:W, about as long as merus, with five simple distal setae; propodus 3.7× L:W, as long as carpus, with two simple dorsodistal setae and simple ventral seta; dactylus half as long as unguis, with seta shorter than unguis; dactylus and unguis together about as long as propodus.

Pereopod-2 (Fig. 13B). Walking type; coxa with apophysis and seta; basis elongate 4.0× L:W, with penicillate dorsoproximal and simple middorsal setae; ischium with simple ventral seta; merus 1.4× L:W, with two simple ventrodistal setae; carpus 1.4× L:W, about as long as merus, with five simple distal setae and minute ventrodistal spine; propodus 3.1× L:W, subequal to merus and carpus combined, with two dorsodistal and one simple ventrodistal setae; dactylus 0.5× as long as unguis, with seta; dactylus and unguis together about 0.5× as long as propodus.

Pereopod-3 (Fig. 13C). Similar to pereopod-2, except basis with two simple and one penicillate setae dorsally; merus with simple ventrodistal seta.

Pereopod-4 (Fig. 13D, I). Clinging type; coxa absent; basis robust twice L:W, with penicillate ventral and simple dorsal setae; ischium short, with two setae; merus triangular, about 1.6× L:W, with two distoventral spines and microtrichia; carpus 1.7× L:W, with robust spine dorsodistally and prickly tubercles half length of carpus, surrounded by spines (Fig. 13I); propodus 3.6× L:W, with robust dorsodistal seta, two subdistal ventral spines and numerous microtrichia; dactylus with microtrichia ventrally; dactylus 2.6× as long as unguis; unguis simple, both combined as long as propodus.

Pereopod-5 (Fig. 13E). Similar to pereopod-4, except basis with one simple and two long penicillate ventral setae; propodus with penicillate middorsal seta.

Pereopod-6 (Fig. 13F). Similar to pereopod-4, except basis with single penicillate ventral seta; carpus with simple distal setae; propodus with three robust distodorsal serrate setae; dactylus and unguis combined shorter than propodus.

Pleopod (Fig. 13G). All pleopods similar; basal article naked; exopod with ten plumose setae on outer margin and with plumose seta on inner margin; endopod with sixteen plumose setae on outer margin. Large gap between proximal seta and others in both rami.

Uropod (Fig. 13H–J). 1.6× as long as pleotelson; basis 1.5× L:W, naked; exopod one-articled, 0.7× as long as endopod, with simple medial seta and microtrichia along inner margin, tipped by stout and simple setae and microtrichia along inner margin (Fig. 13J); endopod one-articled; 6.6× L:W, with penicillate seta medially, tipped by one stout, four simple and one penicillate setae.

Distribution

Brazil: Campos Basin, Rio de Janeiro and Espírito Santo Basin, Espírito Santo. Occurring from the continental shelf until the lower slope, depth range from 46 to 1898.7 m (Fig. 21).

Table 3. Diagnostic characters of species of *Typhlotanais* '*greenwichensis*' group (based on females). Abbreviations: A1 = antennule; A2 = antenna; Che = cheliped; P = pereopod; Prop = propodus; Uro = uropod.

specieS	***T. ischnochela* sp. nov.**	***T. compactus* Kudinova-Pasternak, 1966**	***T. greenwichensis* Shiino, 1970**	***T. herthio* Błażewicz-Paszkowycz *et al*., 2012**	***T. messinensis* Sars, 1882**	***T. mimosis* Błażewicz Paszkowycz, 2007**
type locality	Brazil (South Atlantic)	North Pacific	South Shetland Islands (Antarctica)	Bass Strait (Australia)	Sicily (Mediterranean Sea)	Weddell Sea (Antarctica)
depth (m)	75–720	6065	12–757	81–115	37–50	2659–4655
body [L:W]	8.0×	6.2×	7.0×	6.0×	7.0×	8.6×
A1 article-1 [L:W]	about 6×	2.4×	4×	5.3×	3×	about 3×
A1 article-3 [L:W]	about 6×	5×	3×	8.3×	4.4×	3×
A2 article-4 [L:W]	about 9×	6.4×	7×	about 10×	4×	4.3×
Che. carpus [L:W]	> 4×	2×	3×	2.8×	2.5×	2.7×
Che. carpus ventral seta	3×	3×	3×	3×	2×	3×
Che. prop. [L:W]	about 4×	2.6×	3.3×	3.4×	2.8×	3.0×
Che. finger length/prop. length	> ½	> ½	> ½	> ½	½	> ½
P1–3 basis setae	≤ 3	4–5	4–5	≥ 6	2–3	2
P1–3 carpus setae	≤ 5	4–5	≤ 6	≥ 7	≤ 3	3–6
P4–6 carpus prickly tubercles	surrounded by spines	surrounded by spines	surrounded by spines	surrounded by spines	not surrounded by spines	not surrounded by spines
Uro. exopod row of setae	present	absent	absent	present	absent	absent

Remarks

Typhlotanais ischnochela sp. nov. is part of the '*greenwichensis*' group by the presence of a spur on pereopods 1–3 coxae (Table 3). The new species resembles *T. herthio* in general habitus, slender antennule and cheliped, and uropod with microtrichia on exopod lateral margin (Table 3), However it differs from *T. herthio* by (1) cheliped carpus very slender, more than 4.0× L:W (stouter in *T. herthio*, 2.8× L:W); (2) cheliped propodus slender, about 4.0× L:W (3.4× L:W in *T. herthio*); (3) pereopods 1–3 basis with at most three setae (more than six in *T. herthio*); and (4) pereopods 1–3 carpus with at most five setae (seven or more in *T. herthio*).

Typhlotanais ischnochela sp. nov. differs from *T. greenwichensis* and *T. messinensis* by (1) antennule article-1 very slender, about 6.0× L:W (*T. messinensis* 3.0× and *T. greenwichensis* 4.0× L:W); (2) antennule article-3 long, about 6.0× L:W (*T. messinensis* 4.4× and *T. greenwichensis* 3.0× L:W); (3) antenna article-4 slender, about ninex L:W (*T. messinensis* 4.0× and *T. greenwichensis* 7.0× L:W); (4) cheliped carpus elongate, more than 4.0× L:W (*T. messinensis* 2.5× and *T. greenwichensis* 3.0×

L:W); (5) cheliped propodus long, about 4.0× L:W (*T. messinensis* 2.8× and *T. greenwichensis* 3.3× L:W); and (6) uropod exopod with microtrichia along inner margin.

"*spinicauda*" group

Species included

Typhlotanais spinicauda Hansen, 1913; *Typhlotanais squamiger* Błażewicz-Paszkowycz, 2007; *T. priscilae* sp. nov.

Typhlotanais priscilae sp. nov.

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Figs. 14–16, 21

Diagnosis

Body 5.0× L:W; cephalothorax rounded; antenna article-3 with long seta reaching half-length of article-4; pereopod-1 carpus with two distal long setae (one dorsal and one ventral); pereopods 2–3 ischium with stout seta as long as merus distal margin; propodus with ventrodistal seta; dactylus with seta twice as long as unguis; pereopods 4–6 propodus seta longer than dactylus and unguis combined; uropod stout, 0.9× as long as pleotelson; exopod one-articled, 0.9× as long as endopod; endopod one-articled, 3.0× L:W.

Etymology

Named in honour of MSc. Priscila Soares do Nascimento (Museu Nacional/UFRJ) in recognition of her friendship, collaboration, and great enthusiasm during many years at the Carcinology Lab of Museu Nacional/UFRJ.

Material examined

Holotype

BRAZIL – **Espírito Santo State** • ♀ ovigerous, length 1.2 mm; Espírito Santo Basin; stn AMB 8 E7 R1; 19.7850° S, 39.0533° W; depth 1258 m; 28 Jan. 2012; MZUSP 38972.

Paratypes

BRAZIL – **Rio de Janeiro State** • 1 neuter (dissected), length 1.2 mm; Campos Basin, stn HAB 3 C8 R1; 23.0257° S, 40.7565° W; depth 975 m; 10 May 2008; MZUSP 38017. – **Espírito Santo State** • 1 neuter; Espírito Santo Basin, stn AMB 6 CAMWN 6 R1; 19.8914° S, 39.5487° W; depth 1023 m; 13 Jan. 2012; MZUSP 38962.

Additional material (lost in the fire)

BRAZIL – **Rio de Janeiro State** • 2 neuters; Campos Basin, HAB 3 C8 R3; 23.0257° S, 40.7565° W; depth 975 m; 10 May 2008; MZUSP 22907 • 1 neuter; Campos Basin, stn HAB 3 B8 R2; 23.2298° S, 40.9323° W; depth 986.4 m; 8 May 2008; MZUSP 32867 • 1 neuter; Campos Basin, stn HAB 3 B8; 23.2298° S, 40.9323° W; depth 986.4 m; 8 May 2008; MZUSP 34436.

Description

Paratype (MZUSP 38009 dissected)

Measurements. Length 1.2 mm. Body (Fig. 14A–B) slender, 5.1× L:W. Cephalothorax rounded 1.1× L:W, 1.1× as long as pereonite-1, naked; eyes absent.

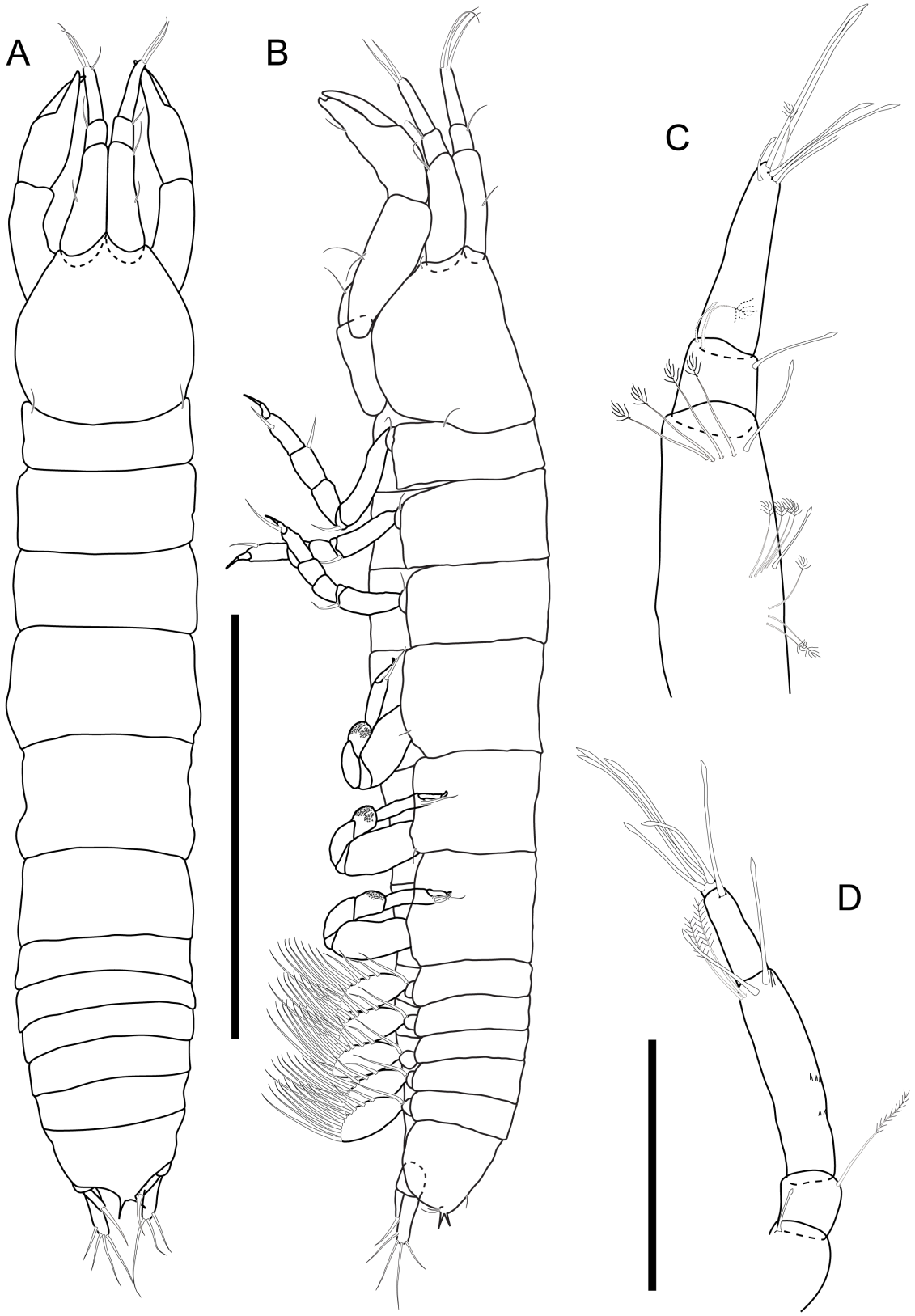

Fig. 14. *Typhlotanais priscilae* sp. nov., ♀, dissected (MZUSP 38009). **A**. Dorsal view. **B**. Lateral view. **C**. Antennule. **D**. Antenna. Scale bars: A–B = 1 mm; C–D = 0.1 mm.

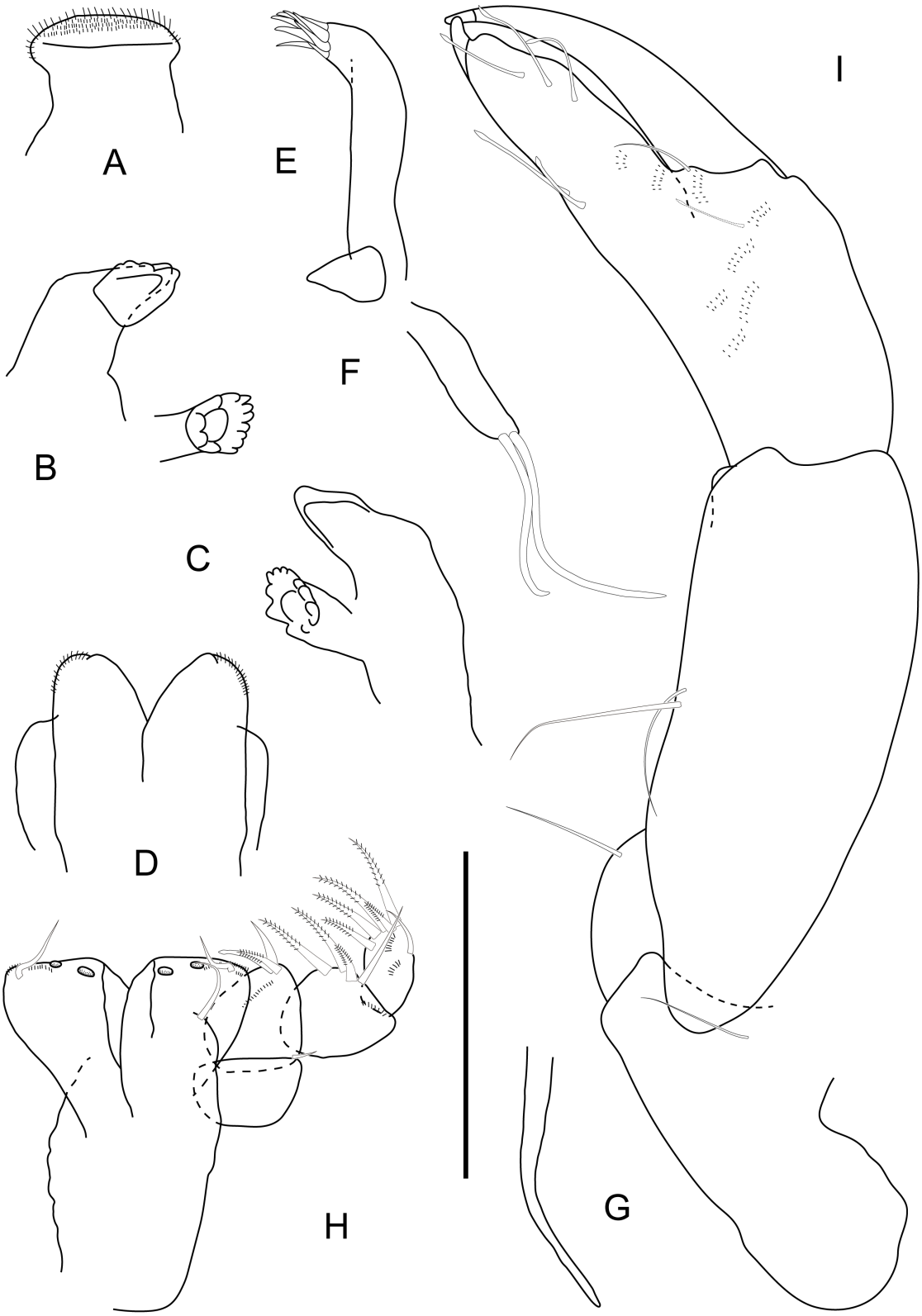

Fig. 15. *Typhlotanais priscilae* sp. nov., ♀, dissected (MZUSP 38009). **A**. Labrum. **B**. Left mandible. **C**. Right mandible. **D**. Labium. **E**. Maxillule. **F**. Maxilla. **G**. Epignath. **H**. Maxilliped. **I**. Cheliped. Scale bar = 0.1 mm.

Pereonites 1–6. All pereonites rectangular, longer than wide, with lateral margins gently convex; pereonite-1 shortest, 0.3 × L:W, with minute seta on proximal margin; pereonite-2 0.5 × L:W; pereonite-3 0.4 × L:W; pereonite-4 0.6 × L:W, with two minute setae on lateral margin; pereonite-5 0.7 × L:W, with minute seta on lateral margin; pereonite-6 0.5 × L:W.

Pleon (Fig. 14A–B) 0.3 × TBL, with five subequal pleonites, together longer than carapace and pereonite-1 combined. Pleotelson trapezoidal 0.6 × L:W, with a pair of terminal spines and three pairs of setae distally.

Antennule (Fig. 14C). As long as cephalothorax, with three articles; article-1 0.6 × TL, 2.3 × L:W, with rod and seven penicillate middle setae, and with rod and four penicillate distal setae; article-2 0.8 × L:W, 0.3 × as long as article-1, with two rod and penicillate distal setae; article-3 3.7 × L:W, 2.3 × as long as article-2, with six rod and penicillate terminal setae.

Antenna (Fig. 14D) of six articles, article-1 lost during dissection; article-2 broken during dissection, with rod seta; article-3 0.9 × L:W, with long penicillate seta (reaching half length of article-4); article-4 3.8 × L:W, 3.8 × as long as article-3, with strong microtrichia on outer margin, two stout rod and two penicillate distal setae; article-5 2.9 × L:W, 0.5 × as long as article-4, with distal rod seta; article-6 minute with five rod terminal setae.

Labrum (Fig. 15A). Rounded, hood-shaped, distally covered by minute setae. Mandible (Fig. 15B–C) molar broad well-developed with many prominent nodules. Left mandible (Fig. 15B) incisor simple, lacinia mobilis well developed, with four lobes; right mandible (Fig. 15C) incisor distally truncated gently undulated, without lacinia mobilis. Labium (Fig. 15D) with distolateral corner finely setose; outer lobe membranous. Maxillule (Fig. 15E) endite with eight terminal spines (one short); palp with two distal stout setae. Maxilla (Fig. 15F) triangular. Epignath (Fig. 15G) elongate, linguiform, naked. Maxilliped (Fig. 15H) sparsely setose; basis with simple as long as distal margin of endites; endites with two large gustatory cusps and seta on distal edge and microtrichia on outer corner; palp with four articles; article-1 triangular, naked; article-2 with three inner setae (one simple, one rod and one serrated) and seta on outer margin; article-3 with three serrated and one simple inner setae; article-4 with five serrated inner setae and subdistal outer seta.

Cheliped (Fig. 15I). Slender, basis elongate, distally rounded, 2.6 × L:W, with dorsodistal seta; merus subtriangular, with ventral seta; carpus 2.1 × L:W, with two ventral setae; propodus 1.1 × as long as carpus, 2.6 × L:W, with two setae near dactylus insertion (one on inner and one on outer side); fixed finger with two rod ventral setae; cutting edge almost simple, with small subdistal protrusion and three rod setae; dactylus as long as fixed finger.

Pereopod-1 (Fig. 16A). Walking type, with strong microtrichia; slender, longer than others; coxa with seta; basis elongate 4.6 × L:W, naked; ischium with ventral stout seta; merus 1.6 × L:W, with dorsodistal rod and ventrodistal simple setae; carpus 1.7 × L:W, slightly longer than merus, with two dorsodistal (one long and one short) and two ventrodistal setae (one long and one short); propodus 2.6 × L:W, 1.1 × as long as carpus, with three stout dorsodistal and one ventrodistal setae; dactylus 1.2 × as long as unguis, with seta as long as unguis; dactylus and unguis together 0.8 × as long as propodus.

Pereopod-2 (Fig. 16B). Walking type, with strong microtrichia; coxa with seta; basis 3.6 × L:W, naked; ischium with ventral stout seta (as long as merus distal margin); merus about as long as wide, with dorsodistal and ventrodistal setae; carpus 0.8 × L:W, with dorsodistal seta and ventrodistal robust spine; propodus 1.9 × L:W, 0.7 × as long as merus and carpus combined, with two dorsodistal (one slightly serrated and one rod) and ventrodistal simple setae; dactylus 1.2 × as long as unguis, with long seta twice as long as unguis (broken during dissection); dactylus and unguis together 0.9 × as long as propodus.

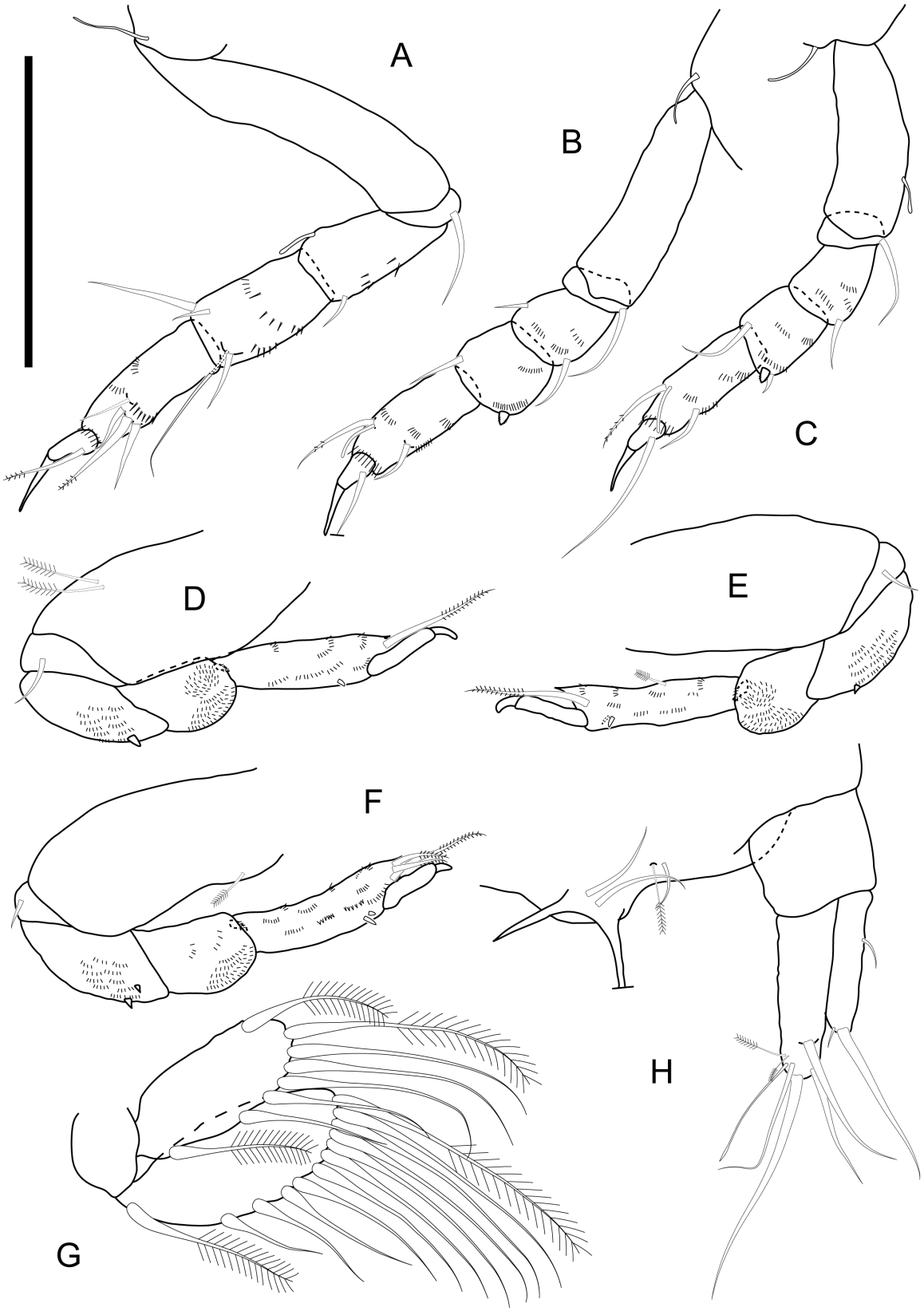

Fig. 16. *Typhlotanais priscilae* sp. nov., ♀, dissected (MZUSP 38009). **A–F**. Pereopods 1–6. **G**. Pleopod. **H**. Uropod. Scale bar = 0.1 mm.

Table 4. Diagnostic characters of species of *Typhlotanais* '*spinicauda*' group (based on females). Abbreviations: A2 = antenna; P = pereopod; Prop. = propodus; Uro. = uropod.

species	*T. priscilae* sp. nov.	*T. spinicauda* Hansen, 1913	*T. squamiger* Błażewicz-Paszkowycz, 2007
type locality	Brazil (South Atlantic)	Davis Strait (Arctic)	Weddell Sea (Antarctic)
depth (m)	975–1258	768–1209	4929–4931
body [L:W]	5.0 ×	7.5 ×	8.3 ×
A2 article-3 seta	long seta (reaching half length of article-4)	absent	absent
P1–3 ischium seta	long	minute	minute
P2–3 prop. ventrodistal ornam.	seta	spine	spine
P2–3 dactylus seta	present (2 × longer than unguis)	present (shorter than unguis)	present (shorter than unguis)
P4–6 prop. seta	longer than unguis	shorter than unguis	shorter than unguis
Uro. length/ pleotelson length	0.9 ×	1.6 ×	1.2 ×
Uro. exopod	1-articled	2-articled	2-articled
Uro. exopod length/ endopod length	0.9 ×	0.4 ×	0.5 ×
Uro. endopod	1-articled	2-articled	2-articled
Uro. endopod [L:W]	3.0 ×	8.0 ×	10.0 ×

Pereopod-3 (Fig. 16C). Similar to pereopod-2, except basis 2.7 × L:W, with ventral rod seta; merus with one ventrodistal seta; carpus 1.1 × L:W; propodus 2.4 × L:W.

Pereopod-4 (Fig. 16D). Clinging type, with strong microtrichia; coxa absent; basis robust 1.3 × L:W, with two long penicillate ventral setae; ischium with seta; merus triangular about 2.2 × L:W, with two ventrodistal spines (only one illustrated); carpus 1.5 × L:W, with dorsodistal spine and prickly tubercles about as long as half carpus; propodus 3.1 × L:W, with slightly serrated dorsodistal seta longer than unguis and two ventrodistal spines (only one illustrated); dactylus 3.2 × as long as unguis, both combined 0.9 × as long as propodus.

Pereopod-5 (Fig. 16E) similar to pereopod-4, except basis 1.7 × L:W, naked; propodus with penicillate middorsal seta.

Pereopod-6 (Fig. 16F). Similar to pereopod-4, except basis twice L:W, with penicillate dorsal seta; propodus with three slightly serrated dorsodistal setae (one longer than and two as long as unguis).

Pleopod (Fig. 16G). All pleopods similar; basal article naked; exopod with seven plumose setae on outer margin and with plumose seta on inner margin; endopod with twelve plumose setae on outer margin; gap between proximal seta and others in both rami.

Uropod (Fig. 16H). Stout, 0.9 × as long as pleotelson; basis 0.8 × L:W, naked; exopod one-articled, 4.4 × L:W, 0.9 × as long as endopod, with simple medial seta, one stout and one minute setae distally; endopod one-articled; 3.3 × L:W, with subdistal stout seta, two rod, two simple and two penicillate setae distally.

Distribution

Brazil: Campos Basin, Rio de Janeiro and Espírito Santo Basin, Espírito Santo. Occurring on the middle slope, depth range from 975 to 1258 m (Fig. 21).

Remarks

Typhlotanais priscilae sp. nov. is part of the '*spinicauda*' group by the presence of two strong spines on distal margin of pleotelson (Table 4). The new species can be distinguished from both *T. spinicauda* and *T. squamiger* by its (1) body stout, 5.0× L:W (*T. spinicauda* 7.5× L:W and *T. squamiger* 8.3× L:W); (2) antenna article-3 with long seta reaching half length of article-4; (3) pereopod-1 carpus with two long setae; (4) pereopods 1–3 ischium with long seta; (5) pereopods 2–3 propodus with ventrodistal seta (instead of spine); (6) pereopods 2–3 dactylus with seta twice as long as unguis; (7) pereopods 4–6 propodus seta longer than unguis; (8) uropod stout, 0.9× as long as pleotelson; (9) uropod exopod one-articled, 0.9× as long as endopod; (10) uropod endopod one-articled, 3.0× L:W.

"*trispinosus*" group

Species included

Typhlotanais spatulasetosus Larsen, 2012; *T. tenuicornis* Sars, 1882; *T. trispinosus* Hansen, 1913; *T. spinibasis* sp. nov.

Typhlotanais spinibasis sp. nov.

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Figs. 17–21

Diagnosis

Pereonites 1–3 elongated, longer than wide; carapace 1.2× as long as pereonite-1; antenna article-2 and 3 without ventral hooks; pereopods 1–3 ischium with long seta extending beyond merus distal margin; merus with long ventrodistal seta extending beyond carpus distal margin; pereopods 2–3 carpus with long ventral seta reaching half length of propodus; pereopods 2–3 propodus with two simple dorsodistal (one longer than unguis) dorsodistally and spine ventrodistally; pereopods 2–3 dactylus with seta longer than dactylus and unguis combined; and pereopods 4–6 basis with large and conspicuous spines.

Etymology

Named after the conspicuous and strong spines on pereopods 4–6 basis.

Material examined

Holotype

BRAZIL – **Espírito Santo State** • neuter, length 2.4 mm; Espírito Santo Basin, stn AMB 5 A7 R3; 21.0793° S, 40.0752° W; depth 1294 m; 31 Dec. 2011; MZUSP 37680.

Paratypes

BRAZIL – **Rio de Janeiro State** • 1 neuter (dissected, length 2.1 mm), 1 juvenile; Campos Basin, stn HAB 4 F9 R3; 22.4289° S, 39.901° W; depth 1288.5 m; 29 May 2008; MZUSP 32893 • 6 neuters; Campos Basin, stn HAB 9 CANAC 7 R2; 21.7907° S, 40.0320° W; depth 780 m; 6 Feb. 2009; MZUSP 32902. – **Espírito Santo State** • 1 neuter; Espírito Santo Basin, stn AMB 5 A7 R3; 21.0793° S, 40.0752° W; depth 1294 m; 31 Dec. 2011; MZUSP 38955 • 2 neuters; Espírito Santo Basin, stn AMB 11 C6 R1; 20.2598° S, 39.7713° W; depth 1040 m; 9 Jan. 2012; MZUSP 38957 • 1 neuter; Espírito Santo Basin, stn AMB 5 B5 R2; 20.5873° S, 39.8966° W; depth 406 m; 8 Jan. 2012; MZUSP 38958 • 2 neuters; 1 juvenile; Espírito Santo Basin, stn AMB 11 B6 R2; 20.6000° S, 39.8596° W; depth 998 m;

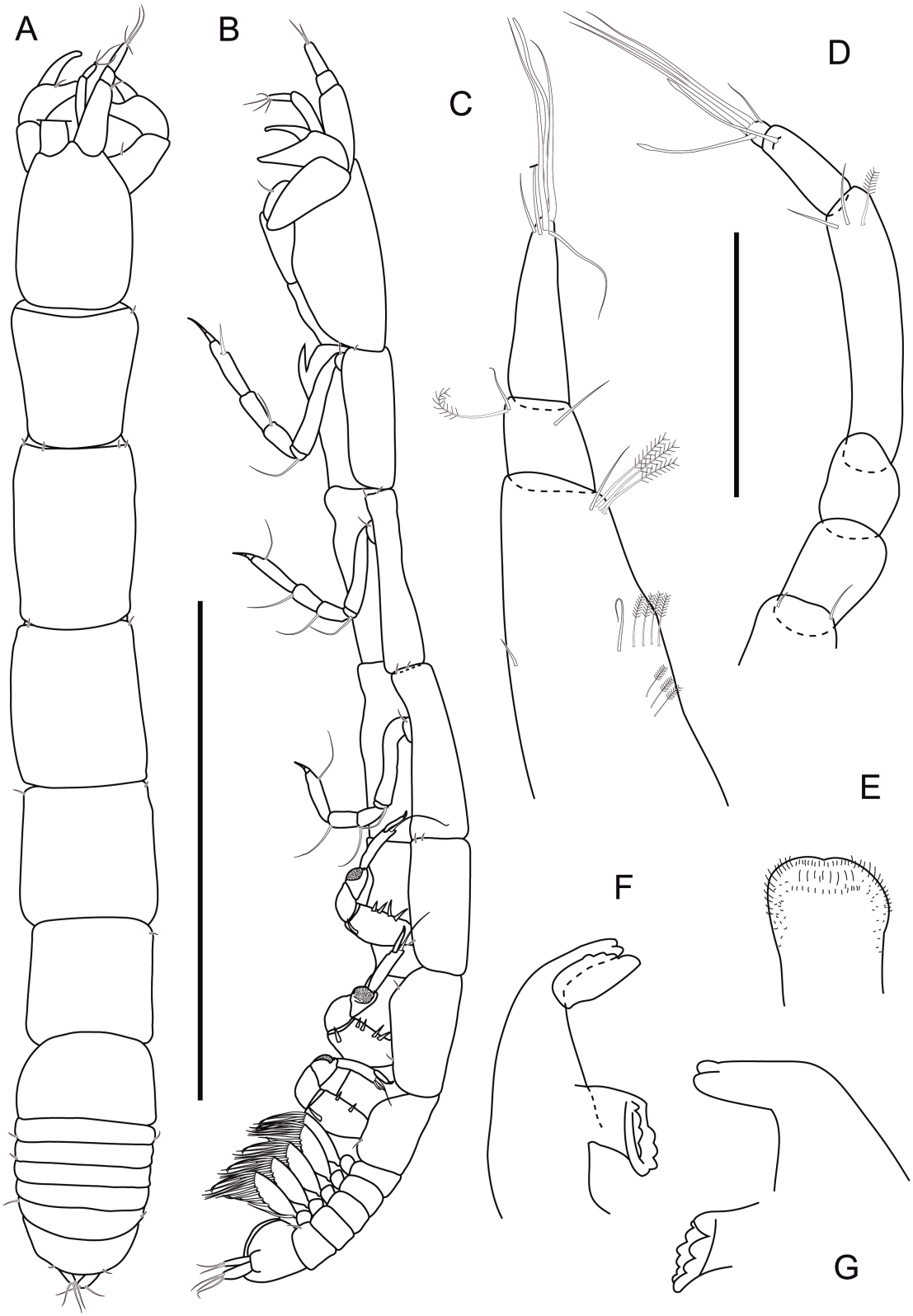

Fig. 17. *Typhlotanais spinibasis* sp. nov. **A–B**. Additional material, ♀ (MZUSP 34473). **A**. Dorsal view. **B**. Lateral view. **C–G**. Paratype (MZUSP 32893), ♀, dissected. **C**. Antennule. **D**. Antenna. **E**. Labrum. **F**. Left mandible. **G**. Right mandible. Scale bars: A–B = 1 mm; C–D = 0.1 mm.

8 Jan 2012; MZUSP 38961 • 1 neuter; Espírito Santo Basin, stn AMB 5 C6 R2; 20.2595° S, 39.7707° W; depth 1041 m; 9 Jan. 2012; MZUSP 38974.

Additional material (lost in the fire)

BRAZIL – **Rio de Janeiro State** • 3 neuters; Campos Basin, stn HAB 4 CANG 7 R2; 21.9367° S, 39.9625° W; depth 720 m; 7 Feb. 2009; MZUSP 32851 • 1 juvenile; Campos Basin, stn HAB 6 CANAC 6 R3; 21.8327° S, 40.1056° W; depth 466.8 m; 28 Jun. 2008; MZUSP 34414 • 1 neuter; Campos Basin, stn HAB 3 C8; 23.0257° S, 40.7565° W; depth 975 m; 10 May 2008; MZUSP 34473 • 2 neuters; Campos Basin, stn HAB 6 CANAC 7 R1; 21.7908° S, 40.0370° W; depth 758.2 m; 28 Jun. 2008; MZUSP 38012 • 1 neuter; Campos Basin, stn HAB 9 H8 R3; 21.6713° S, 39.9684° W; depth 1005.8 m; 6 Feb. 2009; MZUSP 38013 • 1 neuter; Campos Basin, stn HAB 9 CANAC 8 R1; 21.7652° S, 39.9909° W; depth 1030 m; 2 Jun. 2009; MNRJ 25238.

Description

Paratypes (MZUSP 34473; MZUSP 32893 dissected)

Body (Fig. 17A–B). Slender, 8.5 × L:W. Cephalothorax 1.4 × L:W, 1.2 × as long as pereonite-1, naked; eyes absent.

Pereonites 1–6. All pereonites rectangular, with lateral margins parallels; pereonites 1–3 longer than wide, with setae on proximal margin, pereonites 4–6 with lateral setae; pereonite-1 1.2 × L:W; pereonite-2 1.5 × L:W; pereonite-3 1.2 × L:W; pereonite-4 once L:W; pereonite-5 0.9 × L:W; pereonite-6 shortest, 0.6 × L:W.

Pleon (Fig. 17A–B). 0.14 × TBL, with five subequal pleonites, together almost as long as carapace, with lateral setae. Pleotelson distally gently rounded, with a pair of setae distally.

Antennule (Fig. 17C). 0.7 × as long as cephalothorax, with three articles; article-1 0.6 × TL, 2.1 × L:W, with two simple middle setae and seven (or more) penicillate setae (broken), and with one simple and three penicillate setae distally; article-2 about as long as wide, 0.2 × as long as article-1, with two simple and one penicillate distal setae; article-3 3.5 × L:W, 2.5 × as long as article-2, with five simple terminal setae and aestethasc.

Antenna (Fig. 17D). Of six articles, article-1 with two distal setae, fused with body; article-2 1.2 × L:W, naked; article-3 1.2 × L:W, about as long as article-2, naked; article-4 4.2 × L:W, about 2.6 × as long as article-3, with two simple and one penicillate setae distally; article-5 2.4 × L:W, 0.4 × as long as article-4, with distal seta; article-6 minute with five terminal setae.

Labrum (Fig. 17E). Covered by minute setae (view from the top). Mandible (Fig. 17F–G) molar broad with prominent nodules. Left mandible (Fig. 17F) incisor with two lobe, lacinia mobilis well developed, gently crenulated; right mandible (Fig. 17G) as left, but without lacinia mobilis. Maxillule (Fig. 18A) endite with seven to eight terminal spines and microtrichia on outer and inner margins; palp with two distal setae. Maxilla (Fig. 18B) triangular. Labium (Fig. 18C) with distolateral corner finely setose; outer lobe membranous, finely setose. Maxilliped (Fig. 18D) sparsely setose; basis with simple seta not reaching distal margin of endites; endites unfused, with simple seta, two large gustatory cusps on distal edge and microtrichia on outer corner; palp with four articles; article-1 triangular, naked; article-2 with two serrated and one rod on inner margin and simple setae on outer margin; article-3 with three serrated and one simple inner setae; article-4 with five serrated inner setae and simple subdistal outer seta. Epignath not observed.

Fig. 18. *Typhlotanais spinibasis* sp. nov., paratype (MZUSP 32893), ♀, dissected. **A**. Maxillule. **B**. Maxilla. **C**. Labium. **D**. Maxilliped. **E**. Cheliped. Scale bar = 0.1 mm.

Cheliped (Fig. 18E). Stout, basis distally rounded, 1.8× L:W, with minute seta dorsally; merus subtriangular, with ventral seta; carpus stout 1.3× L:W, with two ventral setae; one middle and one dorsodistal simple setae; propodus 1.4× as long as carpus, 1.9× L:W, with two setae near dactylus insertion (one on inner and one on outer side); fixed finger with two simple setae ventrally; cutting edge with three setae; dactylus slightly curved, as long as fixed finger, with one dorsoproximal and two midventral simple setae.

Pereopod-1 (Fig. 19A). Walking type; slender; coxa with seta; basis elongate 5.9× L:W, naked; ischium with long ventral seta (extending beyond merus distal margin); merus twice L:W, slightly shorter than carpus, with long ventrodistal seta (almost reaching carpus distal margin; article folded upwards); carpus 2.5× L:W, with four simple setae distally; propodus 4.5× L:W, 1.6× as long carpus, with two robust and one simple dorsodistal setae, and minute ventral seta; dactylus just half as long as unguis, with seta shorter than unguis; dactylus and unguis together half as long as propodus.

Pereopod-2 (Fig. 19B). Walking type; coxa with seta; basis elongate 5.7× L:W, naked; ischium with long ventral seta (extending beyond merus distal margin); merus 1.8× L:W, subequal to carpus, with one short and one long ventrodistal setae (extending beyond carpus distal margin); carpus 1.9× L:W, with two long (one half as long as propodus and one almost reaching propodus distal margin) and one short setae; propodus 4.1× L:W, 0.9× as long as merus and carpus combined, with two simple dorsodistal (one longer than unguis) and one ventrodistal minute setae; dactylus with seta longer than unguis.

Pereopod-3 (Fig. 19C). Similar to pereopod-2, except carpus with long ventrodistal seta (almost reaching propodus distal margin); propodus 3.6× L:W; dactylus 0.5× as long as unguis; dactylus and unguis together 0.3× as long as propodus.

Pereopod-4 (Fig. 19D). Clinging type; coxa absent; basis robust 1.9× L:W, with six big and strong spines dorsally; simple and two long penicillate setae and big and strong spine ventrally; ischium short, with seta; merus triangular about 1.4× L:W, with spine and seta ventrodistally and microtrichia; carpus 1.3× L:W, with simple seta and robust spine dorsodistally, and prickly tubercles almost as long as carpus; propodus 4.4× L:W, with penicillate middorsal seta, long dorsodistal seta (twice as long as dactylus and unguis combined), subdistal ventral spine and numerous microtrichia; dactylus with small microtrichia dorsally; dactylus 3.2× as long as unguis, both combined 0.6× as long as propodus.

Pereopod-5 (Fig. 19E). Similar to pereopod-4, except basis 1.4× L:W, with seven big and strong spines dorsally; simple and long penicillate setae and big and strong spine ventrally; propodus 4.4× L:W, with long dorsodistal seta and subdistal ventral spine.

Pereopod-6 (Fig. 19F). Similar to pereopod-4, except basis with nine big and strong spines and long penicillate seta dorsally; merus triangular 1.1× L:W, with two spine ventrodistally; carpus once L:W; propodus 3.9× L:W, with two serrate and one long dorsodistal setae (longer than dactylus and unguis combined).

Pleopod (Fig. 19G). All pleopods similar; basal article naked; exopod with six plumose setae on outer margin and with plumose seta on inner margin; endopod with eleven plumose setae on outer margin. Large gap between proximal seta and others in both rami.

Uropod (Fig. 19H). Stout, 0.7× as long as pleotelson; basis 1.2× L:W, naked; exopod one-articled, 0.8× as long as endopod, with simple medial seta and tipped by stout and simple setae; endopod one-articled; 3.4× L:W, with two penicillate setae medially, tipped by five simple and two penicillate setae.

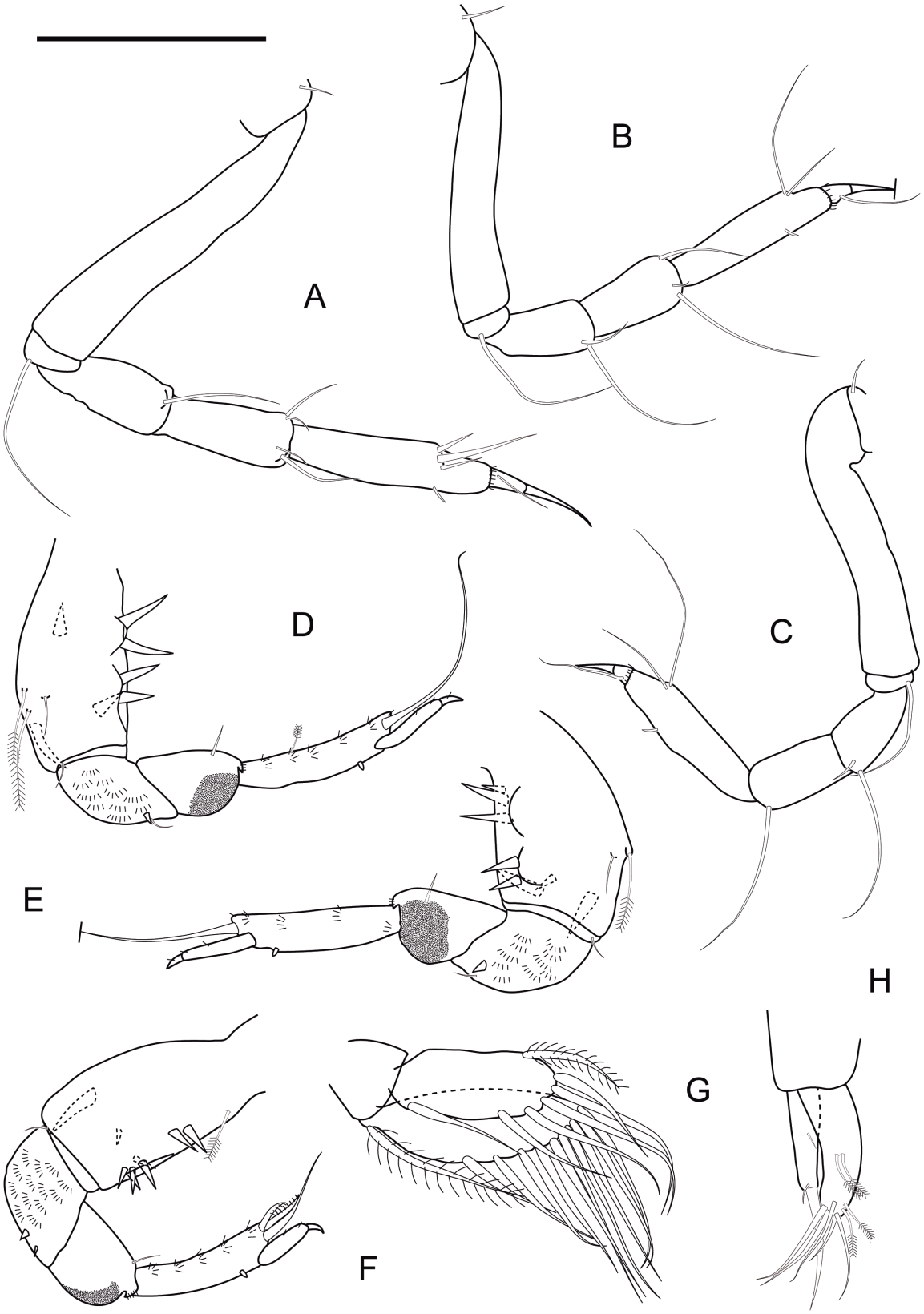

Fig. 19. *Typhlotanais spinibasis* sp. nov., paratype (MZUSP 32893), ♀, dissected. **A–F**. Pereopods 1–6. **G**. Pleopod. **H**. Uropod. Scale bar = 0.1 mm.

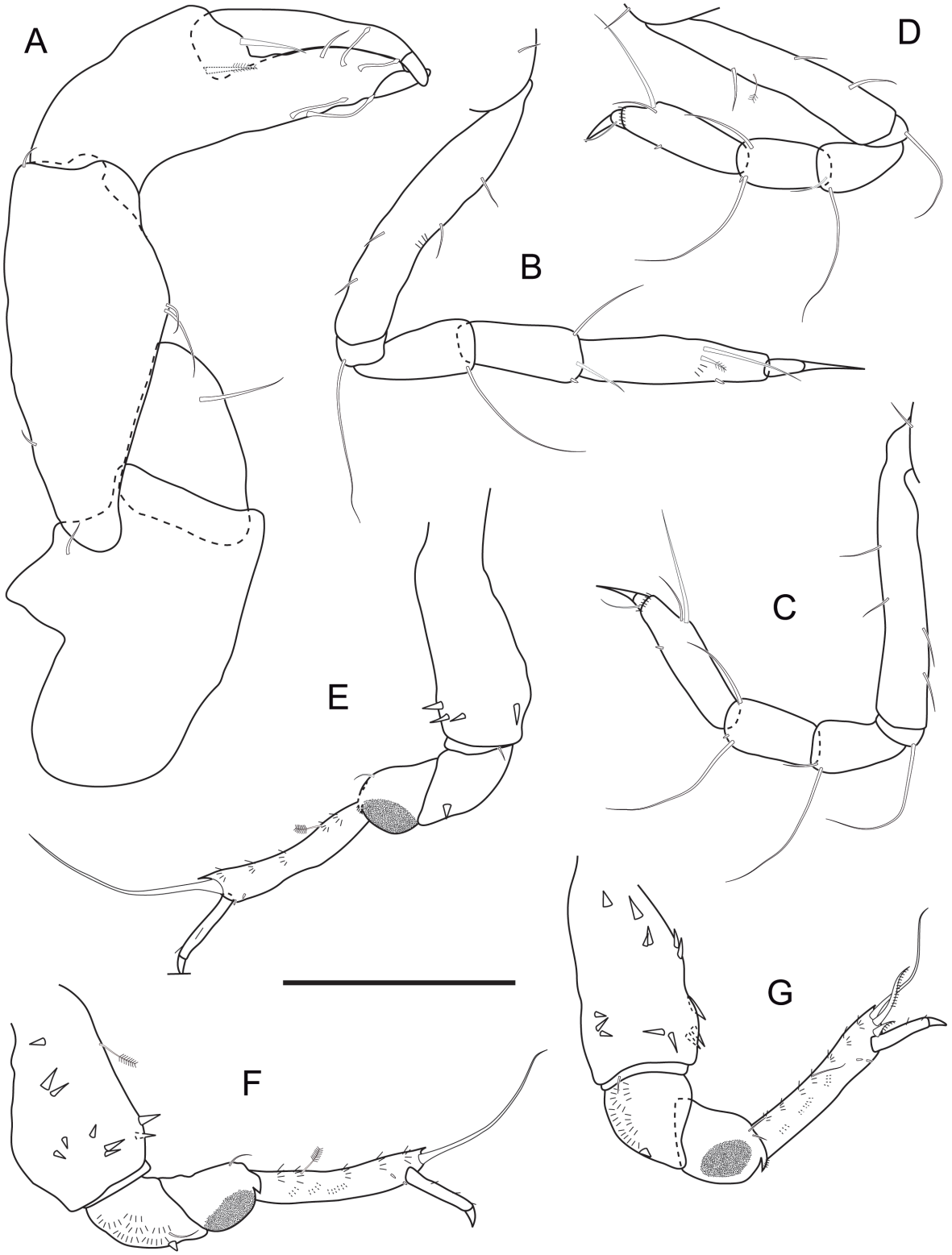

Fig. 20. *Typhlotanais spinibasis* sp. nov., paratype (MZUSP 38011), ♀, dissected. **A**. Cheliped. **B–G**. Pereopods 1–6. Scale bar = 0.1 mm.

Morphological variation

Based on paratype MZUSP 38011

Cheliped (Fig. 20A). More slender, basis twice L:W; merus with two ventral setae; carpus 1.6 × L:W.

Pereopod-1 (Fig. 20B). Basis with two dorsal and two ventral setae; merus as long as carpus, with long ventrodistal seta (extending beyond carpus distal margin); carpus with two simple setae distally (one almost reaching half length of propodus); propodus 3.9 × L:W, with two simple and one serrate dorsodistal setae, and ventral spine.

Pereopod-2 (Fig. 20C). Basis elongate 6.6 × L:W, with two dorsal and two ventral setae; carpus with one dorsodistal and one ventrodistal long setae (one extending beyond half length of propodus and one almost reaching propodus distal margin); propodus 3.5 × L:W, with spine ventrodistally.

Pereopod-3 (Fig. 20D). Basis with simple and penicillate dorsal setae; propodus 2.8 × L:W.

Pereopod-4 (Fig. 20E) basis slender, about 2.8 × L:W, with four spines distally; ischium with seta; merus with spine ventrodistally; propodus 5.4 × L:W; dactylus with small microtrichia dorsally.

Pereopod-5 (Fig. 20F). Basis robust with several spines along the article and penicillate dorsal seta; propodus with two subdistal ventral spines and numerous microtrichia; dactylus over 4.0 × as long as unguis.

Pereopod-6 (Fig. 20G). Carpus with two setae dorsodistally; propodus with middorsal seta, two serrate and one long dorsodistal setae (less than twice as long as dactylus and unguis combined).

Distribution

Brazil: Campos Basin, Rio de Janeiro and Espírito Santo Basin, Espírito Santo. Occurring on the upper and middle slope, from the depth range 406 to 1299.3 m (Fig. 21).

Remarks

We classified *Typhlotanais spinibasis* sp. nov. in the '*trispinosus*' group based on the presence of very long seta on pereopods 1–3 ischium (Table 5). The new species resembles *T. spatulasetosus*, but can be distinguished from it by having (1) antenna article-3 without ventral hooks; (2) cheliped carpus with two ventral seta (instead of three); (3) pereopods 2–3 merus with long ventral seta reaching distal margin of carpus; (4) pereopods 2–3 carpus with long setae reaching half length of propodus; (5) pereopods 2–3 propodus with seta longer than dactylus and unguis combined; and (6) pereopods 4–6 basis with large and conspicuous spines. *Typhlotanais spinibasis* sp. nov. also lacks ventral hooks on antenna article 2 as seen in other species of *Typhlotanais*.

Typhlotanais spinibasis sp. nov. differs from both *T. tenuicornis* and *T. trispinosus* by having (1) antenna article-2 and 3 without ventral hooks; (2) pereopods 2–3 carpus with long ventral seta reaching half length of propodus; and (3) pereopods 4–6 basis with large and conspicuous spines. Also, the new species is distinguished from these three '*trispinosus*' group species by having slender pereonites 1–3, all longer than wide, and pereonite-1 slightly shorter than carapace.

As already mentioned, only *Typhlotanais plicatus*, *T. spinipes* and *T. bolarticulus* sp. nov. have pereopods 4–6 and/or pereopods 2–3 bases with spines. *Typhlotanais spinibasis* sp. nov. is distinguished from *T. plicatus* by pereonites 1–3 not been corrugated, *T. bolarticulus* sp. nov. by pereopods 1–3 ischium with seta shorter than merus, and from *T. spinipes* by (1) body long, 8.5 × L:W (5.2 × in *T. spinipes*); and (2) uropods rami one-articled (two-articled in *T. spinipes*).

Table 5. Diagnostic characters of species of *Typhlotanais* '*trispinosus*' group (based on females). Abbreviations: A1 = antennule; A2 = antenna; Che = cheliped; P = pereopod; Prop = propodus; ? = character state unknown.

species	***T. spinibasis*** **sp. nov.**	***T. spatulasetosus*** **Larsen, 2012**	***T. tenuicornis*** **Sars, 1882**	***T. trispinosus*** **Hansen, 1913**
type locality	Brazil (South Atlantic)	Macaronesia (Northeast Atlantic)	Denmark (North Atlantic)	Davis Strait (North Atlantic)
depth (m)	975–1288	?	218	1435
body [L:W]	8.5×	12.0×	8.5×	8.0×
A1 article-3 spur	absent	present	absent	absent
A2 article-2 hooks	0	0	2	1
A2 article-3 hooks	0	3	2	3
Che. carpus ventral seta	2 simple	3 simple	3 simple	3 (2 simple and 1 rod)
P1 merus ventral seta	shorter than carpus	reaching carpus distal margin	reaching carpus distal margin	shorter than half carpus
P1–3 ischium ventral seta	reaching merus distal margin	reaching merus distal margin	reaching carpus distal margin	reaching carpus distal margin
P2–3 merus ventral seta	reaching carpus distal margin	shorter than half carpus	shorter than half carpus	shorter than half carpus
P2–3 carpus ventral seta	longer than half propodus	shorter than half carpus	shorter than half carpus	shorter than half carpus
P2–3 prop. seta	longer thanlunguis	shorter than unguis	shorter than unguis	shorter than unguis
P4–6 basis spines	present	absent	absent	absent
P4–6 carpus prickly tubercles	not surrounded by spines	not surrounded by spines	not surrounded by spines	surrounded by spines

The most abundant intraspecific variation found was the type with bigger spines on the pereopods 4–6 basis. These two morphological variations are probably two different species, however as the material was destroyed during the fire and the new type material designated for *T. spinibasis* sp. nov. was from the intraspecific variation with bigger spines on the pereopods 4–6 basis, the authors decided to treat them as the same species for the moment.

Key to Typhlotanaidae species in the Brazilian coast (neuter and female only)

1. Pereopods 4–6 carpus with prickly tubercles ..... 2 (***Typhlotanais*** Sars, 1882)
– Pereopods 4–6 carpus without prickly tubercles (with specialized hooks/or variable spines form) . 7

2. Pereopods 1–3 coxae without spur 3
– Pereopods 1–3 coxae with spur ..... ***Typhlotanais ischnochela*** sp. nov.

3. Pereopods 1–3 ischium with seta shorter than merus; pereopods 4–6 basis without conspicuous spines 4
– Pereopods 1–3 ischium with long seta reaching distal margin of merus; pereopods 4–6 basis with conspicuous spines ..... ***Typhlotanais spinibasis*** sp. nov.

4. Pleotelson distal margin lacking spines 5
– Pleotelson distal margin with two strong spines ..... ***Typhlotanais priscilae*** sp. nov.

5. Cheliped basis smooth; pereopod-1 coxa with seta shorter than half of basis length 6
– Cheliped basis with ventral grooves; pereopod-1 coxa with long seta, longer than half of basis length ..... ***Typhlotanais longiseta*** sp. nov.

6. Pereopods 2–3 coxae with very long setae reaching half-length of basis; pereopods 4–6 propodus distal setae shorter than dactylus and unguis combined .....***Typhlotanais andradeorum*** sp. nov.
– Pereopods 2–3 coxae with short setae, less than half of basis; pereopods 4–6 propodus distal setae longer than dactylus and unguis combined; antenna article-2 globose .. ***Typhlotanais bolarticulus*** sp. nov.

7. Pleopods present 8
– Pleopods absent, pleonites with pair of ventral plumose setae ....***Aremus brasilica*** Segadilha, Gellert & Błażewicz, 2018

8. Pereopods 4–6 carpus without specialized hooks (with variable spines form) 9
– Pereopods 4–6 carpus with specialized hooks; unguis with trifurcated tip; body more than 10× L:W .....***Hamatipeda prolata*** Segadilha & Błażewicz, 2019

9. Carapace wider than pereonite-6; pereopods 4–6 merus and carpus with circumplumose spines; dactylus and unguis semi-fused ..... ***Meromonakantha mauri*** Segadilha & Błażewicz, 2019
– Carapace as wide as pereonite-6; pereopods 2–6 merus and carpus with serrated spines; pereopods 4–6 unguis with bifurcated tip; pereopods 4–6 dactylus not fused with unguis ..... 10 (***Paratyphlotanais*** Kudinova-Pasternak & Pasternak, 1978)

10. Cheliped carpus with 9–10 dorsal and 7–8 ventral setae; pereopod-1 coxa with spur present .....***Paratyphlotanais apletos*** Segadilha & Błażewicz, 2019
– Cheliped carpus with two dorsal and two ventral setae; pereopod-1 coxa without spur ....***Paratyphlotanais bessai*** Segadilha & Błażewicz, 2019

Discussion

Typhlotanaidae comprises 14 genera and 116 valid species, of which five species have been reported along the extensive Brazilian coast (Segadilha *et al.* 2019). Herein, we described six new species of *Typhlotanais* from the deep-sea (>200 m) from the Espírito Santo and Campos Basins, Brazil. Only *T. ischnochela* presented a bathymetric range extending onto the continental shelf (Fig. 21). The description of these new typhlotanaid species contributed to an increase of knowledge on our local diversity.

Typhlotanais is a cosmopolitan genus that occurs in all biogeographic zones (Spalding *et al.* 2007; Watling *et al.* 2013). Literature data collected on the distribution of currently recognized species of *Typhlotanais*, together with morphological comparisons between the species described, allow us to highlight that species of *Typhlotanais* from Brazil are more similar to those from the Antarctic and Arctic. However, the collection of *Typhlotanais* studied herein is too restricted to draw a conclusion about zoogeographic relationships.

Most of the analyzed material was stored in the Crustacea Collection at the Museu Nacional (MNRJ) and at the Museu de Zoologia da Universidade de São Paulo (MZUSP) for nearly 20 years as a not identified part of the museal collection. The collection fixed in formalin and preserved in ethanol was in good condition and suitable for taxonomic purposes. Tanaidacean individuals were well sorted from a great number of samples from six projects (REVIZEE, OCEANPROF, HABITATS, AMBES, BCA 185-15 and Peregrino), only few of them became dehydrated after long time storage in vials that eventually dried out, showing the urgency in identifying the museum specimens as their quality may degrade

over time without management. Nevertheless, this rare material turned out to be a remarkable source of information about unique biodiversity on the Brazilian coast, which holds important historical data.

In this context, with new discoveries and investigations of deep-sea communities, our understanding of species richness and ecosystem functioning increases and enhances our knowledge on how to sustainably use them (Rogers *et al.* 2015). Regardless of the efforts, we are still discovering new taxa in these environments. The taxonomic works from understudied regions, such as the coast of Brazil, are essential to provide baseline biodiversity data and act as a springboard for future research in areas as ecology, biogeography and evolution.

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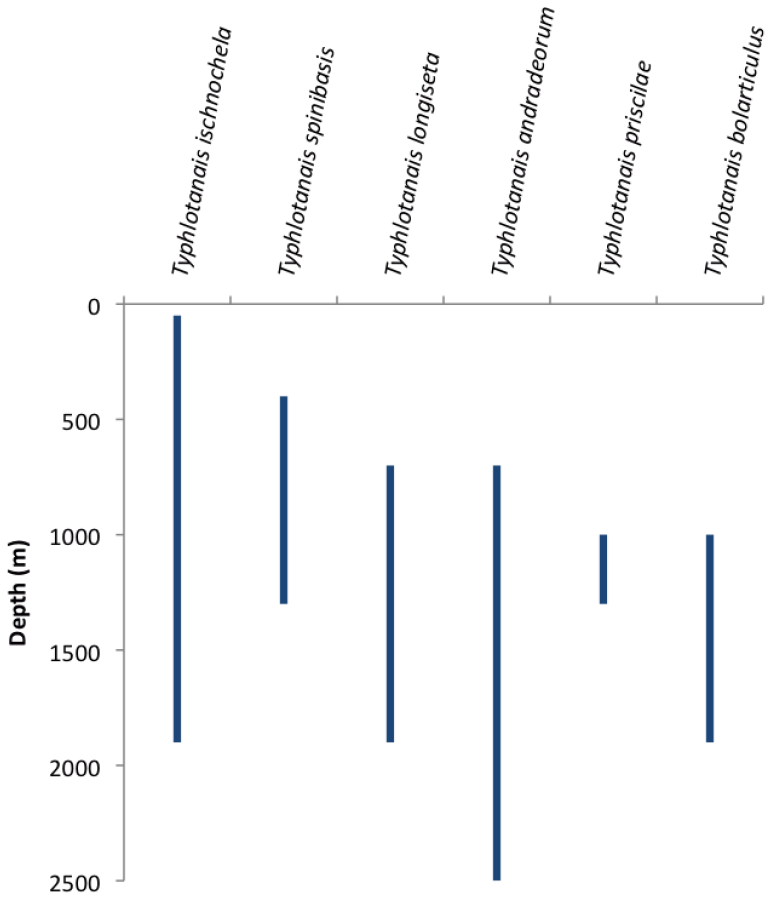

Fig. 21. Bathymetric range of species of *Typhlotanais* along the Brazilian coast (19° S–24° S) based on samples listed in Table 1.

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