

Research article

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Description of a new genus and species of Candonopsini (Crustacea, Ostracoda, Candoninae) from the alluvial valley of the Upper Paraná River (Brazil, South America)

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Abstract. The genus *Candobrasilopsis* gen. nov. is here described, with *C. rochai* gen. nov. sp. nov. as type species, from the alluvial valley of the Upper Paraná River. The enigmatic *Candonopsis brasiliensis* Sars, 1901 is here redescribed and transferred to this new genus, the new combination being *Candobrasilopsis brasiliensis* (Sars, 1901). The new candonid genus belongs to the tribe Candonopsini, because of the absence of the proximal seta on the caudal ramus. It is closely related to *Latinopsis* Karanovic & Datry, 2009, because of the relatively short terminal segment of the mandibular palp (length less than 1.5 times the basal width, while this segment is longer than three times the basal width in *Candonopsis*) and the large and stout b-seta on the T1. However, it differs markedly from *Latinopsis* in the size and shape of the calcified inner lamellae of both valves and in the type of hemipenis. We also discuss the doubtful allocation of several other genera to the Candonopsini, raise *Abcandonopsis* Karanovic, 2004 to generic status and reassess the uncertain position of *Candonopsis anisitsi* Daday, 1905 within *Latinopsis*.

Key words. *Candobrasilopsis rochai* gen. nov. sp. nov., caudal ramus, parallel evolution, taxonomy.

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Introduction

There are approximately 2000 described species and *ca.* 200 described genera of Recent, free-living, non-marine ostracods in the world (Martens *et al.* 2008; Martens & Savatnalinton 2011). About 1000 species and 100 genera of these belong to the family Cyprididae Baird, 1845, and *ca.* 500 species to the family Candonidae Kaufmann, 1900. The latter family was thought to be the most speciose in the northern hemisphere and to be of relatively recent origin (Danielopol 1978), but several recent papers document the presence of (sometimes speciose) lineages in the (sub-)tropics and in the southern hemisphere (Broodbakker 1983; Martens 1992, and several papers on Australian candonids summarised

in Karanovic 2007). Especially the diversity and diversification of the subterranean ostracods in the Pilbara area (NW Australia) is truly astonishing.

Close to 300 species have been described and reported from South America and more than 100 species are known from Brazil (Martens & Behen 1994; Higuti & Martens 2012). Recent work on the alluvial valley of the Upper Paraná River (Higuti *et al.* 2007, 2009a, b, 2010) has contributed significantly to the general knowledge of ecology and biogeography of Brazilian freshwater ostracods, especially those occurring in the pleuston of floating plants. Those same collections also served for taxonomic revisions and several new species and genera have meanwhile been described from lakes, river beds and channels of the Upper Paraná floodplain (Higuti *et al.* 2009c, in press; Higuti & Martens 2012). Most of these new taxa belong to the family Cyprididae; the Candonidae were thus far not treated in any detail.

Here, we describe a new genus and a new species, *Candobrasilopsis rochai* gen. nov. sp. nov. and re-describe an old enigmatic species, *Candonopsis brasiliensis* Sars, 1901, which was labelled *incertae sedis* by Karanovic & Marmonier (2002), confirmed by Karanovic & Datry (2009). This species is here also transferred to *Candobrasilopsis* gen. nov. We discuss the taxonomy of the tribe Candonopsini as well as the position of several species and genera.

Material and Methods

Study area

The alluvial valley formed by the Upper Paraná River incorporates various fluvial systems; each of these has a variety of environment types, ranging from the river itself, over connecting channels linking with open lakes and, finally, closed lakes. The Upper Paraná River consists of a large braided channel, with an extensive floodplain (maximum width of 20 km) and high sediment accumulation in its bed, creating sand bars and islands of diverse sizes (from some hundreds of meters to several kilometers in length) (Agostinho & Zalewski 1996; Agostinho *et al.* 2004). The alluvial valley of the Upper Paraná River, apart from the main channel of the Paraná River, also includes the Ivinhema and Baía Rivers, and associated with it, the isolated lakes of the Taquaruçu area (Souza Filho & Stevaux 2004) (Figure 1).

Material

The material for the present paper was collected in March, July and November of 2004 and in February of 2011, in the alluvial valley of the Upper Paraná River. Ostracods were sampled using a rectangular net (28 cm x 14 cm, mesh size *ca.* 160 µm) hauled close to the sediment-water interface for littoral collections. Floating vegetation (*Eichhornia crassipes*, *Pistia stratiotes*, *Hydrocotyle rannunculoides* and *Salvinia* spp.) was hand-collected, and roots were thoroughly washed in a bucket. The residues were washed in the same hand net.

Water temperature and dissolved oxygen (oxymeter-YSI, YSI Incorporated World Headquarters, Yellow Springs, Ohio, U.S.A.), pH (pHmeter-Digimed, Digimed, São Paulo, Brazil) and electrical conductivity (conductivimeter-Digimed, Digimed, São Paulo, Brazil) were measured close to the surface of the water.

All specimens with OC numbers are stored in the Ostracod Collection of the Royal Belgian Institute of Natural Sciences, Brussels (Belgium). The material with MZUSP numbers is stored in the Museu de Zoologia da Universidade de São Paulo, São Paulo (Brazil).

Morphological analyses

Ostracods were dissected with valves stored dry in micropalaeontological slides and soft part in glycerine in sealed slides. Drawings of soft parts were made with *camera lucida* with a compound microscope (WILD HEERBRUGG). Valves were illustrated and measured using scanning electron microscopy (Philips XL30 SEM at RBINS, Brussels).

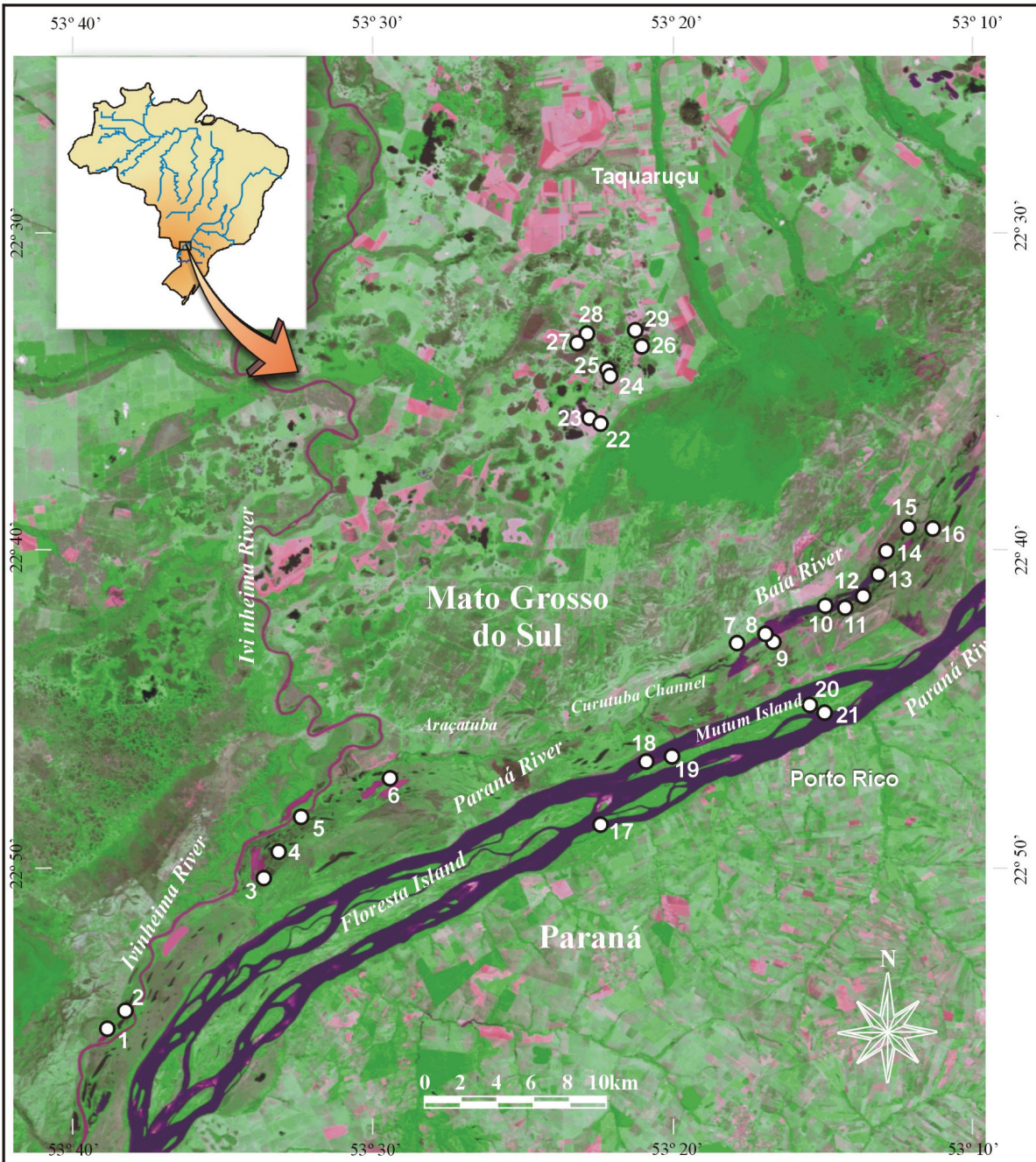


Fig. 1. Map of the area, indicating localities of *Candobrasilopsis rochai* gen. nov. sp. nov. and *C. brasiliensis* (Sars, 1901) comb. nov. were collected. Detailed occurrences are indicated in Table 1. Locality 13 (samples PAR193 and PAR195) is the type locality of *C. rochai* gen. nov. sp. nov.

Table 1. Localities where *Candobrasilopsis rochai* gen. nov. sp. nov. and *Candobrasilopsis brasiliensis* (Sars, 1901) comb. nov. were collected. IVI = Ivinhema River System, BAI = Baía River System, PAR = Paraná River System, TAQ = Taquaruçu System, floating = mixed floating plants, WT= water temperature (°C), EC = electrical conductivity ($\mu\text{S cm}^{-1}$), DO = dissolved oxygen (mg L^{-1}). Number 13 refers to the type locality of *C. rochai* gen. nov. sp. nov. (Table continued on page 5).

Locality name	sample	Data	S°	S'	S''	W°	W'	W''	Loc. type	Subsystem	substrate type	WT	EC	pH	DO	<i>C. rochai</i>	<i>C. brasiliensis</i>
1. Ivinhema	PAR 222	11 Nov. 04	22	54	37.6	53	38	19.4	river	IVI	<i>E. crassipes</i>	25.8	41.3	6.3	5.9	x	x
2. Peroba	PAR 219	11 Nov. 04	22	54	32.8	53	38	23.4	open lake	IVI	<i>E. crassipes</i>	25.6	28.1	5.8	5.6	x	
3. Boca do Ipoitã	PAR 226	11 Nov. 04	22	50	7.3	53	33	58.7	open lake	IVI	<i>E. crassipes</i>	25.7	41.8	5.8	3.5		x
4. Patos	PAR 124	06 Nov. 04	22	49	33.2	53	33	13.8	open lake	IVI	<i>E. crassipes</i>	26	48.2	5.4	2.7		x
5. Capivara	PAR 135	06 Nov. 04	22	47	58.3	53	32	7.8	closed lake	IVI	littoral	27.2	55.9	5.4	0.6		x
6. Jacaré	PAR 137	06 Nov. 04	22	46	59.1	53	29	52.9	closed lake	IVI	<i>P. stratiotes</i>	28.5	35.4	4.7	4.1		x
7. Guaraná	PAR 95	17 Mar. 04	22	43	26	53	18	12	open lake	BAI	<i>P. stratiotes</i>	31.1	52.3	6	2.3		x
7. Guaraná	PAR 207	10 Nov. 04	22	43	16.8	53	18	12.9	open lake	BAI	<i>P. stratiotes</i>	27.4	40.5	5.2	3.3	x	
8. Mané Cotia	PAR 422	01 Feb. 11	22	43	16.4	53	17	0.50	open lake	BAI	<i>E. crassipes</i>	30.5	39.7	5.95	6	x	x
9. Fechada	PAR 28	14 Mar. 04	22	42	40	53	16	29	closed lake	BAI	littoral	28.1	32.5	6.3	5.7	x	x
9. Fechada	PAR 142	07 Nov. 04	22	42	32	53	16	31.6	closed lake	BAI	<i>Sabhinia</i> spp	25.3	27	4.9	2.3		x
10. Pousada das Garças	PAR 26	14 Mar. 04	22	42	12	53	15	33	closed lake	BAI	littoral	27.5	29.3	6.2	4.4		x
10. Pousada das Garças	PAR 146	07 Nov. 04	22	42	2.4	53	15	26	closed lake	BAI	<i>E. crassipes</i>	26.3	29.7	5.5	3.9		x
11. Porcos	PAR 90	17 Mar. 04	22	42	20	53	14	47	open lake	BAI	<i>E. crassipes</i>	29.6	41.3	6.1	3.5		x
11. Porcos	PAR 201	10 Nov. 04	22	42	6.9	53	14	42.5	open lake	BAI	<i>E. crassipes</i>	27.7	41.1	5.5	4.1	x	x
12. Aurélio	PAR 22	14 Mar. 04	22	41	46	53	13	56	closed lake	BAI	littoral	28	36	6	3		x
12. Aurélio	PAR 150	07 Nov. 04	22	41	36.5	53	13	52	closed lake	BAI	floating	26.2	31.1	5	1		x
13. Baía	PAR 83	17 Mar. 04	22	41	8	53	13	3	river	BAI	<i>E. crassipes</i>	29.4	34.4	6	4.5	x	
13. Baía	PAR 192	10 Nov. 04	22	40	37.5	53	12	29	river	BAI	<i>H. ranunculoides</i>	26.7	30.9	5.7	3.1		x
13. Baía	PAR 193	10 Nov. 04	22	40	37.5	53	12	29	river	BAI	<i>P. stratiotes</i>	26.7	30.9	5.7	3.1	x	x
13. Baía	PAR 194	10 Nov. 04	22	40	37.5	53	12	29	river	BAI	<i>Sabhinia</i> spp	26.7	30.9	5.7	3.1	x	
13. Baía	PAR 195	10 Nov. 04	22	40	37.5	53	12	29	river	BAI	<i>E. crassipes</i>	26.7	30.9	5.7	3.1	x	x
14. Maria Luiza	PAR 88	17 Mar. 04	22	40	40	53	13	12	open lake	BAI	<i>E. crassipes</i>	30.4	40.8	6.1	3.5	x	x
14. Maria Luiza	PAR 197	10 Nov. 04	22	40	29.4	53	13	5.8	open lake	BAI	<i>E. crassipes</i>	26.9	33.6	5.5	3.6	x	x
15. Gavião	PAR 188	10 Nov. 04	22	39	37.1	53	12	14	open lake	BAI	<i>E. crassipes</i>	26.7	31.3	5.3	2	x	x

Locality name	sample	Data	S°	S'	S''	W°	W'	W''	Loc. type	Subsystem	substrate type	WT	EC	pH	DO	C. rochai	C. brasiliensis
16. Onça	PAR 81	17 Mar. 04	22	39	56	53	12	8	open lake	BAI	littoral	29.1	37.9	6	2.1		x
16. Onça	PAR 185	10 Nov. 04	22	39	50.5	53	12	5	open lake	BAI	<i>E. crassipes</i>	26.6	25.8	5.1	1.2	x	x
17. Cortado	PAR 69	16 Mar. 04	22	48	50	53	22	35	channel	PAR	<i>E. crassipes</i>	30	66.9	6.6	5.8	x	
17. Cortado	PAR 70	16 Mar. 04	22	48	50	53	22	35	channel	PAR	<i>Sabvinia</i> spp	30	66.9	6.6	5.8	x	
17. Cortado	PAR 73	16 Mar. 04	22	48	50	53	22	35	channel	PAR	<i>P. stratiotes</i>	30	66.9	6.6	5.8	x	
17. Cortado	PAR 233	11 Nov. 04	22	48	45.7	53	22	46.3	channel	PAR	<i>Sabvinia</i> spp	25.1	61.5	6.3	7.1	x	
17. Cortado	PAR 234	11 Nov. 04	22	48	45.7	53	22	46.3	channel	PAR	<i>P. stratiotes</i>	25.1	61.5	6.3	7.1	x	
17. Cortado	PAR 235	11 Nov. 04	22	48	45.7	53	22	46.3	channel	PAR	<i>E. crassipes</i>	25.1	61.5	6.3	7.1	x	
18. Manezinho	S2	11 Nov. 04	22	46	55	53	20	59	open lake	PAR	<i>E. crassipes</i>	24.6	58.7	6	1		x
19. Osmar	PAR 162	08 Nov. 04	22	46	27.8	53	19	58	closed lake	PAR	littoral	25.2	44.6	5.5	3.7	x	
20. Pontal	PAR 41	15 Mar. 04	22	45	15	53	15	25	closed lake	PAR	littoral	29.9	114.9	6.2	2.6		x
20. Pontal	PAR 170	08 Nov. 04	22	45	6.2	53	25	24.6	closed lake	PAR	littoral	23.6	91.4	5.6	1.8		x
21. Clara	PAR 40	15 Mar. 04	22	45	26	53	15	28	closed lake	PAR	littoral	29.8	63.1	6.2	4.7	x	
22. Samambaia 3	PAR 106	04 Jul. 04	22	36	20	53	22	27	closed lake	TAQ	littoral	25.7	13.2	5.3	2.7	x	
22. Samambaia 3	PAR 245	12 Nov. 04	22	36	18.1	53	22	27.4	closed lake	TAQ	littoral	28.3	54.7	5.2	6.3	x	
23. Samambaia 1	PAR 102	04 Jul. 04	22	36	16	53	22	33	closed lake	TAQ	floating	25.4	29.2	6.5	8.3		x
23. Samambaia 1	PAR 239	12 Nov. 04	22	36	15.3	53	22	32.9	closed lake	TAQ	<i>Sabvinia</i> spp	24.2	30.9	6.3	8.5		x
23. Samambaia 1	PAR 241	12 Nov. 04	22	36	15.3	53	22	32.9	closed lake	TAQ	littoral	25.8	31.8	5.9	8.5		x
24. Walter 1	PAR 250	12 Nov. 04	22	34	58.3	53	21	50.9	closed lake	TAQ	littoral	28.6	40.9	6	8.4		x
25. Walter 2	PAR 108	05 Jul. 04	22	34	54	53	21	52	closed lake	TAQ	floating	23.5	32.2	6.1	10.2		x
25. Walter 2	PAR 248	12 Nov. 04	22	34	53.3	53	21	51.9	closed lake	TAQ	floating	29.1	16.9	5.5	8.6		x
25. Walter 2	PAR 249	12 Nov. 04	22	34	53.3	53	21	51.9	closed lake	TAQ	<i>P. stratiotes</i>	29.1	16.9	5.5	8.6	x	
26. Curral	PAR 112	05 Jul. 04	22	34	44	53	22	37	closed lake	TAQ	littoral	24.6	38.7	5.6	13.3		x
27. Banhado	PAR 113	05 Jul. 04	22	33	58	53	23	13	closed lake	TAQ	littoral	24.8	45.8	6	9.8		x
27. Banhado	PAR 255	12 Nov. 04	22	33	58.6	53	23	10.4	closed lake	TAQ	floating	28.4	31.8	5.2	3.9		x
28. Banhadão	PAR 256	12 Nov. 04	22	33	58.6	53	23	10.4	closed lake	TAQ	floating	29.4	23.6	5.5	8.1		x
29. Piranha	PAR 115	05 Jul. 04	22	33	54	53	21	41	closed lake	TAQ	littoral	24.6	32.6	5.5	8.4	x	
29. Piranha	PAR 258	12 Nov. 04	22	33	51.9	53	21	41.8	closed lake	TAQ	littoral	29.2	29.4	5.4	7.1	x	

Abbreviations used in text and figures

A1	=	Antennula
A2	=	Antenna
Cp	=	Carapace
H	=	Height of valves
L	=	Length of valves
Lpp	=	Left prehensile palp
LV	=	Left valve
ls	=	Lateral shield of hemipenis
Md	=	Mandibula
ms	=	Medial shield of hemipenis
Mx1	=	Maxillula
Rpp	=	Right prehensile palp
RV	=	Right valve
T1	=	First thoracopod
T2	=	Second thoracopod
T3	=	Third thoracopod
W	=	Width

Chaetotaxy of the limbs follows the model proposed by Broodbakker & Danielopol (1982), revised for the A2 by Martens (1987) and for the T3 by Meisch (2000). Higher taxonomy of the Ostracoda follows the synopsis by Horne *et al.* (2002).

Results

Taxonomic descriptions

Class Ostracoda Latreille, 1806
Subclass Podocopa G.W. Müller, 1894
Order Podocopida Sars, 1866
Suborder Cypridocopina Baird, 1845
Superfamily Cypridoidea Baird, 1845
Family Candonidae Kaufmann, 1900
Subfamily Candoninae Kaufmann, 1900

Tribes

Candonini Kaufmann, 1900; Candonopsini Karanovic, 2004; Cryptocandonini Karanovic, 2007; Danielocandonini Karanovic, 2007; Humphreyscandonini Karanovic, 2005, Namibcypridini Martens, 1992; Terrestriicypridini Pinto *et al.*, 2005; Trapezicandonini Karanovic, 2007.

Tribe Candonopsini Karanovic, 2004

Diagnosis (new, only partly following the original diagnosis)

Candonid species, with carapace elongated in lateral view and narrow in dorsal and ventral views. Caudal ramus well-developed, distally with two claws and a distal seta, but with proximal seta missing.

Genera

Candonopsis Vavra, 1891, *Latinopsis* Karanovic & Datry, 2009, *Candobrasilopsis* gen. nov.

Not accepted here is the allocation of *Abcandonopsis* Karanovic, 2004 (here raised to generic rank), *Cubacandona* Broodbakker, 1983, *Caribecandona* Broodbakker, 1983, *Marococandona* Marmonier *et al.*, 2005 and *Pioneercandonopsis* Karanovic, 2005 (see discussion below).

Genus *Candobrasilopsis* gen. nov.

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Diagnosis

Anterior calcified inner lamella broad, anterior inner margin sinuous, posterior calcified inner lamella narrow, posterior inner margin running parallel to valve margin. Terminal Md-palp segment short ($L \leq 1.5 \times$ basal width). Prehensile palps one-segmented, base inflated, distal finger long, hook-like. Hemipenis of triangular type, without protruding lobes a and b. Caudal ramus without proximal seta, distal seta reduced to a small spine.

Etymology

Named after the country of Brazil (Brasil in Portuguese), with “Cando-” and “-opsis” denoting relationship to *Candonopsis*.

Type species

Candobrasilopsis rochai sp. nov. (by original designation).

Other species

Candonopsis brasiliensis Sars, 1901; ?*Candonopsis anisitsi* Daday, 1905.

Differential diagnosis

This new genus is closely related to *Candonopsis* Vavra, 1891 (with type species *C. kingsleyi* (Brady & Norman, 1870)) and to *Latinopsis* Karanovic & Datry, 2009 (type species *L. patagonica* Karanovic & Datry, 2009). It differs from *Candonopsis s.s.* mainly in the presence of a short terminal Md-palp segment, by the fact that the prehensile palps have 2 distal setae (1 in *Candonopsis*) and by the relatively simple attachment of the caudal ramus (1 lateral branch in *Latinopsis* and in *Candobrasilopsis* gen. nov., 3 in *Candonopsis s.s.*).

The new genus differs from *Latinopsis* (only *L. patagonica*) mainly in the presence of a broad anterior calcified inner lamella with sinuous inner margin (narrow and with evenly rounded inner margin in *Latinopsis*) and by the absence of protruding lobes ‘a’ and ‘b’ in the hemipenis (present in *Latinopsis*).

Remarks

We propose to tentatively transfer *C. anisitsi* Daday, 1905 to *Candobrasilopsis* gen. nov. based on the morphology of the hemipenis and the prehensile palps (see discussion below).

Candobrasilopsis rochai sp. nov.

Figs 2-6, 7A-B

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Candonopsis annae (Mehes, 1914) – Higuti *et al.* 2009b: 664. — Higuti *et al.* 2010: 267.

Diagnosis

A species of the tribe Candonini, with elongated valves, greatest height well behind the middle; carapace in lateral view with weakly rounded dorsal margin, not straight. Anterior calcified inner lamella in both valves broad; almost 1/4 of total length and with inner margin sinuous, not parallel to valve margin. Base of right prehensile palp broad, almost triangular, distal part curved, distal tip slightly expanded, set with two subequal lateral setae. Left prehensile palp larger and more elongated, with hook-like distal part,

distal tip slightly swollen. Hemipenis with triangular ls, distinctly pointed, proximo-dorsal expansion small, ms rounded and without ventral, wart-like expansion.

Etymology

The new species is named after Prof Dr Carlos Eduardo Falavigna da Rocha (USP, São Paulo, Brazil), in recognition of his vast contributions to the taxonomy of Brazilian Copepoda, but also in acknowledgement of his initiative to start research on terrestrial Ostracoda in South America.

Type material

All type material was collected on 10 Nov. 2004 by the authors, by washing roots of *Eichhornia crassipes* (PAR 195) and *Pistia stratiotes* (PAR 193) over a hand net with mesh size 160 µm. See Table 1 for measurements of water chemistry at time of collecting.

Holotype

1 ♂, with soft parts dissected in glycerine in a sealed slide, and with valves stored dry (MZUSP.28102).

Allotype

1 ♀, dissected and stored as the male (MZUSP.28103).

Paratypes

2 ♂♂ dissected and stored as the holotype (MZUSP.28104, MZUSP.28105); 4 ♂ carapaces stored dry in micropalaeontological slides (OC.3291, MZUSP.28106, MZUSP.28107, MZUSP.28108); 4 ♀♀ dissected and stored as the holotype (OC.3292, MZUSP.28109, MZUSP.28111, MZUSP.28110); 3 ♀ carapaces stored dry in micropalaeontological slides (OC.3293, MZUSP.28112, OC.3294).

Type locality

Baía River in Upper Paraná River Floodplain, in floating plants (*E. crassipes*, *P. stratiotes*), coordinates: 22°40'37.5" S, 53°12'29" W (locality number 13 with samples PAR193 and PAR195 on Figure 1).

Other material investigated

See Table 1 for a list of localities where the present species was collected. Specimens MZUSP.28113, MZUSP.28114, MZUSP.28115 (♂♂) and MZUSP.28116 (♀) are here used for illustrations and are also deposited in the Museu de Zoologia da Universidade de São Paulo, São Paulo (Brazil). Illustrated specimens are listed in Table 2.

Differential diagnosis

The new species differs from the congeneric species (*C. brasiliensis*), and indeed from all other Candonopsini, by the shape of the valves, by the peculiar shape of the prehensile palp (with distal part swollen in Rpp) and by the size and shape of the hemipenis.

Description of male

Valves (Fig. 2A, B) elongated, with greatest height situated behind the middle (and bluntly pointed there) anteriorly rather narrowly and posteriorly rather broadly rounded, RV and LV of highly similar shape; anterior calcified inner lamella broadly rounded, posterior calcified inner lamella very narrow and almost disappearing towards the dorsal side; inner margin of anterior calcified inner lamella slightly sinuous in both valves.

Carapace in right lateral view (Fig. 2C) showing LV overlapping RV slightly on all sides; external surface of valves smooth.

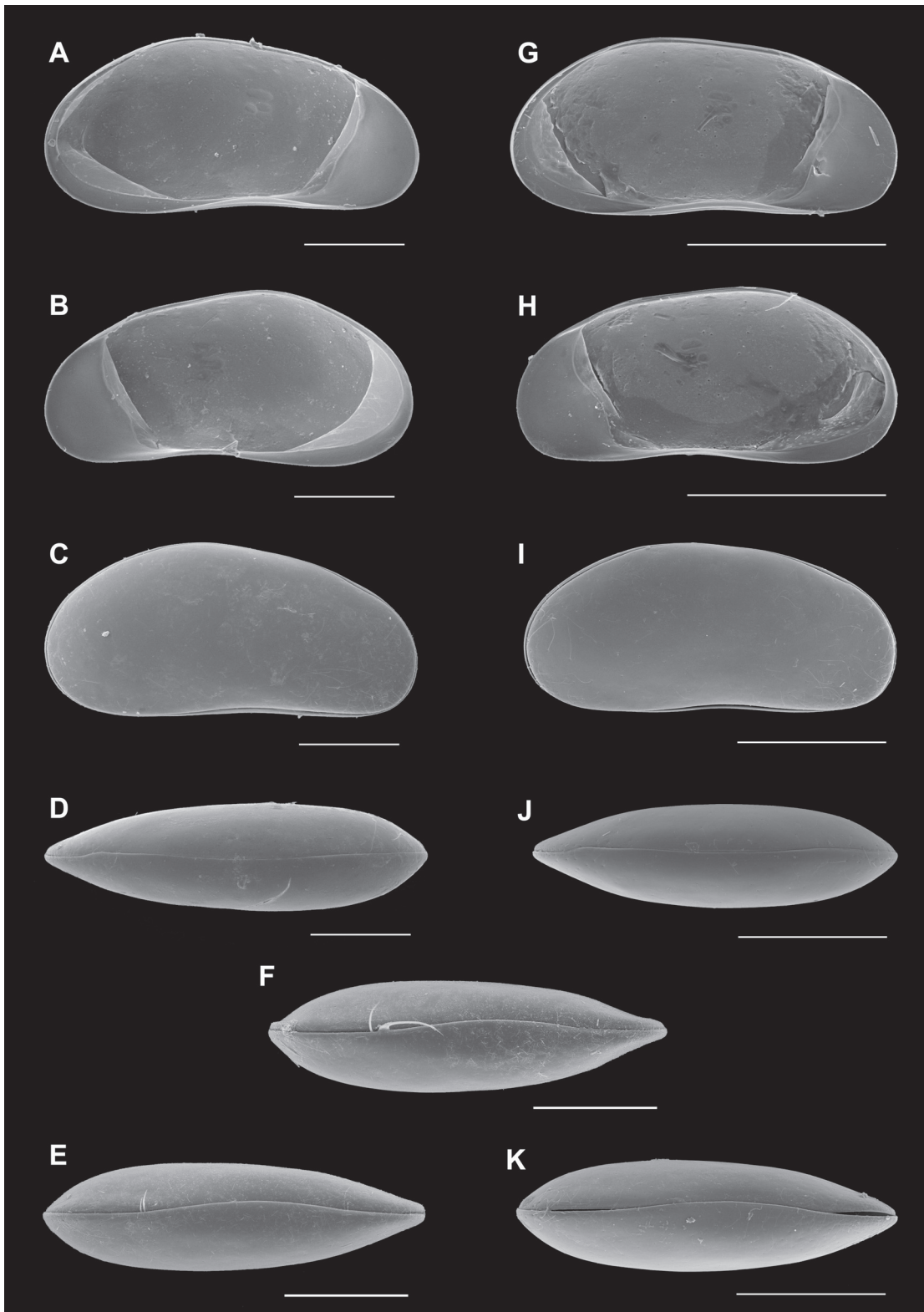


Fig. 2. *Candobrasilopsis rochai* gen. nov. sp. nov., valves (A-F ♂ and G-K ♀). **A, G.** LV, internal view (A: MZUSP.28113, G: MZUSP.28103). **B, H.** RV, internal view (B: MZUSP.28113, H: MZUSP.28103). **C, I.** Cp, right lateral view (C: OC.3291, I: OC.3293). **D, J.** Cp, dorsal view (D: MZUSP.28106, J: MZUSP.28112). **E, F, K.** Cp, ventral view (E: MZUSP.28108, F: MZUSP.28107, K: OC.3294). Scale bars: A-D = 200 µm; E, F = 250 µm; G, H = 400 µm, I-K = 300 µm.

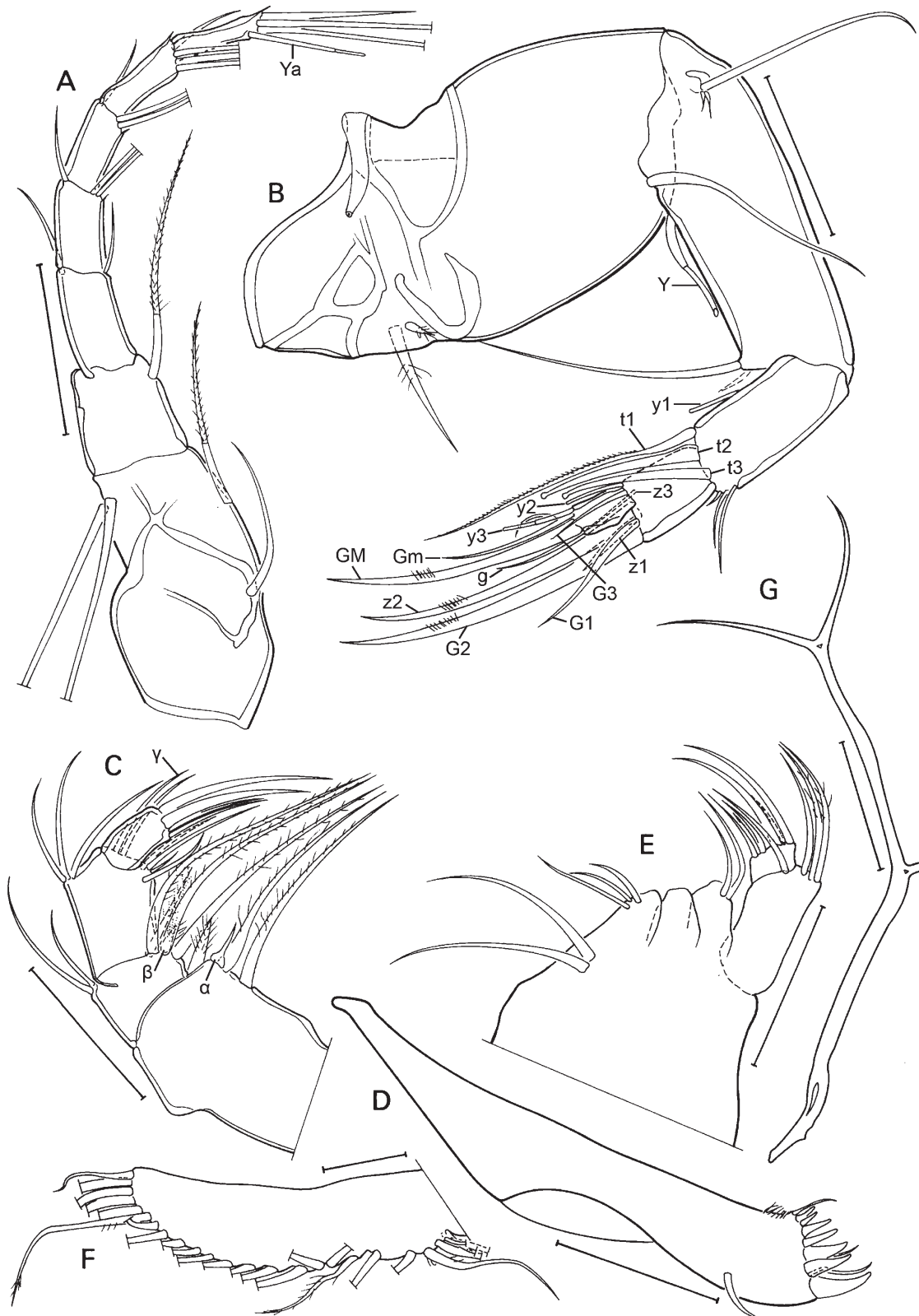


Fig. 3. *Candobrasilopsis rochai* gen. nov. sp. nov., limbs (♂). **A.** A1 (MZUSP.28102). **B.** A2 (MZUSP. 28114). **C.** Md palp (MZUSP.28114). **D.** Md, coxal plate (MZUSP.28114). **E.** Mx1 (Chaetotaxy incomplete) (MZUSP.28105). **F.** Mx1, respiratory plate (MZUSP.28114). **G.** Attachment of the caudal ramus (MZUSP.28104). Scale bars: A-G = 50 μ m.

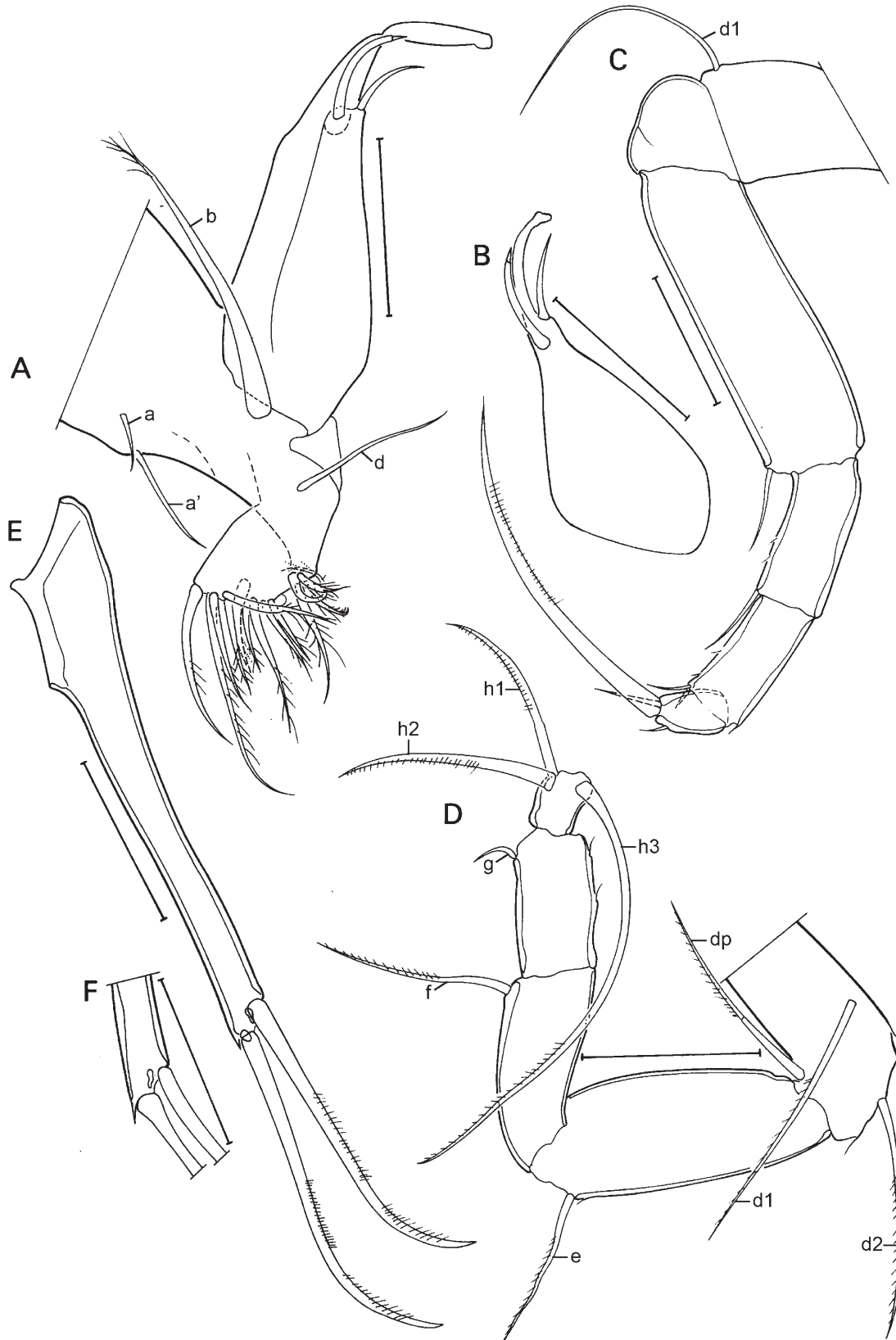


Fig. 4. *Candobrasilopsis rochai* gen. nov. sp. nov., limbs (♂). **A.** T1, left clasper (MZUSP.28114). **B.** Right clasper (MZUSP.28114). **C.** T2 (MZUSP.28114). **D.** T3 (MZUSP.28104). **E.** Caudal ramus (MZUSP.28104). **F.** Detail of caudal ramus (MZUSP.28115). Scale bars: A-F = 50 µm.

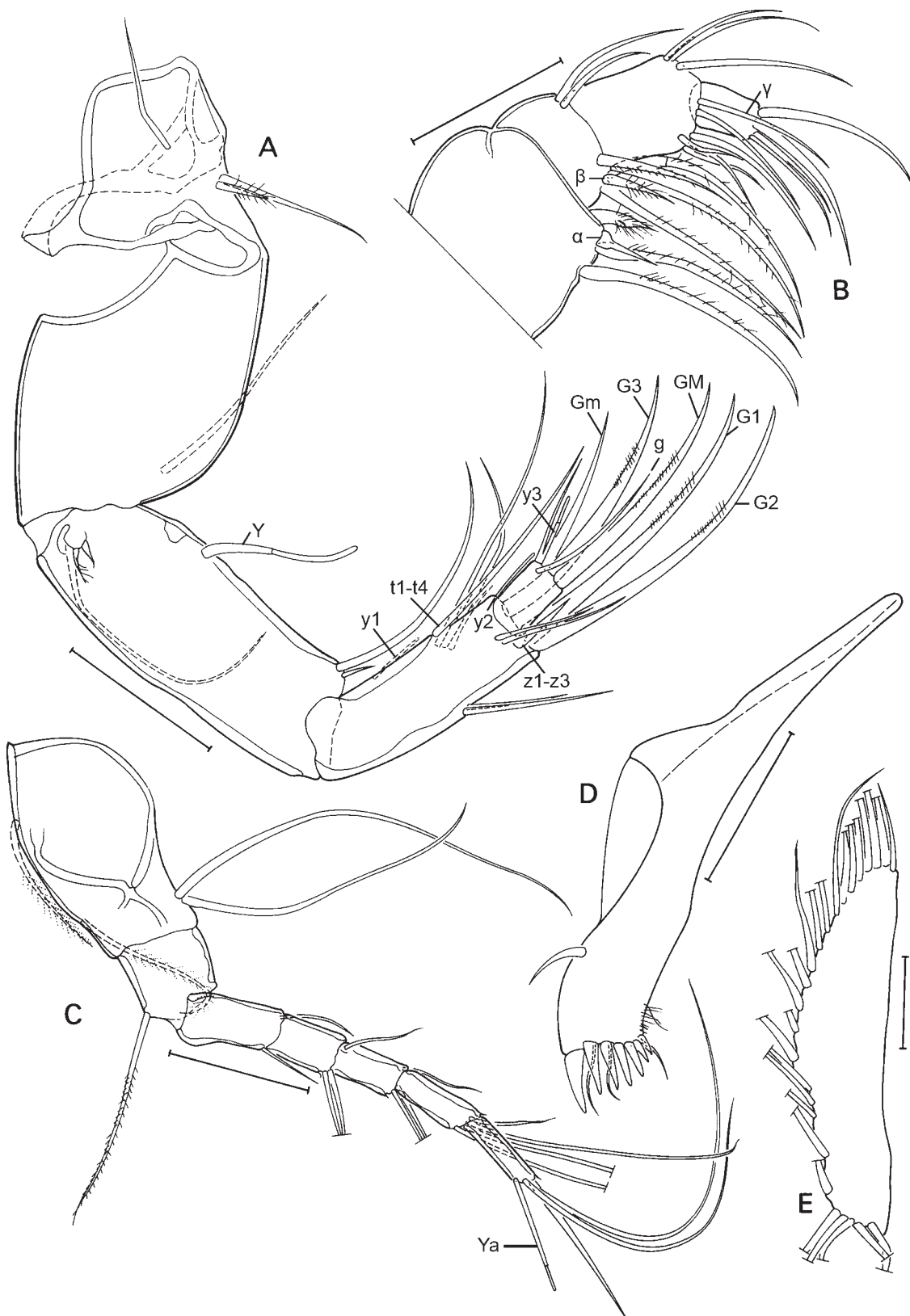


Fig. 5. *Candobrasilopsis rochai* gen. nov. sp. nov., limbs (♀). A. A2 (MZUSP.28110). B. Md palp (OC.3292). C. A1 (OC.3292). D. Md, coxal plate (MZUSP.28109). E. Mx1, respiratory plate (MZUSP.28116). Scale bars: A-E = 50 μm .



Fig. 6. *Candobrasilopsis rochai* gen. nov. sp. nov., limbs (♀). **A.** T3 (OC.3292). **B.** Attachment of the caudal ramus (MZUSP.28110). **C.** T2 (MZUSP.28109). **D.** Caudal ramus (OC.3292). **E.** Mx1 (Chaetotaxy incomplete) (OC.3292). **F.** T1 (MZUSP.28111). Scale bars: A-F = 50 μ m.

In dorsal view (Fig. 2D), carapace lancet-shaped, sharply pointed in the anteriorly, more broadly so posteriorly, greatest width situated well behind the middle.

Carapace also in ventral view (Fig. 2E, F) lancet-shaped, with anterior side more acutely pointed than posterior side.

A1 (Fig. 3A) with 5 terminal segments relatively elongated ($L =$ at least 1.5 x basal width). Basal part of A1 (= undivided protopodite) with 2 long sub-apical, ventral setae and two shorter setae on the dorsal side, one at *ca.* mid-length, the other sub-apical. Next (second) segment with one long (reaching beyond basis of penultimate segment) dorso-apical seta, no ventro-apical seta present. Third segment with one small sub-apical seta on both ventral and dorsal sides. Fourth and fifth segments with two longer dorso-apical and 1 shorter ventro-apical setae. Sixth segment with three longer dorso-apical and one shorter ventro-apical setae. Seventh (terminal segment) most elongate of all, slightly sinuous, bearing one short and two longer setae and one aesthetasc Ya, the latter shorter than the shorter seta.

A2 (Fig. 3B) with basal segment very broad, wide and relatively long, basally with 2 unequal setae, one relatively long and slender, the other very short and broad, both hirsute; apically with a ventral seta. Remnant of exopod consisting of a short plate, one long and two very short setae. Endopod consisting of 4 segments (penultimate segment divided). First endopodal segment long, carrying one long aesthetasc Y on the ventro-basal side, and one long and one short ventro-apical setae. Second endopodal segment shorter and smaller, but still rectangular with one ventral aesthetasc y1 inserted about mid length, 3 t-setae, with t1 a long, hirsute setae, t2 and t3 modified in the male-bristles. Dorso-apically with 3 short setae of unequal length. Third endopodal segment with apical chaetotaxy sexually dimorphic, with z1 and z3 being short setae, z2 being modified into a long claw; G2 a long claw, G1 a long seta and G3 a short setae, aesthetasc y2 short and ventro-apically inserted. Terminal (4th) segment small, distally with claws GM (long) and Gm (short), aesthetasc y3 with its companion seta, fused at the basis and of c equal length, and seta g, slightly longer than y3.

Md with coxa (Fig. 3D) relatively elongated, distally set with a series of strong teeth. Md-palp (Fig. 3C) consisting of 4 segments. Basal segment dorsally carrying the respiratory plate (not shown), ventro-apically with 2 long hirsute setae (s1 & s2) and the alpha seta, the latter proximally with a broad base and a flagellum-like, distal part. Second segment dorso-apically with 2 seta of unequal length, ventro-basally with a short, stout and hirsute seta and ventro-apically with a group of 5 setae: 3 long and hirsute setae (similar to the two s-setae of the previous segment), a shorter, less hirsute seta and the short and hirsute beta-seta. Third segment with a group of 3 dorso-subapical setae, the latter smooth, a central group of two setae, one of which being the gamma seta and ventro-apical group of 4 unequal setae. Terminal segment rectangular, apically set with two large claws and an uncertain number of smaller setae.

Mx1 (Fig. 3E) with a basal (basipodite) part carrying a large respiratory plate (exopodite), 3 endites and a two-segmented palp (endopodite). Respiratory plate elongated, carrying more than 20 respiratory rays, some quite short, others long (Fig. 3F). Palp with first segment carrying 3+1 apical setae; terminal segment short and broad, carrying 2 longer claws and c 3 short setae. Chaetotaxy of three endites impossible to determine. Sideways directed bristles near first endite long and stout.

T1 (sometimes called Mx2 – Fig. 4A) consisting of basal part (basipodite), carrying respiratory plates (not shown), a palp (modified to prehensile palp in males) and an exopodite (?) distally set with 14-15 setae of different morphology and length. Basal plate set with one long and stout ‘b’-seta, a shorter and more slender ‘d’-seta and two ‘a’-setae of unequal length. Prehensile palps (Fig. 4A, B) one-segmented, distally hook-like and set with two unequal, sub-apical setae; palps slightly asymmetrical, right prehensile palp (Fig. 4B) basally slightly more swollen and with distal hook like expansion apically swollen.

T2 (walking limb – Fig. 4C) with 4-segmented endopodite (penultimate segment divided) and elongated. First segment with long seta d1. Knee-segment devoid of seta d2. First segment of endopod especially elongated, with short ventro-apical seta. Second segment also with one short ventro-apical seta. Third segment with two ventro-apical seta, one short, one slightly longer. Terminal segment with one short apical and one short sub-apical seta and a long apical claw.

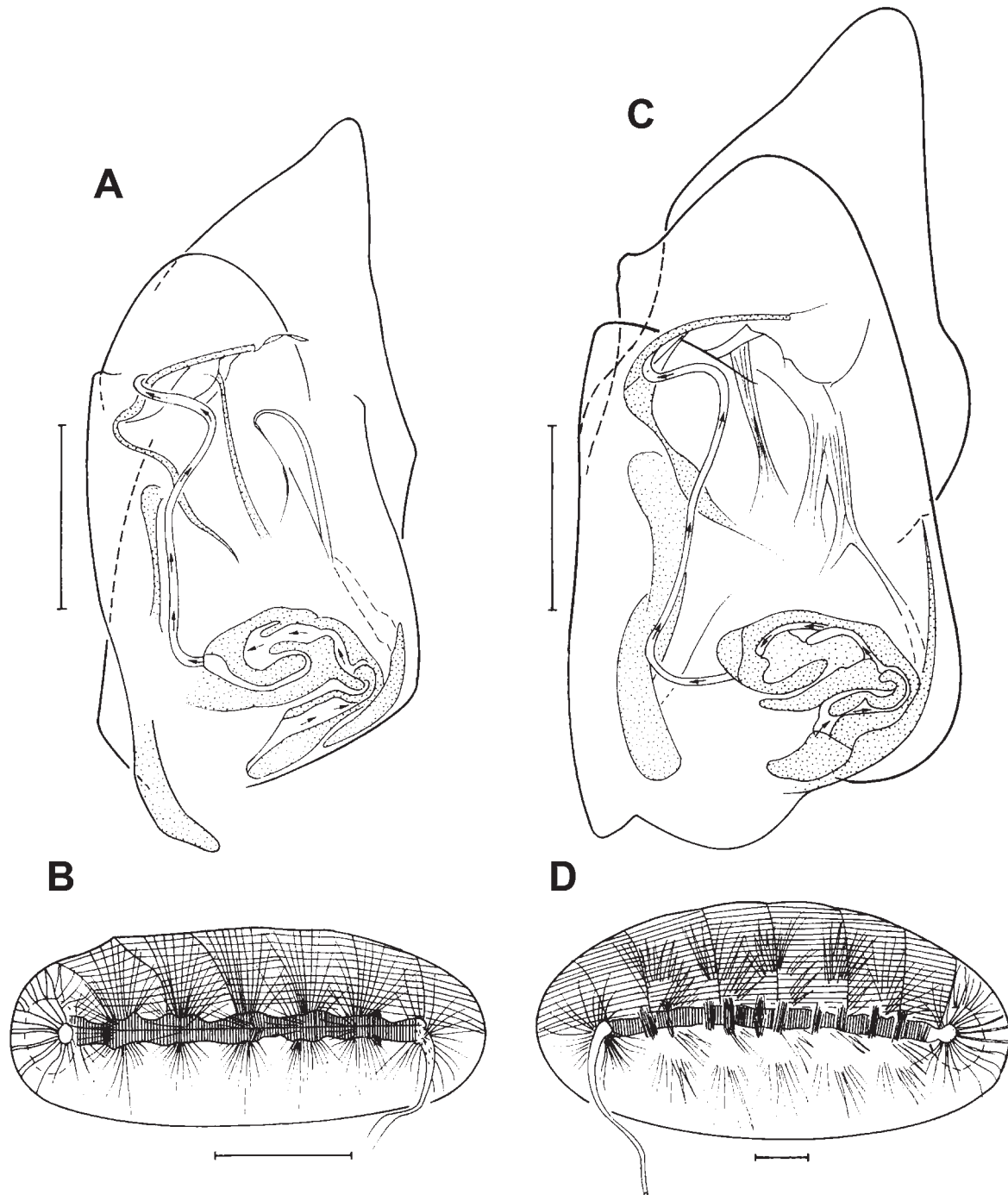


Fig. 7. — **A, B.** *Candobrasilopsis rochai* gen. nov. sp. nov. A. Hemipenis (MZUSP.28104). B. Zenker organ (MZUSP.28115). — **C, D.** *C. brasiliensis* (Sars, 1901) comb. nov. C. Hemipenis (OC.3296). D. Zenker organ (OC.3296). Scale bars: A, C, D = 50 μ m, B = 100 μ m.

T3 (cleaning limb – Fig. 4D) as typical of the family. First segment with three long setae, one medial (d1), one subapical (d2) and one apical (dp). Second segment with one subapical seta (e). Third segment with one long subapical seta (f). Penultimate segment with one short and curved subapical seta (g). Terminal segment well-separated from penultimate segment and carrying three setae: one long and reflexed (h3) and two side-ways directed (h1 & h2), the latter subequal.

Caudal ramus (furca – Fig. 4E) with stout ramus and two stout apical claws. Proximal setae missing, distal seta a small spine. Attachment to caudal ramus (Fig. 3G) long and stout, distally bifurcated and with additional lateral branch at c mid-length. Length ratio ramus/largest claw = 1.51.

Hemipenis (Fig. 7A) relatively small, with rounded ms and bluntly pointed, triangular ls, the latter furthermore with small proximo-dorsal expansion; labyrinth short and stout, postlabyrinthal spermiductus narrow and straight, without additional coils, but with a weak bent at the most distal part.

Zenker organ (Fig. 7B) short and broad, with at least 5 spinous whirls.

Description of female

Valves (Fig. 2G, H) and Cp (Fig. 2I) in lateral view similar to those in the male, RV in inner view dorsally more rounded and less bluntly pointed than in the male. Cp in D and V views (Fig. 2J, K) equally narrow and lancet-shaped, in D view with slight rostrum, in ventral view without the pronounced (anterior and posterior) rostral keels, typical of the male.

Soft parts (Figs 5B-E, 6A-E) largely as in the male, but with sexually dimorphic A2 and T1.

A2 (Fig. 5A) with setae t1-4 setae like, not transformed; z1 and z2 short and slender, seta z3 short and stout. Claws G1, G2, G3 and GM all reaching to about the same point.

T1 (Fig. 6F) with basal part as in the male. Endopod a broad palp, with two short and one long distal setae.

Caudal ramus: length ratio ramus/largest claw = 1.40.

Measurements

See Table 3.

Ecology

See below under *C. brasiliensis*.

Remarks

This species was originally identified by us as *Candonopsis annae* (Mehes, 1914), but subsequent detailed analysis of the valves and soft parts showed that this was not so, and that the populations from the alluvial valley of the Upper Paraná River needed be described as a new species.

Some specimens (Fig. 2F) give the impression that they have an anterior rostrum and a postero-ventral keel. This was observed in 2 male specimens, after their carapaces were dried for SEM. So either these 2 specimens belong to a different species, which is not very likely, or the weak calcification of the valves (typical of *Candonopsis*-like species) has made those parts of the valve implode while drying in air.

Table 2. Locality data of *Candobrasilopsis rochai* gen. nov. sp. nov. and *Candobrasilopsis brasiliensis* (Sars, 1901) comb. nov., material used here.

<p><i>Candobrasilopsis rochai</i> gen. nov. sp. nov.</p> <p>Valves (♂) MZUSP.28113 - Piranha Lake (PAR 115), littoral, coll. 05 Jul. 2004. OC.3291, MZUSP.28106, MZUSP.28107, MZUSP.28108 - Baía River (PAR 195), <i>Eichhornia crassipes</i>, coll. 10 Nov. 2004.</p> <p>Valves (♀) MZUSP.28103, OC.3293, MZUSP.28112, OC.3294 - Baía River (PAR 195), <i>Eichhornia crassipes</i>, coll. 10 Nov. 2004.</p> <p>Soft parts (♂) MZUSP.28102, MZUSP.28104, MZUSP.28105 - Baía River (PAR 195), <i>Eichhornia crassipes</i>, coll. 10 Nov. 2004. MZUSP.28114 - Cortado Channel (PAR 234), <i>Pistia stratiotes</i>, coll. 11 Nov. 2004. MZUSP.28115 - Ivinheima River (PAR 222), <i>Eichhornia crassipes</i>, coll. 10 Nov. 2004.</p> <p>Soft parts (♀) OC.3292, MZUSP.28109, MZUSP.28110 - Baía River (PAR 195), <i>Eichhornia crassipes</i>, coll. 10 Nov. 2004. MZUSP.28116 - Cortado Channel (PAR 234), <i>Pistia stratiotes</i>, coll. 11 Nov. 2004. MZUSP.28111 - Baía River (PAR 193), <i>Pistia stratiotes</i>, coll. 10 Nov. 2004.</p> <p><i>Candobrasilopsis brasiliensis</i> (Sars, 1901) comb. nov.</p> <p>Valves (♂) MZUSP.28118 - Samambaia 1 Lake (PAR 102), floating, coll. 04 Jul. 2004. MZUSP.28119, OC.3297, OC.3298 - Manezinho Backwater (S2), <i>Eichhornia crassipes</i>, coll. 11 Nov. 2004.</p> <p>Valves (♀) MZUSP.28126, OC.3301 - Samambaia 1 Lake (PAR 102), floating, coll. 04 Jul. 2004. MZUSP.28127, MZUSP.28125 - Manezinho Backwater (S2), <i>Eichhornia crassipes</i>, coll. 11 Nov. 2004.</p> <p>Soft parts (♂) MZUSP.28117 - Manezinho Backwater (S2), <i>Eichhornia crassipes</i>, coll. 11 Nov. 2004. OC.3295, OC.3296 - Pontal Lake (PAR 41), littoral, coll. 15 Mar. 2004.</p> <p>Soft parts (♀) MZUSP.28125, OC.3299, OC.3300 - Manezinho Backwater (S2), <i>Eichhornia crassipes</i>, coll. 11 Nov. 2004.</p> <p>Hemipenis MZUSP.28117 - Manezinho Backwater (S2), <i>Eichhornia crassipes</i>, coll. 11 Nov. 2004. OC.3295, OC.3296, MZUSP.28120 - Pontal Lake (PAR 41), littoral, coll. 15 Mar. 2004. MZUSP.28121, MZUSP.28122, MZUSP.28123, MZUSP.28124 - Mané Cotia Lake (PAR 422), <i>Eichhornia crassipes</i>, coll. 1 Feb. 2011.</p>
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Table 3. Measurements of illustrated specimens of *Candobrasilopsis rochai* gen. nov. sp. nov. and *Candobrasilopsis brasiliensis* (Sars, 1901) comb. nov.

Species	Sex	Code	V/Cp	L (mm)	H (mm)	W (mm)
<i>Candobrasilopsis rochai</i> gen. nov. sp. nov.	♂	MZUSP.28113	LVi	748	353	
			RVi	739	356	
		OC.3291	CpRl	744	350	
		MZUSP.28106	CpD	766		218
		MZUSP.28107	CpV	806		224
		MZUSP.28108	CpV	773		217
	♀	MZUSP.28103	LVi	783	361	
			RVi	770	357	
		OC.3293	CpRl	753	342	
		MZUSP.28112	CpD	739		211
		OC.3294	CpV	756		221
		<i>Candobrasilopsis brasiliensis</i> (Sars, 1901) comb. nov.	♂	MZUSP.28118	LVi	977
	RVi			976	475	
MZUSP.28119	CpRl			931	463	
OC.3297	CpD			902		300
♀	OC.3298		CpV	917		301
	MZUSP.28125		LVi	928	451	
			RVi	924	446	
	MZUSP.28126		CpRl	962	480	
	OC.3301		CpD	978		320
	MZUSP.28127		CpV	912		288

***Candobrasilopsis brasiliensis* (Sars, 1901) comb. nov.**
Figs 7C-D, 8-13

Candonopsis brasiliensis Sars, 1901: 45-46.

Candonopsis brasiliensis – Würdig 1984: 439-447. — Martens & Behen 1994:14. — Higuti *et al.* 2007: 1935. — Higuti *et al.* 2009b: 664. — Higuti *et al.* 2010: 267. — Mormul *et al.* 2010: 189.

Candonopsis brasiliensis incertae sedis – Karanovic & Datry 2009: 5.

Diagnosis

A species of the tribe Candonini, with elongated valves, greatest height well behind the middle; carapace in lateral view with dorsal margin straight over 2/3 of the length. Anterior calcified inner lamella in both valves broad; almost 1/5 of total length and with inner margin sinuous, not parallel to the valve margin. Base of right prehensile palp narrow and rounded, distal part curved, distal tip slightly expanded, set with two subequal lateral setae. Left prehensile palp larger and more elongated, with hook-like distal

part, distal tip not swollen. Hemipenis with triangular ls, bluntly pointed, bearing large and rounded proximo-dorsal expansion, and with rounded ms bearing a ventral, wart-like expansion.

Type material and type locality

Sars (1901: 46) wrote: “Only 2 female specimens of this form were secured. They were found in one of my aquaria prepared with mud from São Paulo”. No detailed locality information is provided. Given the expansion of the city of São Paulo over the past 100 years, the actual locality from which the mud was collected has meanwhile almost certainly been destroyed.

Remark

Sars (1901) based his description and illustration (only a dorsal and left lateral view of a carapace) on 2 female specimens only. As females in this genus do not have the most specific characters which are in the hemipenis and prehensile palps of the male, we have decided not to rely on the type material to redescribe this species. Rather, we use new material from the Upper Paraná River, about 700 km WNW from São Paulo City.

Material used for the present redescription

See Table 1 for an overview of localities in the alluvial valley of the Upper Paraná River where this species was found.

Specimens are here used for illustrations and are also deposited in the museums indicated above. Eight ♂♂, with soft parts dissected in glycerine in a sealed slide and with valves stored dry (MZUSP.28117, OC.3295, OC.3296, MZUSP.28120, MZUSP.28121, MZUSP.28122, MZUSP.28123, MZUSP.28124); four ♂ carapaces stored dry in micropalaeontological slides (MZUSP.28119, OC.3297, OC.3298, and MZUSP.28118). Three ♀♀, with soft parts dissected in glycerine in a sealed slide and with valves stored dry (MZUSP.28125, OC.3299, OC.3300); three ♀ carapaces stored dry in micropalaeontological slides (MZUSP.28127, MZUSP.28126, OC.3301).

Differential diagnosis

This species differs from the congeneric species (*C. rochai* gen. nov. sp. nov.), by the shape of the valves, by rounded basal part of the right prehensile palp and by the large hemipenis with blunt tip and the ms with a ventral wart-like expansion.

Redescription of male

Valves (Fig. 8A, B) elongated, with greatest height situated well behind the middle (and bluntly pointed there), middle 2/3 of the dorsal margin straight and sloping towards the anterior margin; anterior margin rather narrowly and posterior rather broadly rounded. RV and LV of highly similar shape; anterior calcified inner lamella broadly rounded, posterior calcified inner lamella very narrow and almost disappearing towards the dorsal side; inner margin of anterior calcified inner lamella slightly sinuous in both valves.

Carapace in right lateral view (Fig. 8C) showing LV overlapping RV slightly on postero-dorsal and ventral sides; external surface of valves smooth.

In dorsal (Fig. 8D) and ventral (Fig. 8E) views, carapace lancet-shaped, bluntly pointed anteriorly, more broadly so posteriorly, greatest width situated well behind the middle.

A1 (Fig. 9C) with 5 terminal segments relatively elongated (L = at least 1.5 x basal width). Basal segment of A1 (= undivided protopodite) with 2 long sub-apical, ventral setae and two shorter setae on the dorsal side, of the latter one inserted at c mid-length, the other sub-apical. Second segment of basal

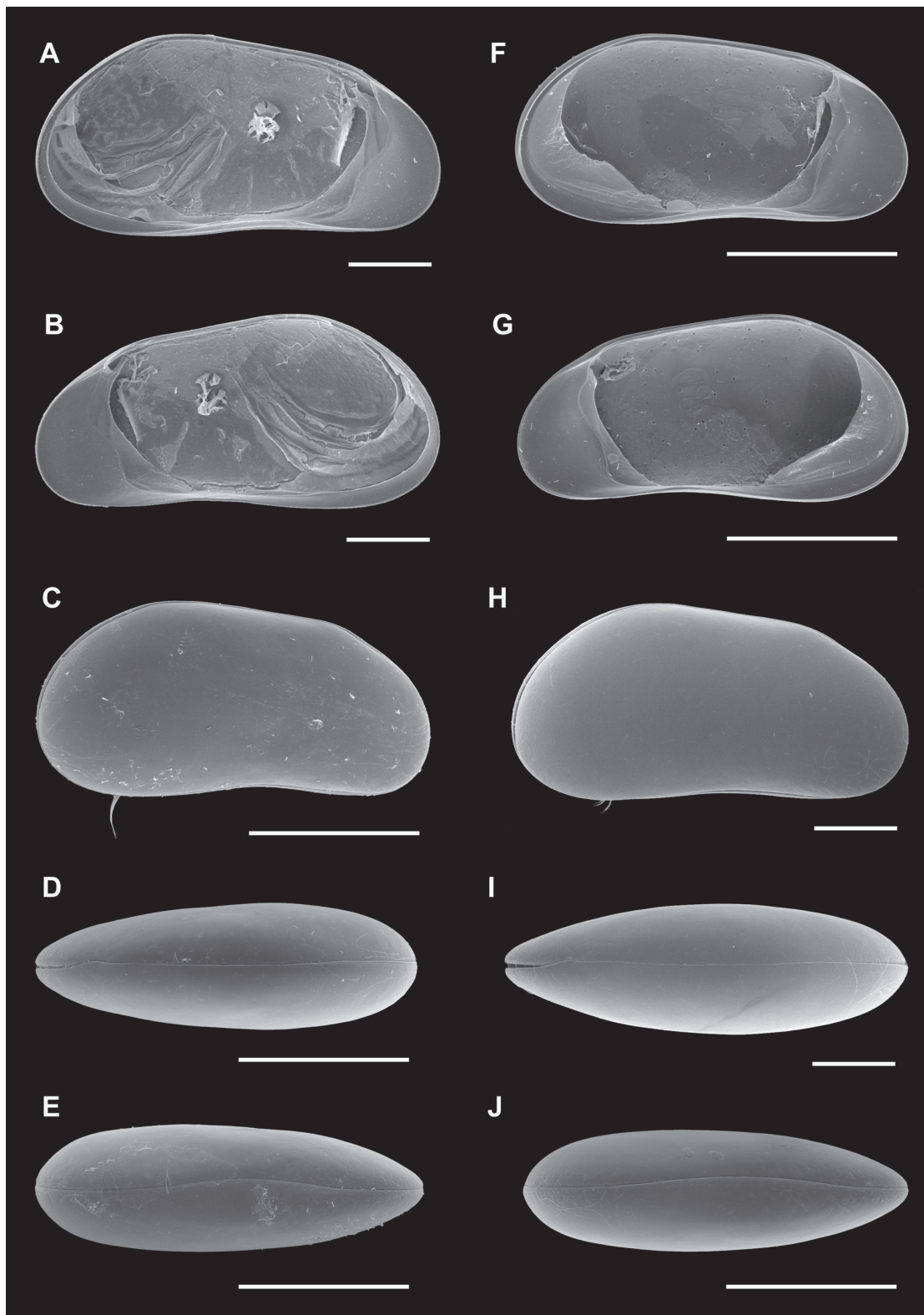


Fig. 8. *Candobrasilopsis brasiliensis* (Sars, 1901) comb. nov., valves (A-E ♂, F-J ♀). **A, F.** LV, internal view (A: MZUSP.28118, F: MZUSP.28125). **B, G.** RV, internal view (B: MZUSP.28118, G: MZUSP.28125). **C, H.** Cp, right lateral view (C: MZUSP.28119, H: MZUSP.28126). **D, I.** Cp, dorsal view (D: OC.3297, I: OC.3301). **E, J.** Cp, ventral view. (E: OC.3298, J: MZUSP.28127). Scale bars: A, B, H, I = 200 μ m; C-G, J = 400 μ m.

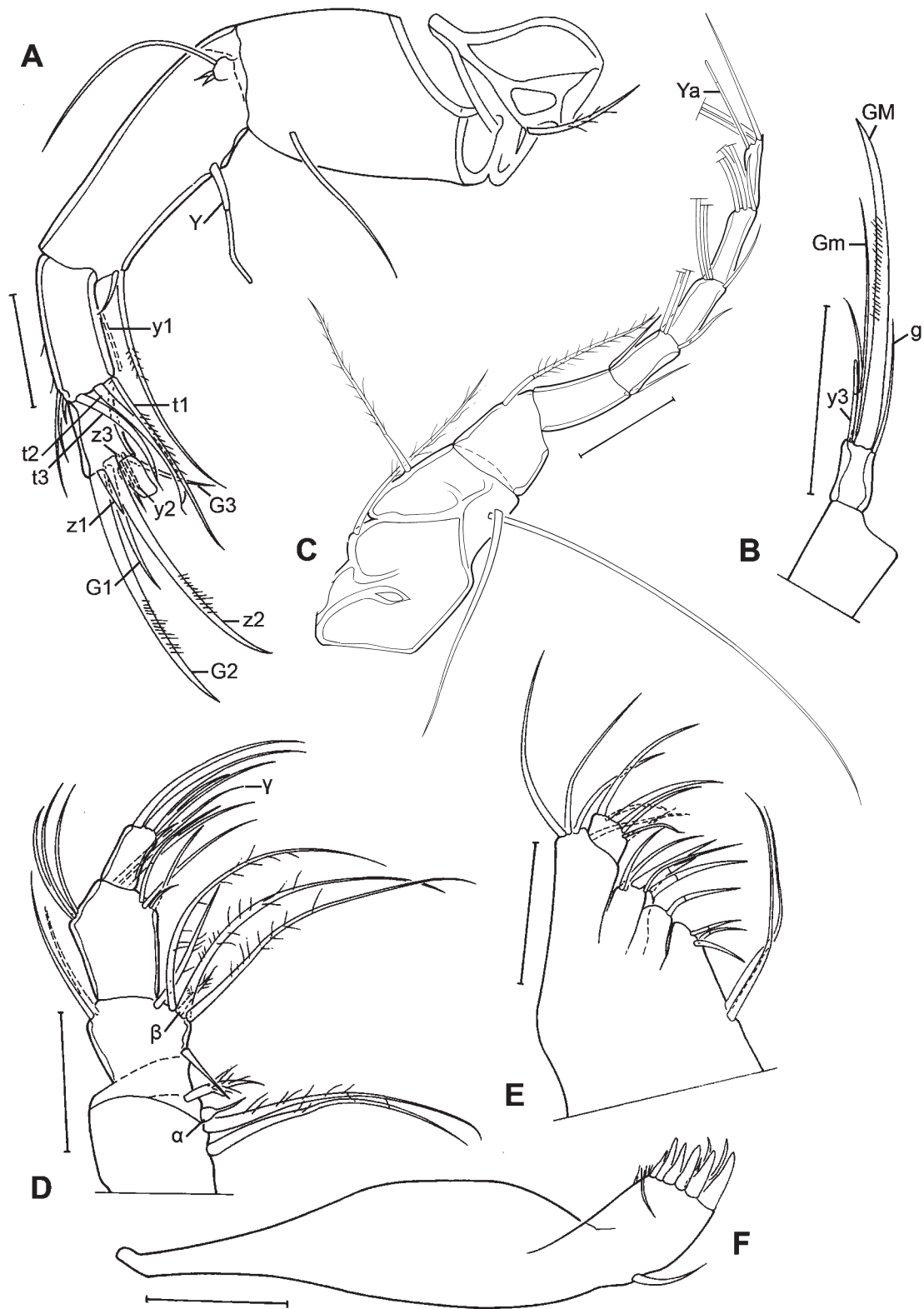


Fig. 9. *Candobrasilopsis brasiliensis* (Sars, 1901) comb. nov., limbs (♂). **A.** A2 (MZUSP.28117). **B.** A2, detail of the last segment (MZUSP.28117). **C.** A1 (MZUSP.28117). **D.** Md palp (MZUSP.28117). **E.** Mx1 (Chaetotaxy incomplete) (OC.3296). **F.** Md, coxal plate (MZUSP.28117). Scale bars: A-F = 50 μ m.

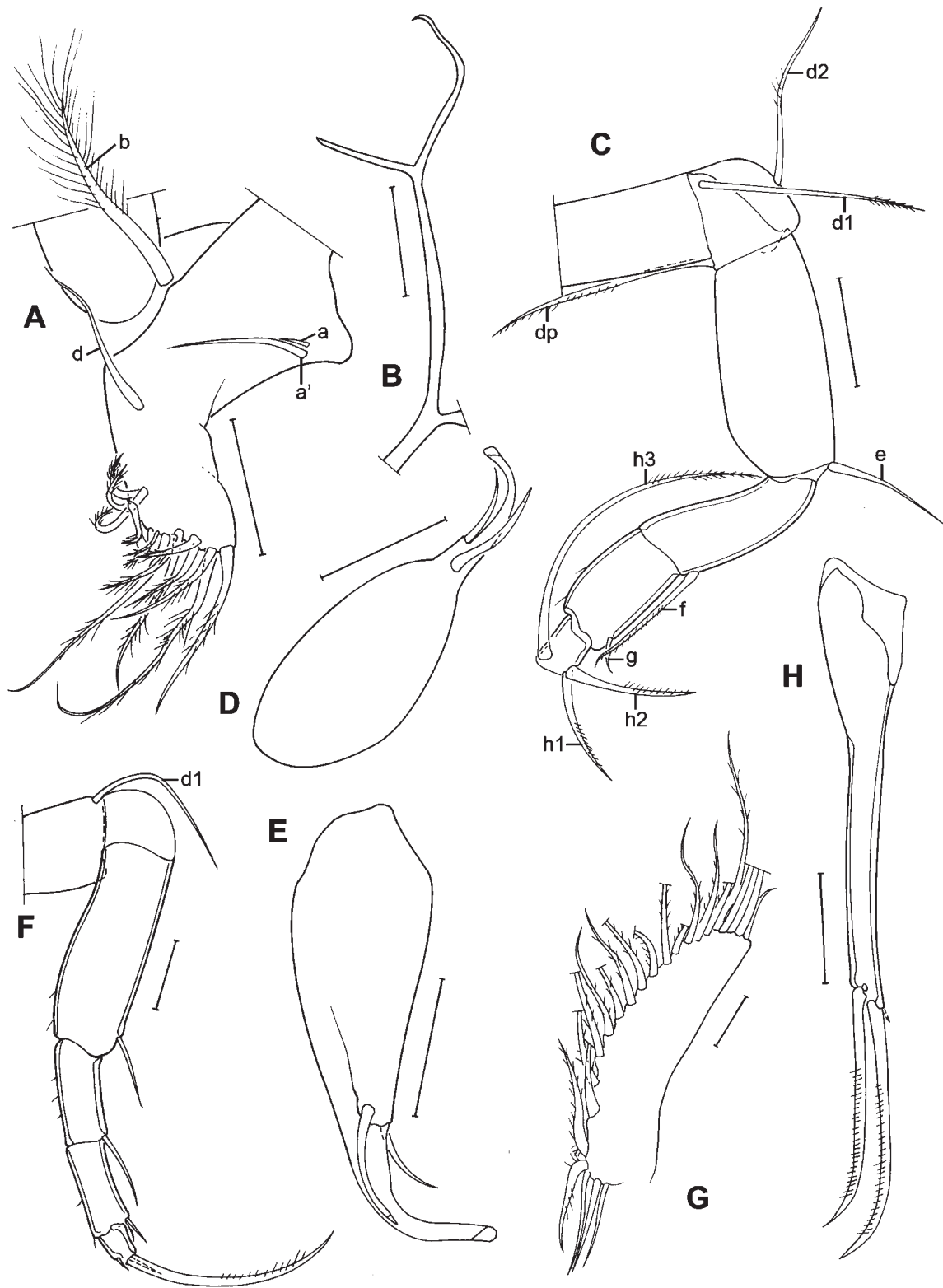


Fig. 10. *Candobrasilopsis brasiliensis* (Sars, 1901) comb. nov., limbs (♂). **A.** T1 (palp not shown) (MZUSP.28117). **B.** Attachment of the caudal ramus (OC.3295). **C.** T3 (MZUSP.28117). **D.** Right clasp organ (MZUSP.28117). **E.** Left clasp organ (MZUSP.28117). **F.** T2 (MZUSP.28117). **G.** Mx1, respiratory plate (OC.3296). **H.** Caudal ramus (OC.3295). Scale bars: A-H = 50 µm.

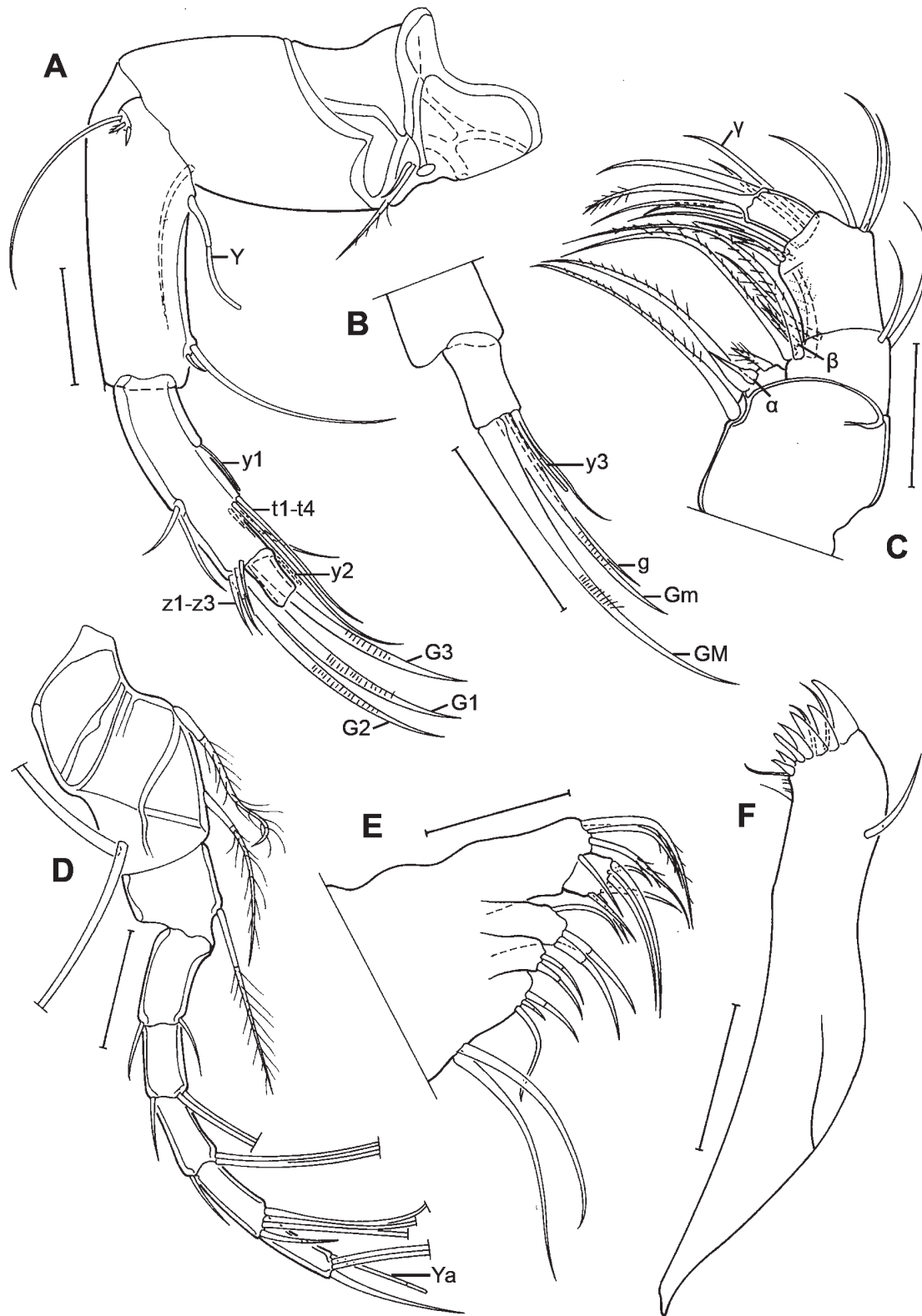


Fig. 11. *Candobrasilopsis brasiliensis* (Sars, 1901) comb. nov., limbs (♀). **A.** A2 (MZUSP.28125). **B.** A2, detail of the last segment (MZUSP.28125). **C.** Md palp (MZUSP.28125). **D.** A1 (MZUSP.28125). **E.** Mx1 (Chaetotaxy incomplete) (OC.3299). **F.** Md, coxal plate (MZUSP.28125). Scale bars: A-F = 50 μ m.

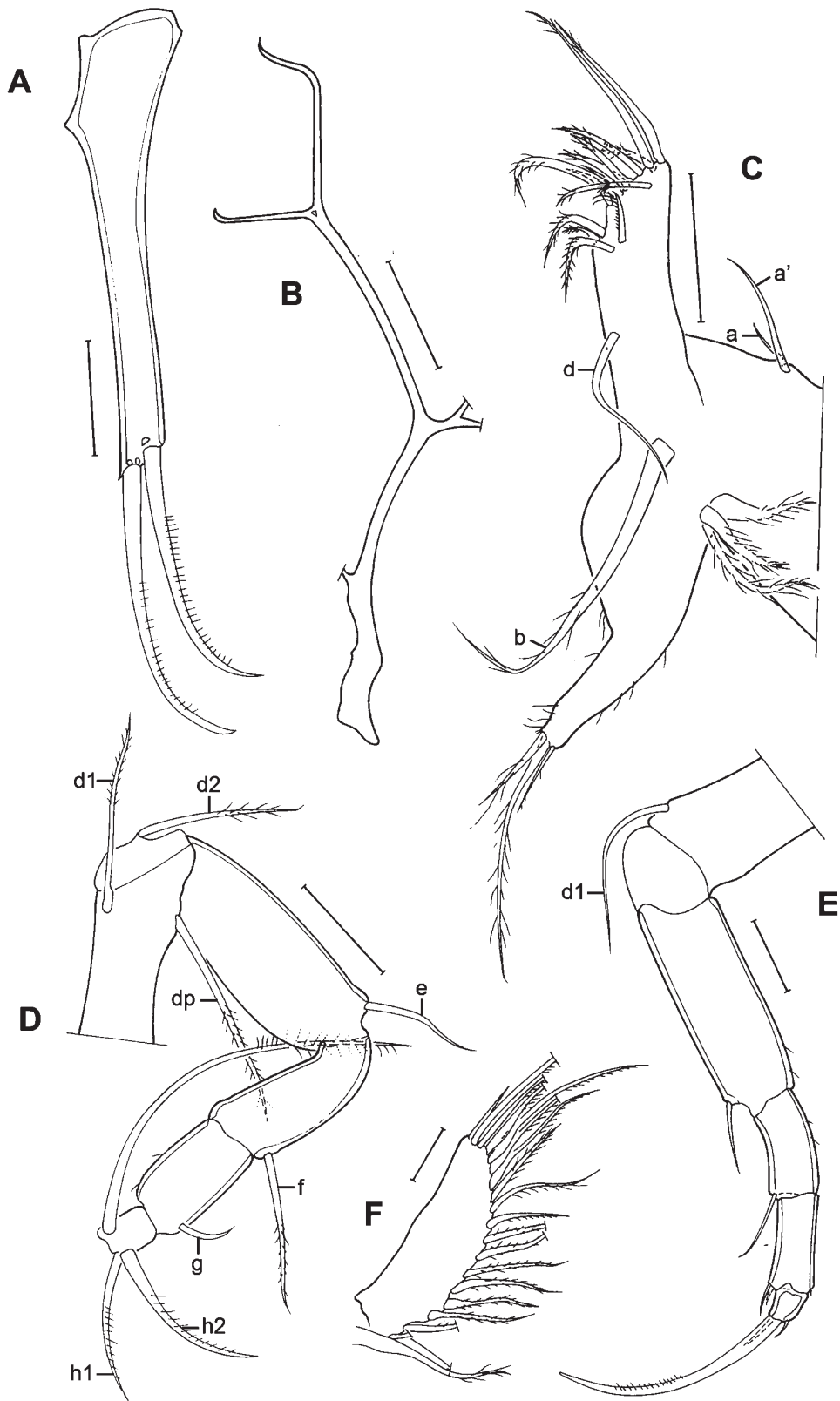


Fig. 12. *Candobrasilopsis brasiliensis* (Sars, 1901) comb. nov., limbs (♀). **A.** Caudal ramus (MZUSP.28125). **B.** Attachment of the caudal ramus (MZUSP.28125). **C.** T1 (OC.3300). **D.** T3 (OC.3300). **E.** T2 (MZUSP.28125). **F.** Mx1, respiratory plate (OC.3299). Scale bars: A-F = 50 μ m.

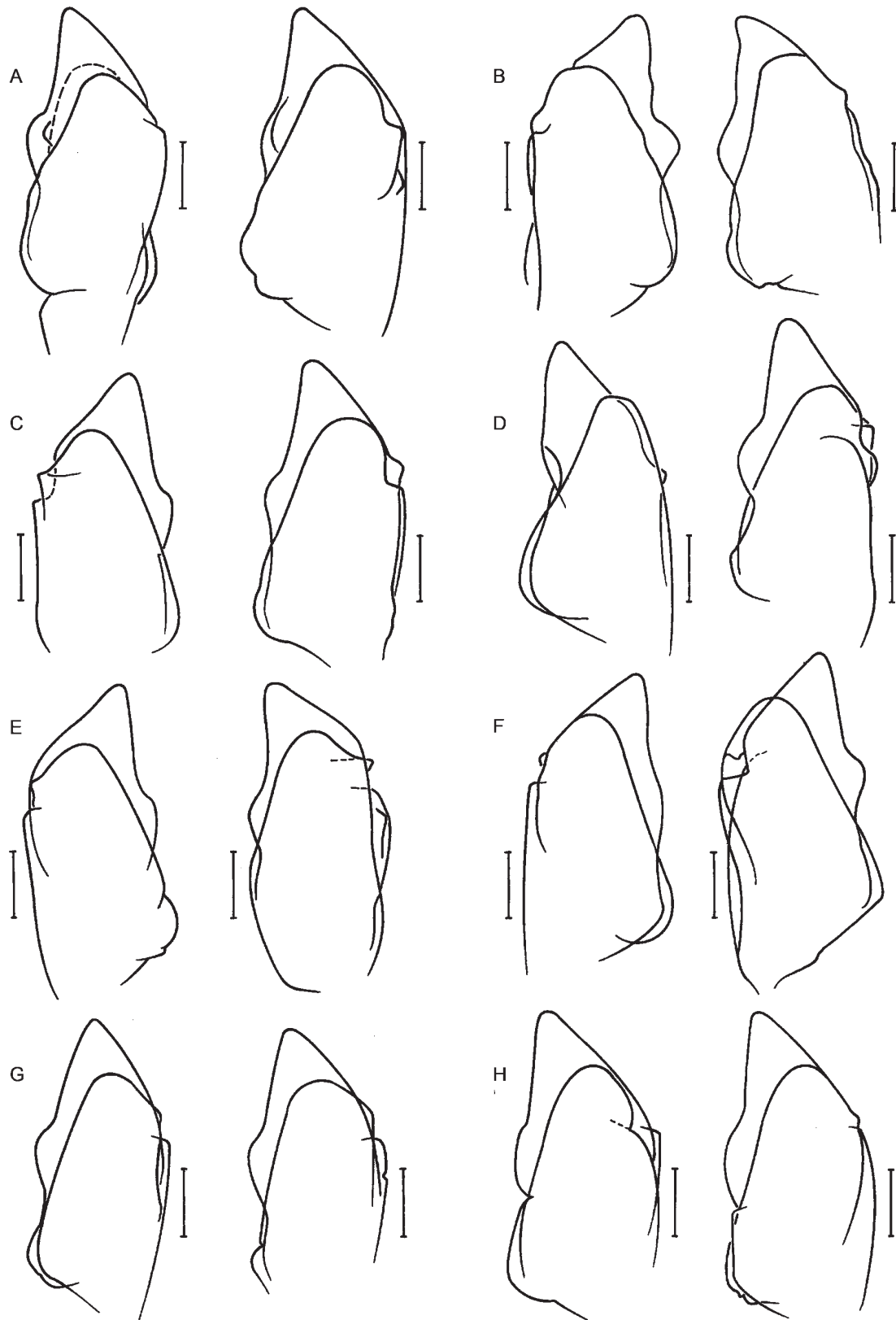


Fig. 13. *Candobrasilopsis brasiliensis* (Sars, 1901) comb. nov., hemipenis. **A.** MZUSP.28117. **B.** OC.3295. **C.** OC.3296. **D.** MZUSP.28120. **E.** MZUSP.28121. **F.** MZUSP.28122. **G.** MZUSP.28123. **H.** MZUSP.28124. Scale bars: A-F = 50 μ m.

part with one long (reaching beyond basis of fifth segment) dorso-subapical seta, no ventro-apical seta present. Third segment with one small sub-apical dorsal and ventral setae. Fourth and fifth segments with two longer dorso-apical and 1 shorter ventro-apical setae. Sixth segment with three longer dorso-apical and one shorter ventro-apical setae. Seventh (terminal segment) most elongate of all, slightly sinuous, bearing one short and two longer setae and one aesthetasc Ya, the latter shorter than the shorter seta.

A2 (Fig. 9A, B) with basal segment broad, wide and relatively long, basally with 2 unequal setae, one relatively long and slender, the other very short and broad, both hirsute; apically with a ventral seta. Remnant of exopod consisting of a short plate, one long and two very short setae. Endopod consisting of 4 segments (penultimate segment divided). First endopodal segment long, carrying one long aesthetasc Y on the ventro-basal side, and one long and one short ventro-apical setae. Second endopodal segment shorter and smaller, but still rectangular with one ventral aesthetasc y1 inserted about mid length, 3 t-setae, with t1 a long, hirsute setae, t2 and t3 modified in the male-bristles; this segment dorso-apically with 3 short setae of unequal length. Third endopodal segment with apical chaetotaxy sexually dimorphic, with z1 and z3 being short setae, z2 being modified into a long claw; G2 a long claw, G1 a long seta and G3 a short setae, aesthetasc y2 short and ventro-apically inserted. Terminal (4th) segment (Fig. 9B) small, distally with claws GM (long) and Gm (short), aesthetasc y3 with its companion seta, fused at the basis and with seta almost twice as long as aesthetasc, and seta g, clearly longer than y3.

Md with coxa (Fig. 9F) relatively elongated, distally set with a series of strong teeth. Md-palp (Fig. 9D) consisting of 4 segments. Basal segment dorsally carrying the respiratory plate (not shown), ventro-apically with 2 long hirsute setae (s1 & s2) and the alpha seta, the latter proximally with a broad base and a flagellum-like, distal part. Second segment dorso-apically with 2 setae of unequal length, ventro-basally with a short, stout and hirsute seta and ventro-apically with a group of 5 setae: 3 long and hirsute setae (similar to the two s-setae of the previous segment), a shorter, less hirsute seta and the short and hirsute beta-seta. Third segment with a group of 3 dorso-subapical setae, the latter smooth, a central apical group of two setae, one of which being the gamma seta and ventro-apical group of 4 unequal setae. Terminal segment rectangular, apically set with two large claws and an uncertain number of smaller setae.

Mx1 (Fig. 9E) with a basal (basipodite) part carrying a large respiratory plate (exopodite), 3 endites and a two-segmented palp (endopodite). Respiratory plate (Fig. 10G) elongated, carrying more than 20 respiratory rays, some quite short, others long. Palp with first segment carrying 3+1 apical setae; terminal segment short and broad, carrying 2 longer claws and c 3 short setae. Chaetotaxy of three endites impossible to determine. Sideways directed bristles near first endite long and stout.

T1 (sometimes called Mx2 – Fig. 10A) consisting of basal part (basipodite), carrying respiratory plates (not shown), a palp (modified to prehensile palp in males) and an exopodite (?) distally set with 14-15 setae of different morphology and length. Basal plate set with one long and stout ‘d’-seta, a shorter and more slender ‘b’-seta and two ‘a’-setae of unequal length. Prehensile palps (Fig. 10D, E) one-segmented, distally hook-like and set with two unequal, sub-apical setae; palps slightly asymmetrical, Rpp (Fig. 10D) slightly smaller than Lpp, distal part of apical hook slightly swollen in Lpp, not at all in Rpp.

T2 (walking limb – Fig. 10F) with 4-segmented endopodite (penultimate segment divided) and elongated. First segment with long seta d1. Knee-segment devoid of seta d2. First segment of endopod especially elongated, with short ventro-apical seta (e). Second segment also with one short ventro-apical seta (f). Third segment with two ventro-apical setae, one short, one slightly longer. Terminal segment with one short apical and one short sub-apical seta and a long apical claw.

T3 (cleaning limb – Fig. 10C) as typical of the family. First segment with three long setae, one medial (d1), one subapical (d2) and one apical (dp). Second segment with one subapical seta (e). Third segment with one long subapical seta (f), Penultimate segment with one short and curved subapical seta (g). Terminal segment well-separated from penultimate segment and carrying three setae: one long and reflexed (h3) and two side-ways directed (h1 & h2), the latter subequal.

Caudal ramus (furca – Fig. 10H) with stout ramus and two stout apical claws. Proximal setae missing, distal seta a small spine. Attachment of caudal ramus (Fig. 10B) long and stout, distally bifurcated and with additional lateral branch before mid-length. Length ratio ramus/largest claw = 1.64.

Hemipenis (Fig. 7C) large, with medial shield rounded and with additional ventral protuberance, lateral shield bluntly pointed, triangular and with rounded, proximo-dorsal expansion; labyrinth short and stout, postlabyrinthal spermiductus narrow and straight, without additional coils, but with a weak bent at the most distal part.

Zenker organ (Fig. 7D) short and broad, with *ca.* 5 spinous whirls.

Redescription of female

Valves (Fig. 8F, G) and Cp (Fig. 8H) in lateral view similar to those in the male; valves in inner view slightly more elongated and less high than in the male. Cp in D and V views (Fig. 8I, J) slightly more slender than in the male.

Soft parts (Figs 11C-F, 12A, B, D-F) largely as in the male, but with sexually dimorphic A2 and T1.

A2 (Fig. 11A, B) with setae t1-4 setae like, not transformed; z1-3 short and slender setae. Claws G1, G2, G3 and GM all reaching to about the same point.

T1 (Fig. 12C) with basal part as in the male. Endopod a broad palp, with two short and one long distal setae.

Caudal ramus: length ratio ramus/largest claw = 1.61.

Measurements

See Table 3.

Ecology

Together, both species have been found in 29 localities, in a total of 48 localities sampled in the alluvial valley of the Upper Paraná River, they occurred sympatrically in only 11 localities.

Candobrasilopsis rochai gen. nov. sp. nov. occurred in 17 localities in the alluvial valley. The pH ranged between 5.1 and 6.6, electrical conductivity between 13.2 and 66.9 $\mu\text{S cm}^{-1}$ and dissolved oxygen between 1.2 and 8.6 mg L^{-1} .

Candobrasilopsis brasiliensis comb. nov. was found in 26 localities, with pH values ranging between 4.7 and 6.5, electrical conductivity between 23.6 and 114.9 $\mu\text{S cm}^{-1}$ and dissolved oxygen between 0.6 and 13.3 mg L^{-1} .

These species were predominant in several types of substrates as sediment (named littoral in Table 1) and different species of floating macrophytes (*Eichhornia crassipes*, *Pistia stratiotes*, *Hydrocotyle ranunculoides* and *Salvinia* spp.) in different habitats (lakes, channels and rivers) (Table 1).

Remarks

As some small differences in hemipenis morphology between two different populations of this species were detected, we dissected a longer series of males from 3 populations and illustrated both hemipenes of each individual (Fig. 13). It is clear that indeed some variability exists, i.e. in the size of the proximo-dorsal expansion of the ls, as well as in the ventral expansion of the ms. Some of this variability might be a result of different positions of these organs between cover slip and glass slide. Therefore, we deem all of these populations to be conspecific.

Discussion

Candobrasilopsis versus *Latinopsis*

Karanovic & Datry (2009) erected the genus *Latinopsis*, with the type species *L. patagonica* Karanovic & Datry, 2009 from Chile, based mainly on the fact that the length of the terminal segment of the Md-palp is much shorter in this South American genus than in *Candonopsis* s.s. We agree that this is a significant character that merits the distinction of a separate lineage within the Candonopsini.

Here, we describe a new genus with the same character, the short terminal segment on the mandibular palp, but which differs markedly from *Latinopsis* in a number of characters. Firstly, in the size and shape of the anterior calcified inner lamella, which is narrow and of which the inner margin is evenly rounded, running parallel to the valve margin in *Latinopsis patagonica*, but which is ca. 3 times broader in *Candobrasilopsis* and which has a sinuous inner margin in both valves, not parallel to the anterior valve margin. In fact, the anterior calcified inner lamella in *Latinopsis* species have a juvenile appearance, and if the illustrations in Karanovic & Datry (2009: figs 1A, 3A) are correct, one would suspect a heterochronic valve development in this genus. Secondly, the hemipenis of *Latinopsis patagonica* is not at all of the type that is typical of ‘*Candonopsis*’ species: it has two distinct lobes (named a and b in Karanovic & Datry, loc.cit.) and as such is more of the ‘*Candona*’ s.l.-type (see extensive descriptions in Danielopol 1978). The hemipenis in ‘*Candonopsis*’ s.l., as in *Candobrasilopsis* gen. nov. and in *C. anisitsi*, has a large, triangular and pointed lateral shield (named lobe a in Karanovic & Datry, 2009) and an almost non-existent medial shield (Fig. 7A, C). The Candonopsini thus have at least 2 separate lineages within the Neotropics.

The position of *Candonopsis anisitsi* Daday, 1905

Karanovic & Datry (2009) also included several (older, and ill described) species into their new genus, including *Candonopsis anisitsi* Daday, 1905 from Paraguay. Of this latter species, they re-described type material and illustrated several of the limbs (not the valves, which were apparently missing in the type material). It is clear from this re-description that there are several differences between *L. patagonica* and *C. anisitsi*, for example (1) in the type of hemipenis, which has a ‘*Candona*’ – like appearance with lobes a and b in *Latinopsis patagonica*, but has the real ‘*Candonopsis*’ – type with triangular lateral shield (ls) and reduced medial shield (ms) in *Candonopsis anisitsi* (see above); (2) the morphology of the prehensile palps (almost symmetrical in *Latinopsis patagonica* and with distinct asymmetry in *C. anisitsi* and (3) in the size, shape and position of the seta ‘b’ on the endopod of the T1 (seta b large and stout and placed distinctly away from seta d in *Latinopsis* and *Candobrasilopsis* gen. nov.; small and positioned closely to seta d in *C. anisitsi*). There also appear to be differences in other aspects of the chaetotaxy between *L. patagonica* and *C. anisitsi*, but these are more difficult to interpret. For example, the rest of the chaetotaxy of the mandibular palp appears to be different between both species.

We agree that both species belong to related lineages within Candonopsini, and differ from *Candonopsis* s.s., but do not necessarily belong in the same genus.

New material of this species needs to be re-examined to determine the exact shape and position of seta b on T1 and of the shape and size of the anterior calcified inner lamella (and of the inner margin) in this species. The other species transferred to *Latinopsis* by Karanovic & Datry (2009), namely *Candona columbiensis* Mehes, 1914 and *Candonopsis falclandica* Vavra, 1898, need to be re-examined in detail to see in which genus they belong.

Taxonomy of the Candonopsini

The taxonomic identity of the *Candonopsini* relied first and foremost on the absence of the proximal seta of the caudal ramus. This feature is still the first delimiting factor to distinguish between ‘real’ candonids on the one hand and candonopsines on the other hand. There are at present three genera with a well-developed caudal ramus (i.e. a strong ramus, with 2 well-developed claws) in which the proximal seta is missing: *Candonopsis* Vavra, 1891, *Latinopsis* Karanovic & Datry, 2009 and *Candobrasilopsis* gen. nov. These genera most likely belong to the same phyletic clade and can thus be united in a tribe, the Candonopsini. However, meanwhile several species with further reductions in the chaetotaxy of the caudal ramus have been described within *Candonopsis* s.s. (e.g. *C. westaustraliensis* Karanovic & Marmonier, 2002), while *Marococandona* Marmonier *et al.*, 2005 comprises one species with fully developed caudal ramus (*M. danielopoli*) and one species in which the caudal ramus consists of only a ramus and one apical claw (*M. nicolae*). Moreover, several other genera with strongly reduced caudal rami have been lodged in the Candonopsini by Karanovic & Datry (2009) and Karanovic (2012): *Abcandonopsis* Karanovic, 2004 (here raised to generic rank), *Cubacandona* Broodbakker, 1983, *Caribecandona* Broodbakker, 1983, *Marococandona* Marmonier *et al.*, 2005 and *Pioneercandonopsis* Karanovic, 2005.

We have issues with this taxonomic situation, as it is almost certain that not all of these species and genera effectively belong to the same phyletic lineage. A reduction in size and chaetotaxy of the cypridoid caudal ramus has occurred many times in different lineages and is in fact one of the most common examples of parallel evolution (homeomorphy) in non-marine Ostracoda (see also McKenzie 1982). The polyphyletic nature of the Candonopsini as defined by Karanovic (2012) is further demonstrated by the fact that the different genera have several other characters in which they differ from each other: “Carapace shape various (*sic*) (reniform, elongated, trapezoidal) (...), A1 7-segmented (...) or the number of segments reduced. Male sexual bristles on A2 present (...) or absent.” (Karanovic 2012: 258). Other differences occur in hemipenis morphology.

A revision of the Candonopsini is urgently needed so that the different lineages which are presently grouped within it, can be recognised and can be properly classified.

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References

- Agostinho A.A. & Zalewski M. 1996. *A planície alagável do alto rio Paraná: importância e preservação. (Upper Paraná River Floodplain: Importance and Preservation)*. Maringá, EDUEM.
- Agostinho A.A., Gomes L.C., Thomaz S.M & Hahn N.S. 2004. The Upper Paraná River and its Floodplain: Main Characteristics and Perspectives for Management and Conservation. In: Thomaz S.M., Agostinho A.A. & Hahn N.S. (eds) *The Upper Paraná River and its Floodplain: Physical Aspects, Ecology and Conservation*: 381-393. Backhuys Publishers, Leiden.
- Broodbakker N.W. 1983. The subfamily Candoninae (Crustacea, Ostracoda) in the West Indies. *Bijdragen tot de Dierkunde* 53: 287-326.
- Broodbakker N.W. & Danielopol D.L. 1982. The chaetotaxy of Cypridacea (Crustacea, Ostracoda) limbs: proposals for a descriptive model. *Bijdragen tot de Dierkunde* 52: 103-120.
- Danielopol D.L. 1978. *Über Herkunft und Morphologie der Süßwasser-hypogäischen Candoninae (Crustacea, Ostracoda)*. Sitzungsberichte der Österreichischen Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Klasse, Abteilung I 187: 1-162. Academy of Sciences, Vienna.
- Higuti J., Velho L.F.M., Lansac-Tôha F.A. & Martens K. 2007. Pleuston communities are buffered from regional flood pulses: the example of ostracods in the Paraná River floodplain, Brazil. *Freshwater Biology* 52: 1930-1943. <http://dx.doi.org/10.1111/j.1365-2427.2007.01821.x>
- Higuti J., Lansac-Tôha F.A., Velho L.F.M., Pinto R.L., Vieira L.C.G. & Martens K. 2009a. Composition and distribution of Darwinulidae (Crustacea, Ostracoda) in the alluvial valley of the upper Paraná River, Brazil. *Brazilian Journal of Biology* 69: 253-262. <http://dx.doi.org/10.1590/S1519-69842009000200004>
- Higuti J., Lansac Tôha F.A., Velho L.F.M. & Martens K. 2009b. Biodiversity of non-marine ostracods (Crustacea, Ostracoda) in the alluvial valley of the upper Paraná River, Brazil. *Brazilian Journal of Biology* 69 (suppl): 661-668. <http://dx.doi.org/10.1590/S1519-69842009000300020>
- Higuti J., Meisch C. & Martens K. 2009c. On *Paranacypris samambaiensis* n.gen. n.sp. (Crustacea, Ostracoda), the first South American psychrodromid, from the floodplain of the Upper Parana River (Parana, Brazil). *Journal of Natural History* 43: 769-783. <http://dx.doi.org/10.1080/00222930802702506>
- Higuti J., Declerck S.A.J., Lansac-Tôha F.A., Velho L.F.M. & Martens K. 2010. Variation in ostracod (Crustacea, Ostracoda) communities in the alluvial valley of the upper Paraná River (Brazil) in relation to substrate. *Hydrobiologia* 644: 261-278. <http://dx.doi.org/10.1007/s10750-010-0122-1>
- Higuti J. & Martens K. 2012. On a new cypridopsine genus (Crustacea, Ostracoda, Cyprididae) from the Upper Paraná River Floodplain (Brazil). *Zootaxa* 3391: 23-38.
- Higuti J., Schön I., Audenaert L. & Martens K. (in press). On the *Strandesia obtusata/elliptica* - lineage (Ostracoda, Cyprididae) in the alluvial valley of the Upper Paraná River (Brazil), with the description of three new species. *Crustaceana* (accepted).
- Horne D.J., Cohen A. & Martens K. 2002. *Taxonomy, morphology and biology of Quaternary and living Ostracoda*. In: Holmes J.A. & Chivas A.R. (eds) *Biology, Taxonomy and Identification Techniques*: 5-36. American Geophysical Union, Washington DC.
- Karanovic I. 2007. *Candoninae (Ostracoda) from the Pilbara Region in Western Australia*. Crustaceana Monographs 7, Brill, Leiden.
- Karanovic I. 2012. *Recent Freshwater Ostracods of the World. Crustacea, Ostracoda, Podocopida*. Springer, Heidelberg.
- Karanovic I. & Marmonier P. 2002. On the genus *Candonopsis* (Crustacea: Ostracoda: Candonidae) in Australia, with a key to the world recent species. *Annales de Limnologie - International Journal of Limnology* 38: 199-240. <http://dx.doi.org/10.1051/limn/2002018>

- Karanovic I. & Datry T. 2009. Overview of the Candoninae (Crustacea, Ostracoda) of South America and the West Indies, with the description of two new species and one new genus. *Zootaxa* 2267: 1-25.
- Martens K. 1987. Homology and functional morphology of the sexual dimorphism in the antenna of *Sclerocypris* Sars, 1924 (Crustacea, Ostracoda, Megalocypridinae). *Bijdragen tot de Dierkunde* 57:183-190.
- Martens K. 1992. On *Namibcypris costata* n. gen. n. sp. (Crustacea, Ostracoda, Candoninae) from a spring in northern Namibia, with the description of a new tribe and a discussion on the classification of the Podocopina. *Stygologia* 7: 27-42.
- Martens K. & Behen F. 1994. *A checklist of the non-marine ostracods (Crustacea, Ostracoda) from South-American inland waters and adjacent islands*. Travaux scientifiques du Musée d'Histoire naturelle de Luxembourg 22. Musée d'Histoire naturelle, Luxembourg.
- Martens K., Schön I., Meisch C. & Horne D.J. 2008. Global biodiversity of non-marine Ostracoda (Crustacea). In: Balian E., Lévêque C., Segers H. & Martens K. (eds) Freshwater animal diversity assessment. *Hydrobiologia* 595: 185-193. <http://dx.doi.org/10.1007/s10750-007-9245-4>
- Martens K. & Savatnalinton S. 2011. A subjective checklist of the recent, free-living, non-marine Ostracoda (Crustacea). *Zootaxa* 2855: 1-79.
- McKenzie K.G. 1982. Homeomorphy: Persistent joker in the taxonomic pack, with the description of *Bradleycypris* gen.nov. In: Bate R.H, Robinson E. & Sheppard L.M. (eds) *Fossil and Recent Ostracods*: 407-438. Ellis Horwood Ltd., Chichester.
- Meisch C. 2000. *Freshwater Ostracoda of Western and Central Europe*. Heidelberg/Berlin, Spektrum Akademischer Verlag GmbH.
- Mormul R.P., Thomaz S.M., Higuti J. & Martens K. 2010. Ostracod (Crustacea) colonization of one native and one non-native macrophyte species of Hydrocharitaceae: an experimental evaluation. *Hydrobiologia* 644: 185-193. <http://dx.doi.org/10.1007/s10750-010-0112-3>
- Sars G.O. 1901. Contributions to the knowledge of the freshwater Entomostraca of South America. Part II. Copepoda-Ostracoda. *Archiv for Matematik og Naturvidenskab, B* 14: 1-52.
- Souza Filho E.E., Stevaux J.C. 2004. Geology and Geomorphology of the Baía-Curutuba-Ivinheima River complex. In: Thomaz S.M., Agostinho A.A. & Hahn N.S. (eds) *The Upper Paraná River and its Floodplain: Physical Aspects, Ecology and Conservation*: 1-29. Backhuys Publishers, Leiden.
- Würdig N.L. 1984. *Ostracodes do Sistema Lagunar de Tramandai, RS, Brasil. Sistemática, Ecologia e Subsídios à Paleoecologia. Volume 2*. PhD thesis, Universidade Federal do Rio Grande do Sul.

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