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Morphology of the first zoeal stages of five species of the portunid genus *Callinectes* (Decapoda, Brachyura) hatched at the laboratory

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ABSTRACT

The genus *Callinectes* Stimpson, 1860 currently consists of 16 species, six of which are reported in Brazilian coast. In the present study, the first zoeal stages of *Callinectes bocourti*, *C. danae*, *C. exasperatus*, *C. ornatus* and *C. sapidus* from Brazil were obtained from ovigerous females. The morphological and meristic characters of all these larval stages are described and illustrated. Those of *C. bocourti, C. danae* and *C. sapidus* are redescribed and compared with the previous descriptions, and differences are listed. Larval characters of these species were examined for interspecific differences, as well as larval features to distinguish the genus *Callinectes* within Portunidae. In addition, other portunid genera and species with a known first zoeal stage are compared, with special attention to those species present in the same geographical area. Our findings concord with some previous molecular studies, and we discuss the complexity within the group.

Key words: larval morphology, Portunidae, Portunoidea, zoea.

INTRODUCTION

Swimming crabs of the genus *Callinectes* Stimpson, 1860 are ubiquitous representatives of the portunid fauna in tropical and subtropical waters. Under present systematic treatments, 16 species of *Callinectes* are currently recognized for this genus worldwide (compiled from Rathbun 1930, Stephenson and Campbell 1959, Williams 1974, 1984, Melo 1996, Schubart et al. 2001, Robles et al. 2007, Ng et al. 2008). Six are reported in Brazilian waters: *Callinectes affinis* Fausto-Filho 1980*, C. bocourti* A. Milne-Edwards 1879, *C. danae* Smith 1869, *C. exasperatus* (Gerstaecker 1856), *C. ornatus* Ordway 1863 and *C. sapidus* Rathbun 1896.

Despite the ecological, evolutionary and economic importance of *Callinectes*, controversies remain regarding the systematic arrangement of the genus (Williams 1974, Norse 1977), which has been based up the present on morphological and physioecological data. The validity of morphological characters was tested by molecular tools only recently (Schubart et al. 2001, Robles et al. 2007). However, despite the unquestionable importance of larval morphology for the study

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of phylogenetic relationships (Rice 1980), larval descriptions are not available for most species and many genera of portunids; and many existing descriptions are incomplete or erroneous. Larval information is available for less than 8% of all known portunid crab species.

Considering this promising scenario for taxonomic investigation and the potential for zoeal morphology to provide helpful information, we describe and illustrate here the first zoeal stages of five species (*Callinectes bocourti*, *C. danae*, *C. exasperatus*, *C. ornatus* and *C. sapidus*) hatched in the laboratory, and compare their morphology with described zoeae of other portunid species. The morphology of the zoea I of *Callinectes exasperatus* and *C. ornatus* is described for the first time, and the zoeae of *C. bocourti, C. danae* and *C. sapidus* are redescribed and compared with the previous descriptions by Lopes et al. (2000), Sankarankutty et al. (1999) and Costlow and Bookhout (1959), respectively. The differences in morphology are listed.

MATERIALS AND METHODS

Ovigerous females were obtained by trawling in two regions (São Vicente and Ubatuba) of the coast of São Paulo, Brazil, during 2002 and 2003. Females were transported to the laboratory, and the ovigerous females were isolated in aquaria with aerated sea water at a salinity of 34 psu and constant temperature (24 ± 1°C) until hatching. Newly hatched zoea stages were fixed in a 1 : 1 solution of 70% ethanol and glycerin. The first zoeae were dissected for detailed examination under a stereoscope, and mounted on semipermanent slides. Measurements and morphological characters were checked using a compound microscope equipped with a *camera lucida*. A minimum of 10 specimens were used for measurements, and 20 specimens for descriptions.

For the zoeae I the following measurements were taken: cephalothoracic dorsal spine length (DL), distance from the base to tip of the dorsal spine; cephalothoracic rostral spine length (RL), distance from the base to tip of the rostral spine; rostrodorsal length (RDL), distance from the tip of the rostral spine to the tip of the dorsal spine; cephalothorax length (CL), from between the eyes (base of the rostrum) to the postero-lateral cephalothorax margin. The descriptions follow the standard proposed by Clark et al. (1998). The long terminal plumose natatory setae on distal exopod segments of the first and second maxillipeds are drawn truncated. We followed the seta and setal classifiation proposed by Garm (2004).Voucher samples of the parental female and zoea I of all species were deposited in the Crustacean Collection of the Biology Department (CCDB) of the Faculty of Philosophy, Sciences and Letters of Ribeirão Preto (FFCLRP) at the University of São Paulo (USP) under accession numbers CCDB 4256-4271. The collections of specimens conducted in this study complied with current applicable state and federal laws of Brazil (permanent license to FLM for collection of Zoological Material No. 11777-1 MMA/IBAMA/SISBIO).

RESULTS

Description

A complete detailed description of the zoea I of the type species of the genus, *Callinectes sapidus*, as well as of the previously unknown zoea I of *C. exasperatus* and *C. ornatus* are provided. For the zoeae I of *Callinectes bocourti* and *C. danae* only the differences with regards to that of *C. sapidus* are mentioned.

Callinectes sapidus

Zoea I (Figs 1-2)

Measurements: DL: 0.40 ± 0.02 mm; RL: 0.26 ± 0.03 mm; RDL: 0.96 ± 0.04 mm; CL: 0.39 ± 0.03 mm.

Cephalothorax (Fig. 1A). With long dorsal spine, curved distally backward and without setae; rostral spine long, slightly longer than antenna; lateral spines present and well developed; between the eyes a well-developed protuberance; each lateroventral

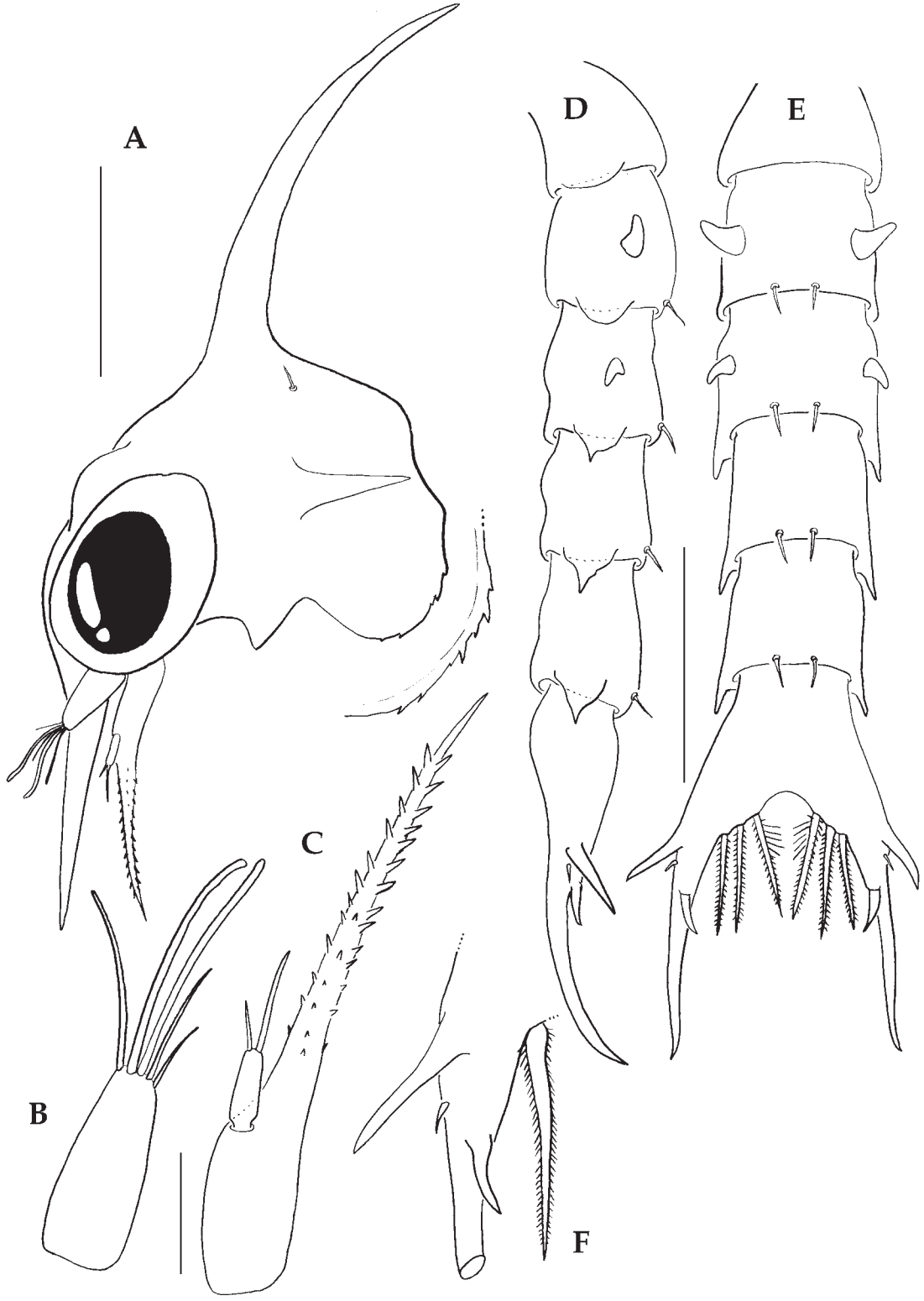

Fig. 1 - *Callinectes sapidus*, zoea I. **A**, Cephalothorax, lateral view, with magnification of the ventral margin; **B**, antennule; **C**, antenna; **D**, pleon, lateral view; **E**, pleon, dorsal view; **F**, detail of the spinulation of the telson furca. Scale bars, **A** = 0.2 mm, **B-C**, **F** = 0.05 mm, **D-E** = 0.2 mm.

margin denticulate and without setae; one pair of posterodorsal simple setae present; eyes sessile.

Antennule (Fig. 1B). Uniramous, smooth and conical; endopod absent; exopod unsegmented, with 3 terminal aesthetascs and 2 simple setae.

Antenna (Fig. 1C). Biramous, protopod very long with 2 rows of 12-14 spinules of different sizes, increasing toward the tip, in the midpart a row of 6 medium-sized spinules; endopod absent; one-segmented exopod, shorter than the spinous process, approximately 1/7 of protopod length, with 2 unequal subterminal simple setae.

Mandible. Incisor and molar processes differentiated; mandibular palp absent.

Maxillule (Fig. 2A). Coxal endite with 6 plumodenticulate setae; basial endites with 2 cuspidate and 3 plumodenticulate setae; endopod 2-segmented, proximal segment without setae, distal segment with 2 medial and 3 terminal plumodenticulate and 1 terminal simple setae; exopodal seta absent.

Maxilla (Fig. 2B). Coxal endite bilobed, with 3 plumodenticulate setae on proximal lobe, and 3 plumodenticulate setae and 1 terminal spine on distal lobe; basial endite bilobed, with 4 plumodenticulate setae and 1 terminal spine on proximal lobe, and 4 plumodenticulate setae on distal lobe; unsegmented endopod bilobed, with 1 long sparsely plumodenticulate setae and 1 simple seta on proximal lobe, 1 long sparsely plumodenticulate seta and 3 simple setae on distal lobe, and microtrichia on lateral margin; exopod (scaphognathite) margin with 4 plumose setae and a long distal process.

First maxilliped (Fig. 2C). Coxa with 1 simple seta; basis with 10 simple setae arranged 2+2+3+3; endopod 5-segmented with 2, 2, 0, 2, sparsely plumose and 5 (1 subterminal simple and 4 terminal plumodenticulate) setae, respectively; exopod 2-segmented, distal segment with 4 long terminal plumose natatory setae.

Second maxilliped (Fig. 2D). Coxa without setae; basis with 4 simple setae arranged 1+1+1+1; endopod 3-segmented with 1 sparsely plumose, 1 sparsely plumose, and 5 (2 simple, 1 serrulate, 1 sparsely plumodenticulate, and 1 long sparsely plumose) setae, respectively; exopod 2-segmented, distal segment with 4 long terminal plumose natatory setae.

Third maxilliped. Absent.

Pereiopods. Absent.

Abdomen (Figs. 1D, E). Five somites; somites 2 and 3 with one pair of dorsolateral processes; somite 2 with short rounded posterolateral processes, somites 3-5 with long acute posterolateral processes; somite 1 without setae, somites 2-5 with one pair of posterodorsal simple setae; pleopods absent.

Telson (Fig. 1D-F). Telson furcae with one pair of well-developed lateral spines, one pair of small lateral simple setae just below the lateral spines, and one pair of dorsal spines; inner margin with 3 pairs of serrate setae.

Callinectes bocourti

Zoea I (Figs. 3A, 5A, 6A, 6E, 7A)

Measurements: DL: 0.42 ± 0.03 mm; RL: 0.26 ± 0.02 mm; RDL: 0.98 ± 0.03 mm; CL: 0.38 ± 0.03 mm.

Cephalothorax (Figs. 3A, 5A). With long dorsal spine, curved distally backward but not as strong as in *C. sapidus*; rostral spine long, slightly shorter than antenna; each lateroventral margin with more numerous and stronger acute denticles than in *C. sapidus*.

Antennule (Fig. 6A). Exopod unsegmented, with 2 terminal aesthetascs and 2 simple setae.

Antenna (Fig. 6E). Protopod very long, with 2 rows of 14-16 spinules of different sizes, increasing toward the tip, the last 3 spines not paired, in the basal part 3 medium-sized spinules; one-segmented exopod, shorter than the spinous process, approximately 1/8 of protopod length.

Telson (Fig. 7A). Slight differences in spinulation of serrate setae.

Callinectes danae

Zoea I (Figs. 3B, 5B, 6B, 6F, 7B)

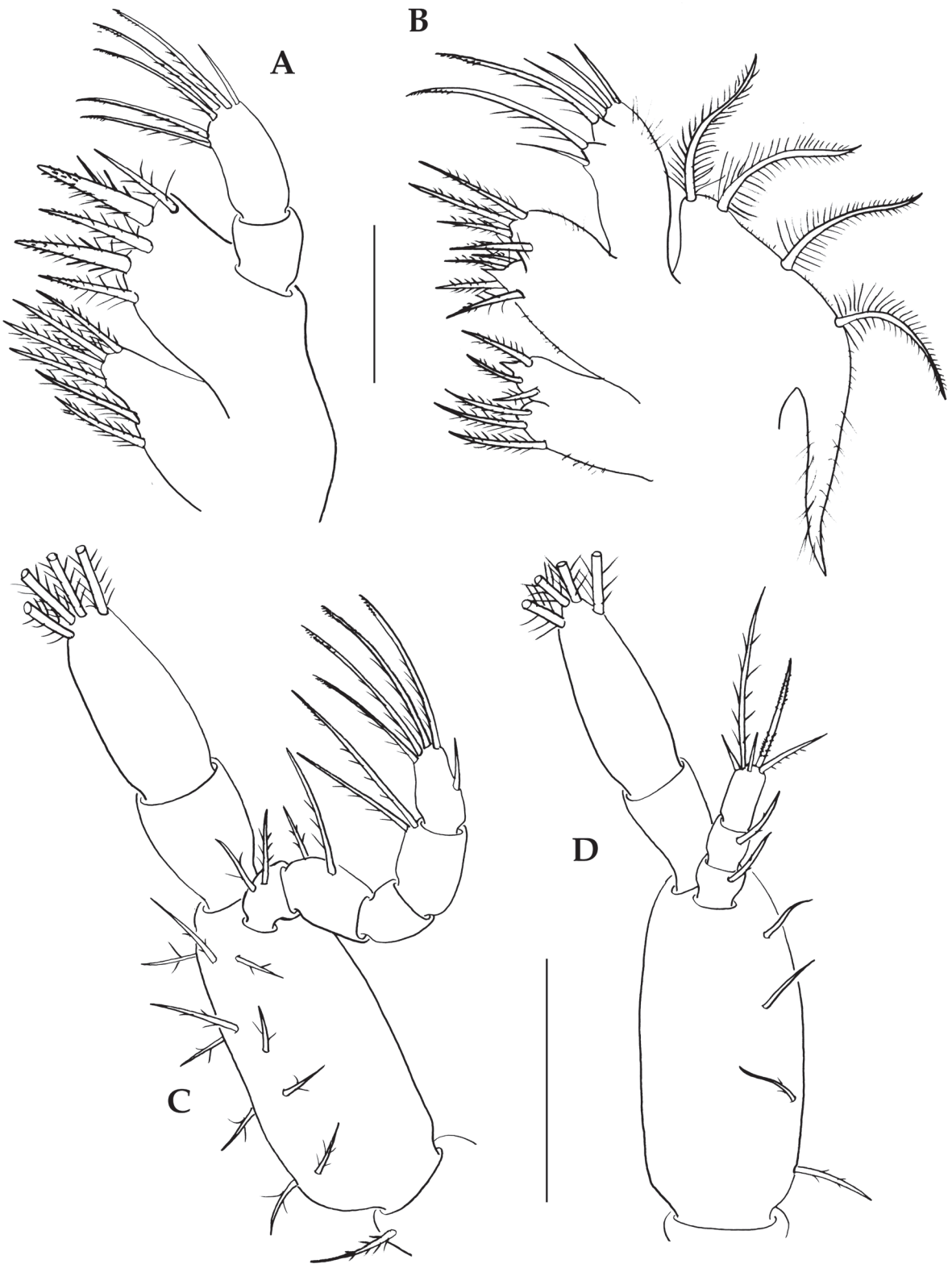

Fig. 2 - *Callinectes sapidus*, zoea I. **A**, Maxillule; **B**, Maxilla; **C**, First maxilliped; **D**, Second maxilliped. Scale bars, **A-B** = 0.05 mm, **C-D** = 0.125 mm.

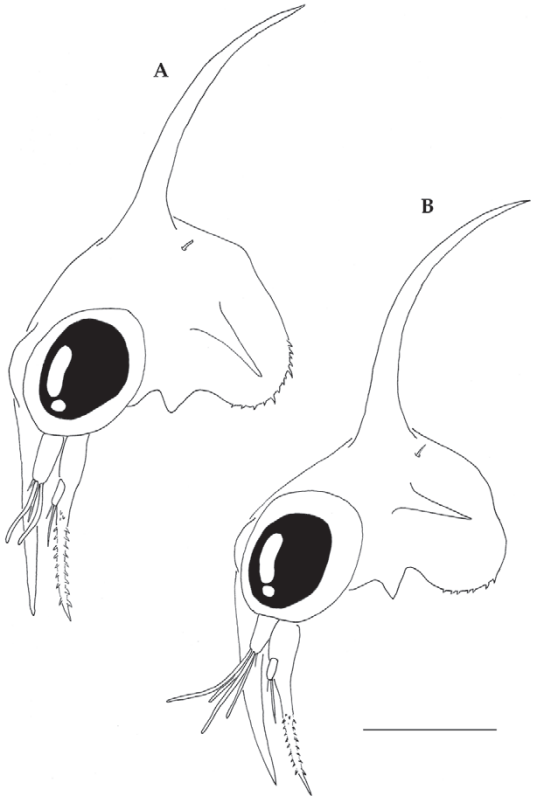

Fig. 3 - Cephalothorax, lateral view. **A**, *Callinectes bocourti*; **B**, *Callinectes danae*. Scale bar = 0.2 mm.

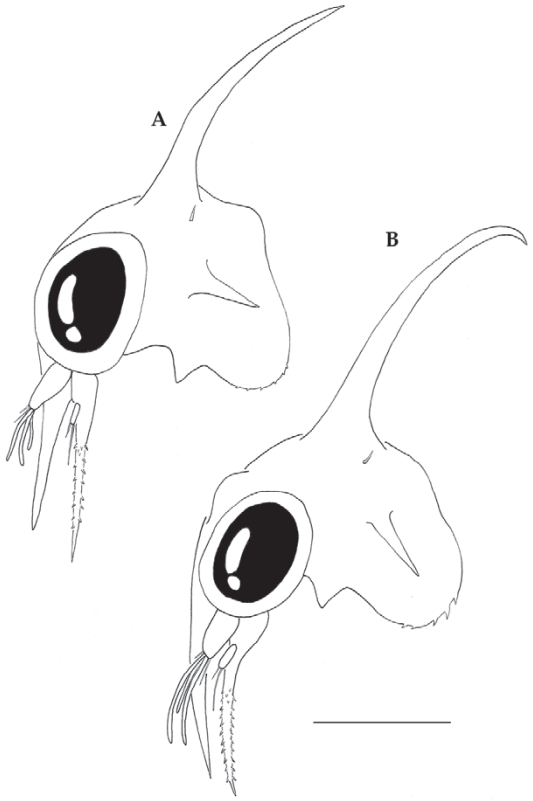

Fig. 4 - Cephalothorax, lateral view. **A**, *Callinectes exasperatus*; **B**, *Callinectes ornatus*. Scale bar = 0.2 mm.

Measurements: DL: 0.41 ± 0.03 mm; RL: 0.24 ± 0.03 mm; RDL: 0.93 ± 0.03 mm; CL: 0.36 ± 0.04 mm.

Cephalothorax (Figs. 3B, 5B). With long dorsal spine, curved distally backwards but not as strong as in *C. sapidus*; rostral spine long, slightly shorter than antenna; each lateroventral margin with more numerous and stronger acute denticles than in *C. sapidus*.

Antennule (Fig. 6B). Exopod unsegmented, with 4 terminal aesthetascs and 1 simple seta.

Antenna (Fig. 6F). Protopod very long, with two rows of 12-13 paired spinules of different sizes, increasing toward the tip, in the basal part 3 medium-sized spinules; exopod one-segmented, shorter than the spinous process, approximately 1/10 of protopod length.

Telson (Fig. 7B). Slight differences in spinulation of serrate setae.

Callinectes exasperatus

Zoea I (Figs. 4A, 5C, 6C, 6G, 7C)

Measurements: DL: 0.38 ± 0.04 mm; RL: 0.23 ± 0.02 mm; RDL: 0.88 ± 0.03 mm; CL: 0.35 ± 0.02 mm.

Cephalothorax (Figs. 4A, 5C). With long dorsal spine, curved distally backward but not as strong as in *C. sapidus*; rostral spine long, but shorter than antenna; lateral spines present and well developed; between the eyes a well-developed protuberance; each lateroventral margin with some minute denticles and without setae; one pair of posterodorsal simple setae present; eyes sessile.

Antennule (Fig. 6C). Uniramous, smooth and conical; endopod absent; exopod unsegmented, with 3 terminal aesthetascs and 2 simple setae.

Antenna (Fig. 6G). Protopod very long, with 2 unequal rows of 10 and 5 spinules of similar sizes, all spinules not paired, in the basal part a group of

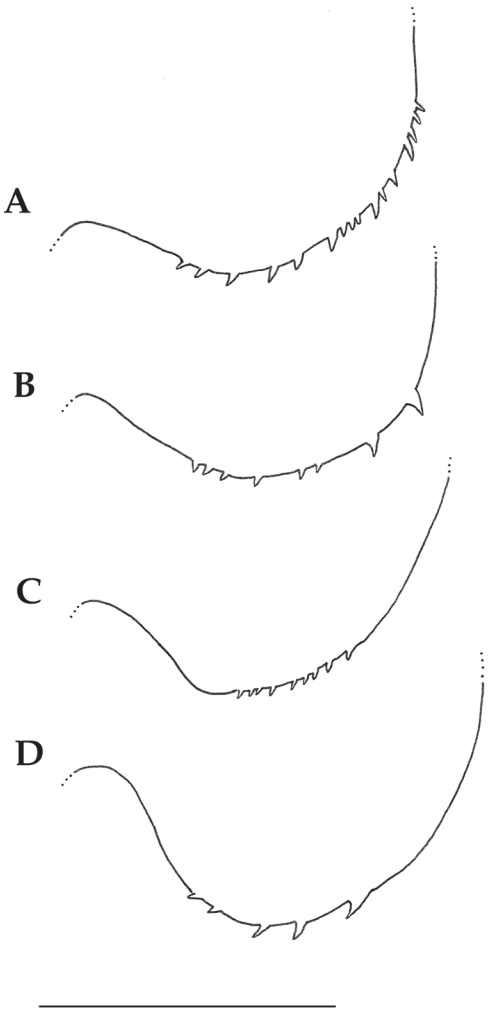

Fig. 5 - Cephalothorax, lateroventral margin. **A**, *Callinectes bocourti*; **B**, *Callinectes danae*, **C**, *Callinectes exasperatus*; **D**, *Callinectes ornatus*. Scale bar = 0.2 mm. Scale bar = 0.125 mm.

3 medium-sized spinules; exopod one-segmented, shorter than the spinous process, approximately 1/8 of protopod length, with 2 unequal subterminal simple setae.

Mandible. Incisor and molar processes differentiated; mandibular palp absent.

Maxillule. Coxal endite with 6 plumodenticulate setae; basial endites with 2 cuspidate and 3 plumodenticulate setae; endopod 2-segmented, proximal segment without setae, distal segment with 2 medial and 3 terminal plumodenticulate and 1 terminal simple setae; exopodal seta absent.

Maxilla. Coxal endite bilobed, with 3 plumodenticulate setae on proximal lobe, and 3 plumodenticulate setae and 1 terminal spine on distal lobe; basial endite bilobed, with 4 plumodenticulate setae and 1 terminal spine on proximal lobe, and 4 plumodenticulate setae on distal lobe; unsegmented endopod bilobed, with 1 long sparsely plumodenticulate setae and 1 simple seta on proximal lobe, 1 long sparsely plumodenticulate seta and 3 simple setae on distal lobe, and microtrichia on lateral margin; exopod (scaphognathite) margin with 4 plumose setae and a long distal process.

First maxilliped. Coxa with 1 simple seta; basis with 10 simple setae arranged 2+2+3+3; endopod 5-segmented with 2, 2, 0, 2, sparsely plumose and 5 (1 subterminal simple and 4 terminal plumodenticulate) setae, respectively; exopod 2-segmented, distal segment with 4 long terminal plumose natatory setae.

Second maxilliped. Coxa without setae; basis with 4 simple setae arranged 1+1+1+1; endopod 3-segmented with 1 sparsely plumose, 1 sparsely plumose , and 5 (2 simple, 1 serrulate, 1 sparsely plumodenticulate, and 1 long sparsely plumose) setae, respectively; exopod 2-segmented, distal segment with 4 long terminal plumose natatory setae.

Third maxilliped. Absent.

Pereiopods. Absent.

Abdomen. Five somites; somites 2 and 3 with one pair of dorsolateral processes; somite 2 with short rounded posterolateral processes, somites 3-5 with long acute posterolateral processes; somite 1 without setae, somites 2-5 with one pair of posterodorsal simple setae; pleopods absent.

Telson (Fig. 7C). Telson furcae with one pair of well-developed lateral spines, one pair of small lateral simple setae just below the lateral spines, and one pair of dorsal spines; inner margin with 3 pairs of serrate setae. Slight differences in spinulation of serrulate setae respect to *Callinectes sapidus*.

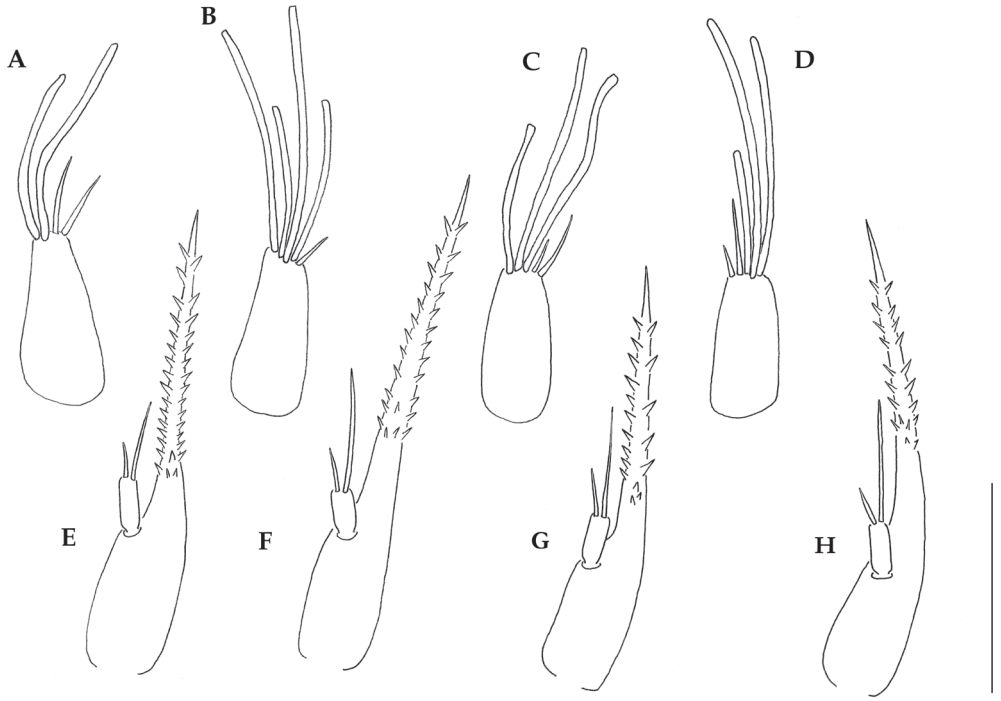

Fig. 6 - Antennule. **A**, *Callinectes bocourti*; **B**, *C. danae,* **C**, *C. exasperatus*; **D**, *C. ornatus*. Antenna. **E**, *C. bocourti*; **F**, *C. danae,* **G**, *C. exasperatus*; **H**, *C. ornatus*. Scale bar = 0.125 mm.

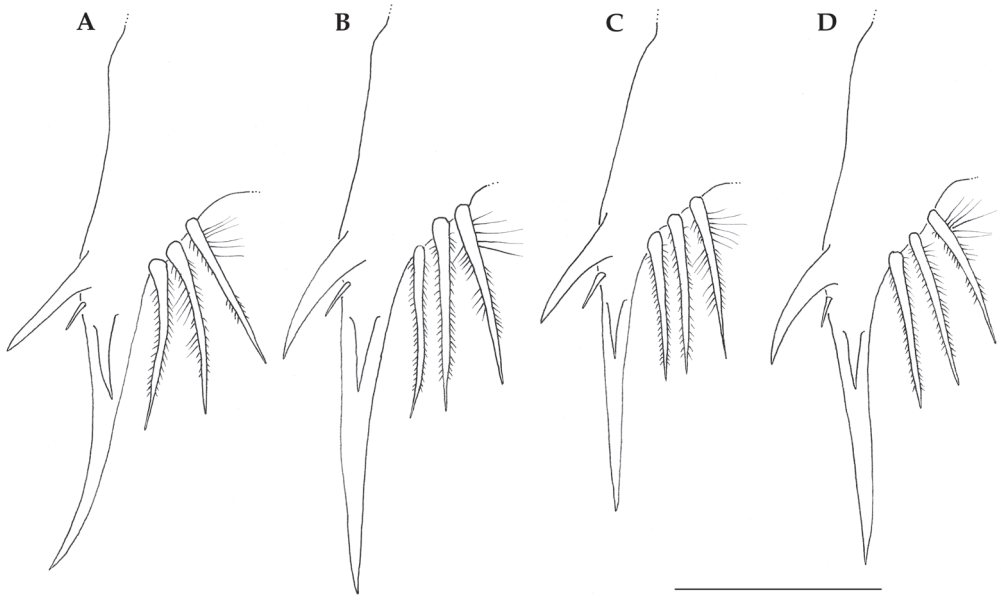

Fig. 7 - Telson furcae, detail of spinulation. **A**, *Callinectes bocourti*; **B**, *C. danae*, **C**, *C. exasperatus*; **D**, *C. ornatus*. Scale bar = 0.125 mm.

Callinectes ornatus

Zoea I (Figs. 4B, 5D, 6D, 6H, 7D)

Measurements: DL: 0.39 ± 0.02 mm; RL: 0.24 ± 0.03 mm; RDL: 0.91 ± 0.02 mm; CL: 0.37 ± 0.03 mm.

Cephalothorax (Figs. 4B, 5D). With long dorsal spine, strongly curved at the tip; rostral spine long, shorter than antenna; lateral spines present and well developed; between the eyes a well-developed

protuberance; each lateroventral margin with a few strongly acute denticles, without setae; one pair of posterodorsal simple setae present; eyes sessile.

Antennule (Fig. 6D). Uniramous, smooth and conical; endopod absent; exopod unsegmented, with 3 terminal aesthetascs and 2 simple setae.

Antenna (Fig. 6E). Protopod very long, with two rows of 8-9 paired spinules of different sizes, increasing toward the tip, in the basal part 3 medium-sized spinules; exopod one-segmented, shorter than the spinous process, approximately 1/9 of protopod length, with 2 unequal subterminal simple setae.

Mandible. Incisor and molar processes differentiated; mandibular palp absent.

Maxillule. Coxal endite with 6 plumodenticulate setae; basial endites with 2 cuspidate and 3 plumodenticulate setae; endopod 2-segmented, proximal segment without setae, distal segment with 2 medial and 3 terminal plumodenticulate and 1 terminal simple setae; exopodal seta absent.

Maxilla. Coxal endite bilobed, with 3 plumodenticulate setae on proximal lobe, and 3 plumodenticulate setae and 1 terminal spine on distal lobe; basial endite bilobed, with 4 plumodenticulate setae and 1 terminal spine on proximal lobe, and 4 plumodenticulate setae on distal lobe; unsegmented endopod bilobed, with 1 long sparsely plumodenticulate setae and 1 simple seta on proximal lobe, 1 long sparsely plumodenticulate seta and 3 simple setae on distal lobe, and microtrichia on lateral margin; exopod (scaphognathite) margin with 4 plumose setae and a long distal process.

First maxilliped. Coxa with 1 simple seta; basis with 10 simple setae arranged 2+2+3+3; endopod 5-segmented with 2, 2, 0, 2, sparsely plumose and 5 (1 subterminal simple and 4 terminal plumodenticulate) setae, respectively; exopod 2-segmented, distal segment with 4 long terminal plumose natatory setae.

Second maxilliped. Coxa without setae; basis with 4 simple setae arranged 1+1+1+1; endopod 3-segmented with 1 sparsely plumose, 1 sparsely plumose, and 5 (2 simple, 1 serrulate, 1 sparsely plumodenticulate, and 1 long sparsely plumose) setae, respectively; exopod 2-segmented, distal segment with 4 long terminal plumose natatory setae.

Third maxilliped. Absent.

Pereiopods. Absent.

Abdomen. Five somites; somites 2 and 3 with one pair of dorsolateral processes; somite 2 with short rounded posterolateral processes, somites 3-5 with long acute posterolateral processes; somite 1 without setae, somites 2-5 with one pair of posterodorsal simple setae; pleopods absent.

Telson (Fig. 7D). Telson furcae with one pair of well-developed lateral spines, one pair of small lateral simple setae just below the lateral spines, and one pair of dorsal spines; inner margin with 3 pairs of serrate setae. Slight differences in spinulation of serrulate setae respect to *Callinectes sapidus*.

DISCUSSION

The zoea I of the five species of *Callinectes* described here has very similar morphology, and only a combination of some slight differences allows them to be distinguished. Main differences are found in the antennule and antenna formulae, the ratio between the antennal exopod and protopod length (see Table I), the degree of curvature of the dorsal spine, the spinulation of the cephalothoracic lateroventral margin, and the spinulation of the serrulate setae of the telson.

Regarding the previous descriptions of *C. bocourti, C. danae* and *C. sapidus*, some commonly overlooked differences in the setae or other structures were detected (see Table II), but must be corrected to prevent confusion and not taken to be real differences rather than errors.

Among the portunids reported from the southwestern Atlantic, those of the subfamily Portuninae are characterized by possessing: antennal protopod as long as rostral spine (in some cases longer), lateral and dorsal spines on

TABLE I
Comparison of selected morphological characters among zoea I of Portuninae.

Species	Postero-lateral process on abdominal somites 3-5	Spinous process/ Exopod length of antenna	Maxillule endopod setation	Maxilla endopod setation	1st mxpl endopod setation	2nd mxpl endopod setation	Source
*Achaelous (Portunus) gibbesii**	long	1/3	0,5	5	†	1,1,3	Kurata 1970
Achaelous (Portunus) spinicarpus	long	1/3	0,6	6	2,2,0,2,5	1,1,5	Bookhout and Costlow 1974
Achaelous (Cronius) tumidulus	long	1/3	0,6	6	2,2,0,2,5	1,1,5	Fransozo et al. 2002
Arenaeus cribrarius	short	1/8	1,6	6	2,2,0,2,5	1,1,5	Stuck and Truesdale 1988
Callinectes bocourti	absent (?)	1/10	0,5(?)-6	5(?)	2,2,0,2,5	1,1,3(?)	Lopes et al. 2000
Callinectes bocourti	long	1/8	0,6	6	2,2,0,2,5	1,1,5	Present study
Callinectes danae	long	1/8	0,5(?)	5(?)	1,1,0,2,5(?)	1,1,4	Sankarankutty et al. 1999
Callinectes danae	long	1/10	0,6	6	2,2,0,2,5	1,1,5	Present study
Callinectes exasperatus	long	1/8	0,6	6	2,2,0,2,5	1,1,5	Present study
Callinectes ornatus	long	1/9	0,6	6	2,2,0,2,5	1,1,5	Present study
Callinectes sapidus	long	1/8	0,6	6	2,2,0,2,5	1,1,4(?)	Costlow and Bookhout 1959
Callinectes sapidus	long	1/7	0,6	6	2,2,0,2,5	1,1,5	Present study
Callinectes similis	long	1/8	0,6	6	2,2,0,2,5	1,1,5	Bookhout and Costlow 1977
Portunus acuminatus	long	1/4	1,6	5	2,2,0,2,5	1,1,5	Meyer et al. 2006
Portunus gladiator	long	†	1,6	6	2,2,0,2,5	†	Terada 1979
Portunus pelagicus	long	1/6	1,6	6	2,2,1,2,5	1,1,5	Shinkarenko 1979, Josileen and Menon 2004
Portunus rubromarginatus	long	1/3	1,6	5	2,2,0,2,5	1,1,5	Greenwood and Fielder 1979
Portunus trituberculatus	long	1/4	1,6	6	2,2,0,2,5	1,1,5	Yatsuzuka and Sakai 1982
Scylla serrata	short	1/4	1,6	6	2,2,1,2,5	1,1,4	Wear and Fielder 1985
Charybdis bimaculata	long	1/4	1,6	6	2,2,0,2,5	1,1,5	Hwang and Kim 1995
Charybdis hellerii	long	1/5	1,6	6	2,2,0,2,5	1,1,5	Negreiros-Fransozo 1996, Dineen et al. 2001
Charybdis japonica	long	1/3	1,6	6	2,1,0,2,3	1,1,5	Yatsuzuka et al. 1984
Cronius ruber	short	1/7	1,6	6	2,2,0,2,5	1,1,5	Fransozo et al. 2002

(†) no data; (?) possibility of error; *The genus *Achelous* De Haan 1833 was recently resurrected in a revised taxonomic arrangement, with reassignment of *Cronius tumidulus* and nine American species currently treated under *Portunus* (Mantelatto et al. 2009).

TABLE II
Comparison of differences between previous and present descriptions of zoeae I of *Callinectes bocourti*, *C. danae* and *C. sapidus*. Abbreviations: a, aesthetascs, s, setae; ps, plumose setae; (-) character without differences.

	C. bocourti	*C. bocourti*	*C. danae*	*C. danae*	*C. sapidus*	*C. sapidus*
Appendages / Structures	Lopes et al. 2000	Present paper	Sankarankutty et al. 1999	Present paper	Costlow and Bookhout 1959	Present paper
Cephalothorax	Dorsolateral setae absent	Dorsolateral setae present	(-)	(-)	Dorsolateral setae absent	Dorsolateral setae present
Cephalothorax latero-ventral margin	Without spinulation	Spinules present	(-)	(-)	(-)	(-)
Antennule	(-)	(-)	2a, 1s	4a, 1s	(-)	(-)
Antenna	Base of protopod without spinules	Base of protopod with a group of 3 spinules	Base of protopod without spinules	Base of protopod with a group of 3 spinules	Base of protopod without spinules	Third row of intermediate spinules present
Maxillule endopods	(-)	(-)	1,4	2,4	(-)	(-)
Maxilla endopods	2,3	2,4	2,3	2,4	(-)	(-)
Maxilla scaphognathite	(-)	(-)	(-)	(-)	3 ps	4 ps
First maxilliped basis	2,2,2,3	2,2,3,3	2,2,2,2	2,2,3,3	2,2,2,2	2,2,3,3
First maxilliped endopods	(-)	(-)	1,1,0,2,5	2,2,0,2,5	(-)	(-)
Second maxilliped endopods	1,1,3	1,1,5	1,1,4	1,1,5	1,1,4	1,1,5
Second maxilliped basis	1,1,1	1,1,1,1	1,1,1	1,1,1,1	(-)	(-)
Telson	Dorsal spine absent, inner lateral spine present*	Dorsal spine present, inner lateral spine absent	(-)	(-)	Small lateral spine absent	Small lateral spine present

*(these internal lateral spines could not exist).

the furca, and relatively small zoeal stages. Only a combination of several anatomical characters would allow routine separation of zoea I from these species. The first zoeal stages of *Callinectes* species described here have the common features known for this subfamily, suggesting that this taxonomic unit is phenetically coherent based on larval morphology. We can therefore infer that all species of *Callinectes* have a proportionally shorter exopod than those of Portuninae (see Table I), which could be a potential character to differentiate larvae. In addition, the cohesiveness of the clade formed by larvae of members of *Callinectes* is unquestionable, and supports the previous phylogeny of the group based on molecular tools (Schubart et al. 2001, Robles et al. 2007).

Our description of larval morphology provided more information to support recent results obtained from molecular analysis (Mantelatto et al. 2007, 2009). These inferences led to the proposal of taxonomic changes for *Cronius* and some members of *Portunus* (Mantelatto et al. 2009), in combination with important differences noted previously in the larval morphology of *Cronius* species (Fransozo et al. 2002). Zoeae with relatively long antennal exopods are typical of the presently assigned *Achaelous tumidulus*, *Achaelous gibbesii*, and *Achaelous spinicarpus* (*sensu* Mantelatto et al. 2009), while those with short antennal exopods occur in *Cronius ruber*, *Arenaeus cribrarius*, and some members of *Callinectes* and *Charybdis*. The exception is *Scylla serrata*, which holds a somewhat intermediate position in terms

of larval morphology (as previously mentioned by Fransozo et al. 2002: Table I) and a basal position in the molecular phylogeny of Mantelatto et al. (2007, 2009). The zoeal subgroups correspond perfectly with the groups obtained by 16S mtDNA analyzed by these latter authors; only members of the newly defined *Achelous* have an antennal exopod length equal to or exceeding 1/3 the protopod length and a maxillule endopod setation formula of 0,6.

While far from being complete, significant progress has been made in recent decades in the knowledge of decapod larvae of the southwestern Atlantic (Pohle et al. 1999). Determining phylogenetic relationships of this subfamily based on zoea descriptions alone is premature; but as descriptions of zoea morphology become available for more species of Portuninae, as well as other taxonomically useful information (e.g., cladistic analysis, molecular sequences, genetic, spermatophore morphology and fossil evidence), it could be possible to determine the phylogeny and evolution of the anatomically diverse Portunoidea. We argue here in favor of new descriptions, especially of genera and species for which larval morphology is still unknown, in order to gain a more complete overview of this topic and use it in a phylogenetic context.

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RESUMO

O gênero *Callinectes* Stimpson, 1860 atualmente é composto por 16 espécies, seis das quais são registradas para a costa brasileira. No presente estudo foi obtido o primeiro estagio de zoea de *Callinectes bocourti*, *C. danae*, *C. exasperatus*, *C. ornatus* e *C. sapidus* a partir de fêmeas ovigeras coletadas no Brasil. Os caracteres morfológicos e merísticos de todas estas larvas foram descritos e ilustrados. Para *C. bocourti, C. danae* e *C. sapidus* tais estruturas foram redescritas e comparadas com descrições previas, listando-se as diferenças. Os caracteres larvais destas espécies foram verificados em busca de diferenças interespecíficas, bem como os aspectos larvais para distinguir o gênero *Callinectes* dentro de Portunidae. Em complemento, foram feitas comparações com outros gêneros e espécies de portunídeos, cujo primeiro estágio de zoea é conhecido, com atenção especial para aquelas espécies presentes na mesma área geográfica. Nossos achados corroboram estudos moleculares prévios e discutimos tal complexidade dentro do grupo.

Palavras-chave: morfologia larval, Portunidae, Portunoidea, zoea.

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