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A new species of the deepwater shrimp genus *Leontocaris* (Hippolytidae: Caridea) from the South Mid-Atlantic Ridge

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The hippolytid genus Leontocaris *includes eight species, all restricted to the deep sea (240–2182 m). Associations with deep sea coralline habitats were reported and are herein confirmed. Three Australian species were recorded at seamounts as were the specimens herein identified as* L. smarensis *sp. nov. These specimens were sampled at the South Mid-Atlantic Ridge (SMAR) by the Mar Eco project during 12 bottom trawls using a Sigsbee trawl. The SMAR is a seamount chain that rises from 4000 m depth, with mountains of 100–200 km wide and 14,000 km length.* Leontocaris smarensis *sp. nov. shows closest affinity to* L. lar *from the north-western Atlantic and* L. yarramundi*, from Australia and New Zealand. It differs from* L. lar *mainly in: (1) the scaphocerite distolateral tooth reaching the distal margin of the blade while clearly falling short in the latter species; and (2) the mandibular palp possessing three distal setae while setae are absent in* L. lar*. The new species differs from* L. yarramundi *in the number and disposition of dorsal teeth on rostrum and in the absence of an acute posterolateral spine on abdominal somites 4 and 5.*

Keywords: Hippolytidae, *Leontocaris*, new species, South Mid-Atlantic Ridge, deep sea, coral reefs

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INTRODUCTION

The hippolytid genus *Leontocaris* Stebbing, 1905 is restricted to the deep sea (240–2182 m) (Taylor & Poore, 1998; Fransen, 2001; Poore, 2009) and recognized by the striking structure of the major cheliped of pereopod 2. This limb forms a zigzag structure with interlocking plates and sockets that extends anteriorly (Poore, 2009). The effective use of this tool is yet unknown; some authors suggest that it is predatory (Stebbing, 1905; Bruce, 1990; Taylor & Poore, 1998) and according to Poore (2009) the twisted dentate dactyl suggests a specialized diet but there is no evidence about what that could be. Another striking feature in this genus is the tympanum at the grooved portion of the propod of the major second cheliped. It is an elongate or rounded slit with rows of soft, membranous, digitiform papillae (Fransen, 2001; Poore, 2009). Its function is not clear. Poore (2009) suggests that a hydraulic expansion of the papillae may serve to unlock the proximal articles from the propod to allow extension of the folded claw.

Eight species are included in *Leontocaris*: *L. paulsoni* Stebbing, 1905 from the south-eastern Atlantic; *L. lar* Kemp, 1906 from the north-western Atlantic; *L. pacificus* Zarenkov, 1976 from the Pacific; *L. vanderlandi* Fransen, 2001 from the Indian Ocean; plus three from Australia and New Zealand *L. amplectipes* Bruce, 1990; *L. yarramundi* Taylor & Poore, 1998; *L. alexander* Poore, 2009; and one from Australia: *L. bulga* Taylor & Poore, 1998 (Poore, 2009; Ahyong, 2010; De Grave & Fransen, 2011). The descriptions of species in this genus are based on few specimens so intra-specific variation is not well known (Fransen, 2001).

Associations with deep sea coelenterates (Antipatharia and *Lophelia* sp.) were reported by Kemp (1910) for *L. lar* and by Fransen (2001) for *L. vanderlandi* as they were caught together with scleractinian corals and zoantharians which could be their host. Bruce (1990) also suggested a commensal life-style for *L. amplectipes* observing morphological features of the species. Taylor & Poore (1998) reinforced this idea when finding two species (*L. bulga* and *L. yarramundi*) living on seamounts covered by corals.

Leontocaris smarensis sp. nov. was also caught together with live fragments of the deep sea coelenterates *Enallopsammia rostrata* (Pourtalès, 1878) (one of the main builders of deep sea coral reefs), *Corallium* cf. *bayeri* Simpson & Watling, 2011 (also a reef building species) and *Narella alvinae* Cairns & Bayer, 2003 (very common in and near coralline deep sea habitats) (D. Pires, personal communication). The occurrence of these species confirms that the new species is living in a deep sea coralline habitat.

Three Australian and New Zealand species were recorded predominantly from seamounts (Poore, 2009; Ahyong, 2010) as are the specimens herein identified as *L. smarensis* sp. nov. Seamounts are biologically distinctive habitats in the open ocean exhibiting a number of unique features (Rogers, 1994) such as the formation of eddies of water associated with upwelling of nutrient rich waters. Because food supplies are restricted in the open-ocean, seamounts and the water column above them serve as important habitats, feeding grounds and sites of reproduction for many open-ocean and deep-sea species (Rogers, 1994; Probert, 1999).

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The Mid-Atlantic Ridge (MAR) rises from 4000 m depth to reach peaks of 500 m of altitude; this mountain range is 100–200 km wide and has a length of 14,000 km. Given the very complicated nature of this region, it should be home to a diverse and interesting deep-sea fauna. This expectation has prompted recent biological investigations on the southern MAR, within the framework of the international project MAR-ECO ('Patterns and Processes of the Ecosystems of the Northern Mid-Atlantic'). This project is an element of the Census of Marine Life and aims to enhance our understanding on the occurrence, distribution and ecology of animals and animal communities along the MAR.

MATERIALS AND METHODS

The first oceanographic cruise of South Mar Eco by the RV 'Akademik Ioffe' occurred in 2009 (from 25 October to 29 November). Bottom trawls sampled the macrobenthos using a Sigsbee trawl. A total of 12 benthic sampling events were conducted, five in the South Equatorial MAR Sector (SEMS), two in the Tropical MAR Sector (TMS) and five in the Walvis Ridge Sector (WRS).

The specimens were fixed in ethanol 70%, identified, drawn, described and deposited at the Crustacea collection of the Museu Nacional/Universidade Federal do Rio de Janeiro (MNRJ). Measurements presented are postorbital carapace length (cl) in millimetres. The diagnosis and description presented herein follow those provided by Taylor & Poore (1998), Fransen (2001) and Poore (2009).

RESULTS

SYSTEMATICS

Order DECAPODA Latreille, 1802
Infraorder CARIDEA Dana, 1852
Family HIPPOLYTIDAE Spence Bate, 1888
Genus *Leontocaris* Stebbing, 1905
Leontocaris smarensis sp. nov.
(Figures 1–6)

TYPE MATERIAL

Holotype: ovigerous female (7.8), Superstation 2, SEMS, 00°26, 18′N/17°03, 57′W, 902 m, MNRJ 22561; paratypes: 2 ovigerous females (5.3 and 5.5), 1 female (5.2), Superstation 2, SEMS, 00°26. 18′N/17°03. 57′W, 902 m, MNRJ 22560.

DIAGNOSIS

Carapace with 3–6 mid-dorsal epigastric spines. Rostrum 1.0–1.58 (N = 3) times as long as carapace length, curving upwards, with 9–12 (N = 3) dorsal teeth, 11–15 ventral teeth (N = 3). Abdominal somite 3 mid-posterodorsally rounded, without flat triangular projection. Abdominal somite 5 pleuron with 0–2 small acute posterolateral spines and rounded posteroventral margin. Cornea well developed, broader than eyestalk. Scaphocerite with produced distolateral tooth reaching blade distal margin and 18–24 (N = 4) lateral marginal teeth. Mandibular palp of 1 article. Major pereopod 2 (right or left) with fixed finger short, tridentate; dactyl sickle like with a prominent tooth on cutting edge. Pereopod 3 carpus slightly shorter than propod (pereopod 4 propod lost), pereopod 5 carpus slightly longer than propod; dactyls 0.23 (N = 2, pereopods 3 and 5 from holotype) times length of propod. Uropodal exopod lateral margin with 17–23 spines (N = 4). Telson with 5 pairs of dorsolateral spines (N = 3) and three pairs of distal spines (N = 3).

DESCRIPTION OF HOLOTYPE

Carapace with 3 epigastric spines, centred around mid-length, similar in shape though one-third smaller in size (Figure 1A, B). Antennal spine well developed, sharp, straight. Pterygostomial corner rounded. Rostrum 1.58 times as long as carapace (Figure 1B), curving upwards, tapering; with 9 dorsal teeth, first 5 of same size, closely set, 2 small widely set and 2 small distal teeth near tip; 12 ventral teeth, decreasing in size distally, basal third widely set, median third closely set and distal third widely set (Figure 1A).

Abdominal somite 3 mid-posterodorsally unarmed, without flat triangular projection. Abdominal somites 1–4 pleura rounded. Abdominal somite 5 pleuron without acute posterolateral spine. Abdominal somite 6 pleuron like that of abdominal somite 5 but smaller. Abdominal somites 4–6 and telson dorsal lengths with ratio 1:0.94:1.55:2.72 (Figure 1A).

Eye globular, cornea fully pigmented, diameter 1.3 times stalk width.

Antennular peduncle 0.52 of rostrum length; article 1, 7.3 times as long as distal width; stylocerite with distolateral spine reaching 0.54 length of article 1 (Figure 1B). Antennal

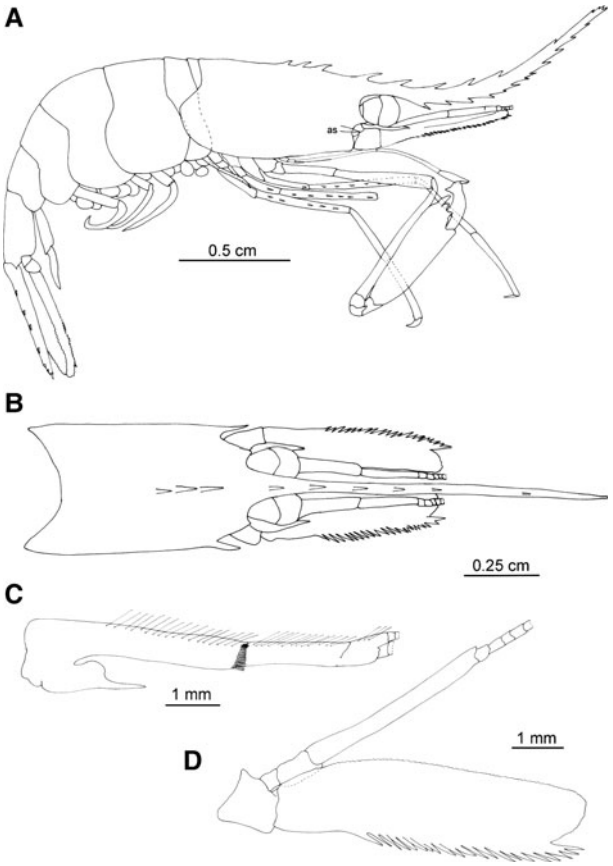

Fig. 1. *Leontocaris smarensis* sp. nov., holotype, ovigerous female (7.8), MNRJ 22561: (A) whole animal, lateral view; (B) anterior region, dorsal view; (C) right antennular peduncle, dorsal view; (D) right antennal peduncle, dorsal view. as, antennal spine.

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scale overreaching antennular peduncle, 4.17 times as long as greatest width, with produced distolateral tooth reaching blade margin, with 19 (left side) and 21 (right side) teeth closely set along distal 0.75 of length, distal margin rounded (Figure 1B, D).

Mandibular palp of 1 article with 3 apical simple setae (Figure 2A). Mouthparts as figured (Figure 2A–E).

Maxilliped 3 coxa and basis wider than long, medially setose; basis incompletely distinct from ischium–merus; ischium–merus 5 times as long as basal width; carpus unarmed; propod with clusters of simple setae; dactyl fused to propod, with 3 serrate setae. Ratios of lengths in ischium–merus: carpus: propod-dactyl = 1:0.37:0.48 (Figure 2F, G).

Pereopod 1 slender, smooth, without ornamentations; ratio of lengths of merus: carpus: propod = 1:1.21:0.47 (Figure 3A).

Major pereopod 2 (right) ischium and merus unarmed; carpus with 4 articles, first article inner margin with 1 distal small tubercle, articles 2 and 3 with distolateral triangular projections (Figure 3B); propod greatest depth at median third of dorsal length (Figure 3B, C), tympanum formed by elongate cavity with a central pit and more than 20 digitiform papillae around it (Figure 3D), distomesial horizontal cylindrical projection directed anteriorly (Figure 3C), fixed finger with oblique cutting edge, with 3 teeth, median and outer tooth smooth with rounded apex, inner tooth with 3 denticles (Figure 3E); dactyl twisted, sickle like, cutting edge with 1 mesial tooth inserting between inner and median teeth of fixed finger, distal area tapering abruptly in a well developed tooth (Figure 3E).

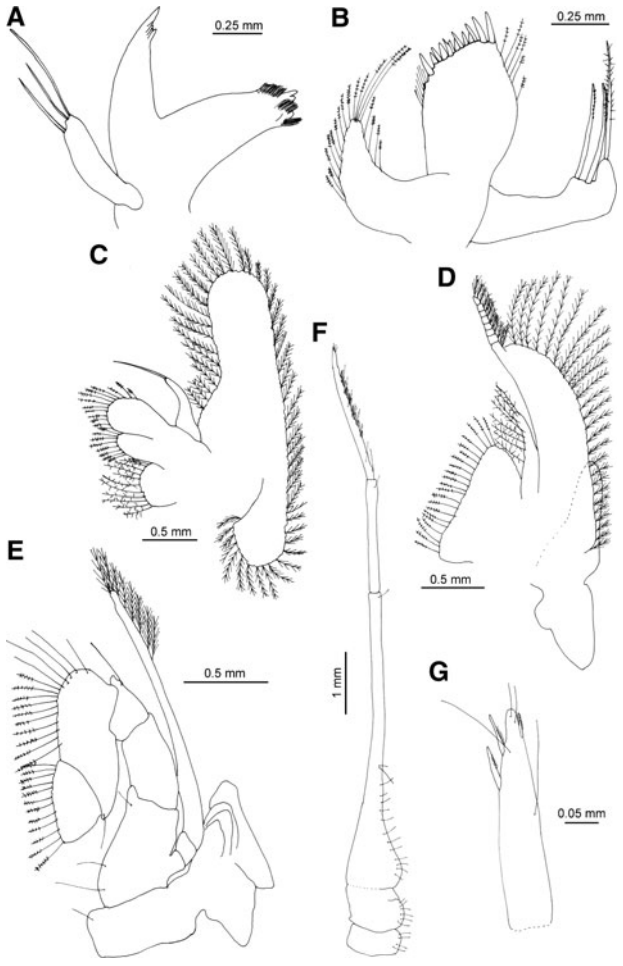

Fig. 2. *Leontocaris smarensis* sp. nov., holotype, ovigerous female (7.8), MNRJ 22561: (A) left mandible, anterior view; (B) left maxillula, anterior view; (C) left maxilla, anterior view; (D) left maxilliped 1, anterior view; (E) left maxilliped 2, anterior view; (F) left maxilliped 3, anterior view; (G) left maxilliped 3, posterior region of propod-dactyl, anterior view.

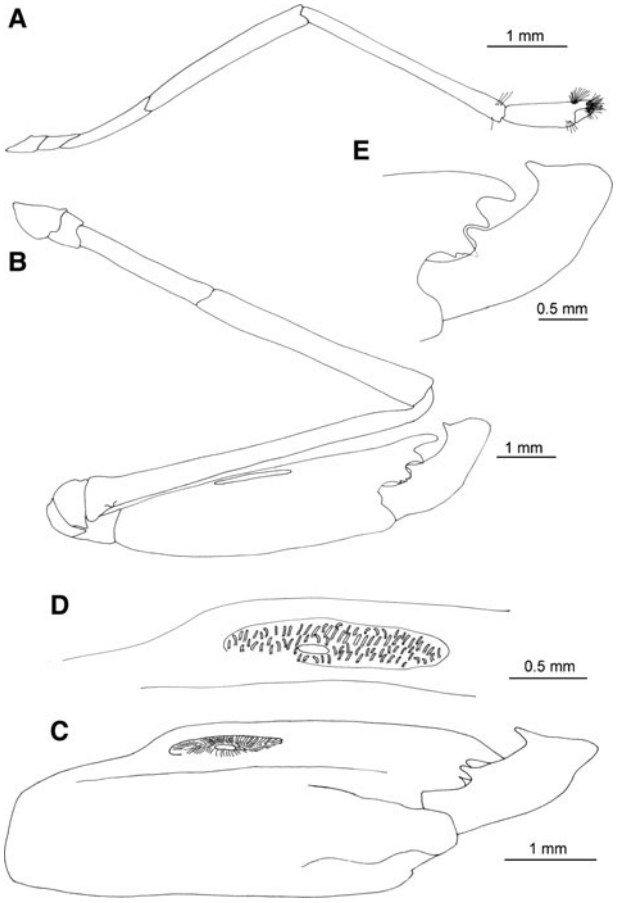

Fig. 3. *Leontocaris smarensis* sp. nov., holotype, ovigerous female (7.8), MNRJ 22561: (A) right first pereopod, lateral view; (B) major, right second pereopod, lateral view; (C) major, right second pereopod, propod and dactyl, lateral view; (D) tympanum, lateral view; (E) major, right second pereopod, propod cutting edge and dactyl, lateral view.

Minor pereopod 2 (left) slender, ratio of length of ischium: merus: carpus: propod = 1:1.10:1.90:0.56; carpus with 4 articles 0.76:0.048:0.048:0.14 times total length (Figure 4A).

Pereopods 3–5 similar (Figure 4B), pereopod 4 propod and dactyl lacking. Pereopod 5 slightly shorter than pereopod 3. Pereopod 3 ischium with 1 subdistal spine, merus with 6 mesial spines, ratio of ischium: merus: carpus: propod = 1:2.10:1.56:1.41:0.33. Pereopod 4 ischium with 1 subdistal spine, merus with 6 mesial spines. Pereopod 5 ischium without spine, merus with 5 mesial spines.

Uropodal rami of equal length; endopod 4 times as long as wide; exopod 3.4 times as long as wide, lateral margins with 19 (left side) and 18 (right side) spines over distal two-thirds (Figure 4C).

Telson 1.75 times as long as abdominal somite 6, 3.47 times as long as basal width, evenly tapering, with 5 pairs of dorsolateral spines distributed over its entire length, apex with 3 pairs of distal spines (Figure 4C).

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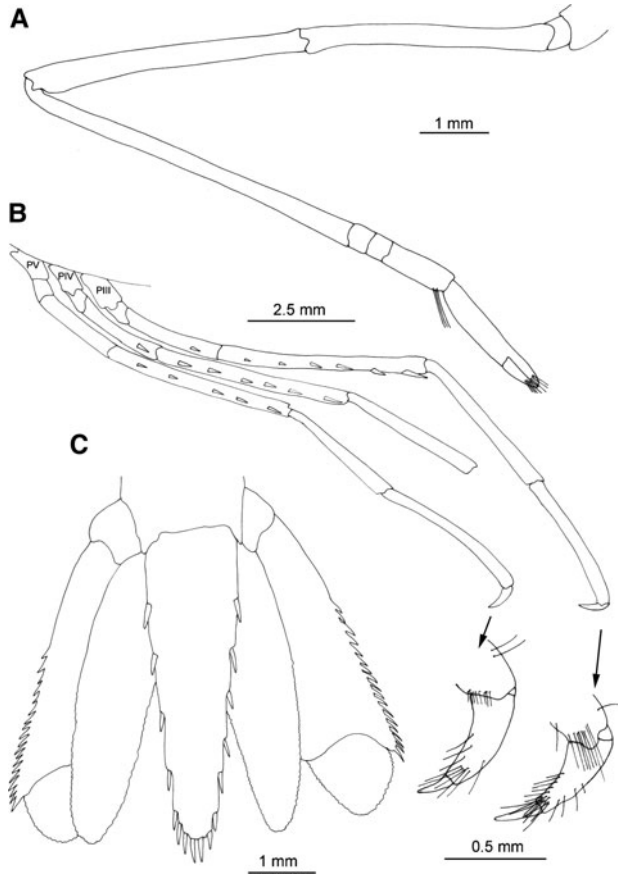

Fig. 4. *Leontocaris smarensis* sp. nov., holotype, ovigerous female (7.8), MNRJ 22561: (A) minor, left second pereopod, lateral view; (B) right pereopods 3–5, lateral view; (C) telson and uropods, dorsal view.

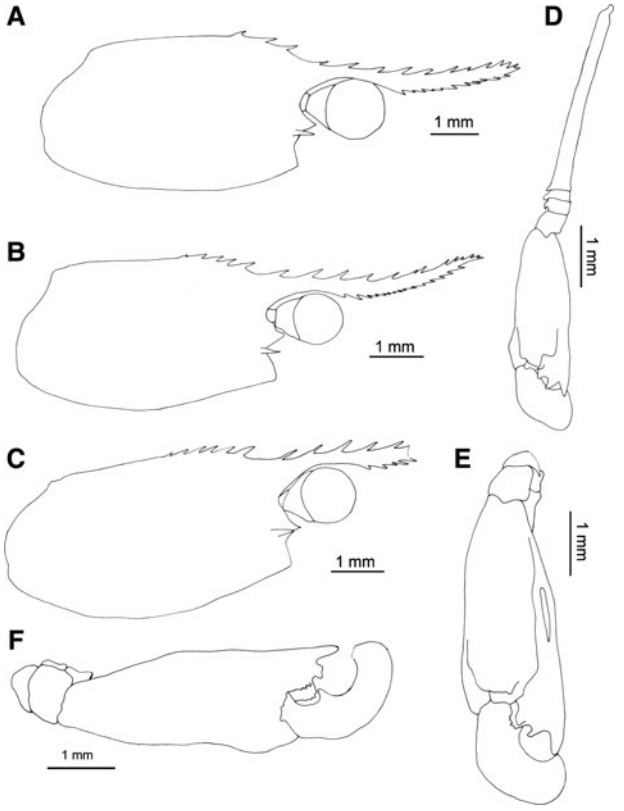

Fig. 5. *Leontocaris smarensis* sp. nov., paratypes, MNRJ 22560, female (5.2); (A) carapace, lateral view; (D) major, left second pereopod, lateral view. Ovigerous female (5.3): (B) carapace, lateral view; (E) major, left second pereopod, lateral view. Ovigerous female (5.5): (C) carapace, lateral view; (F) major, left second pereopod, lateral view.

VARIATION

Males are not known. The carapace length in paratypes is shorter (5.2–5.5 mm) than in the holotype (7.8 mm). A variation in the number of rostrum teeth and length of the rostrum was observed and it is correlated with carapace length. The paratypes present shorter rostra with more teeth than the holotype (Figure 5A, B). The number of epigastric teeth varies from 3–6 and shows no correspondence with carapace size, one female with cl 5.2 mm presents 3 epigastric teeth (Figure 5A) as in the holotype (cl 7.8 mm), while an ovigerous female with 5.5 mm cl presents 6 teeth (Figure 5C). The major pereopod 2 is on the right side in the holotype and on the left in the paratypes, besides this only small variations in teeth shape were observed (Figure 5D–F). The number of spines on the merus of pereopods 3–4 varies between specimens, ranging from 5–6 on pereopod 3, from 6–7 on pereopod 4 and from 4–5 on pereopod 5.

A striking variation occurs in the dentition of the pleuron of abdominal somite 5, which shows no acute spines in the holotype, and has 1 or 2 spines in the paratypes. In 2 paratypes, female (5.2 mm) and ovigerous female (5.3 mm), there are 2 acute spines (Figure 6A, B), while in the paratype ovigerous female (5.5 mm) there is 1 spine on the left side (Figure 6C) and at least 1 on the broken right side (Figure 6D).

ETYMOLOGY

Derived from the type-locality, the South Mid Atlantic Ridge (SMAR).

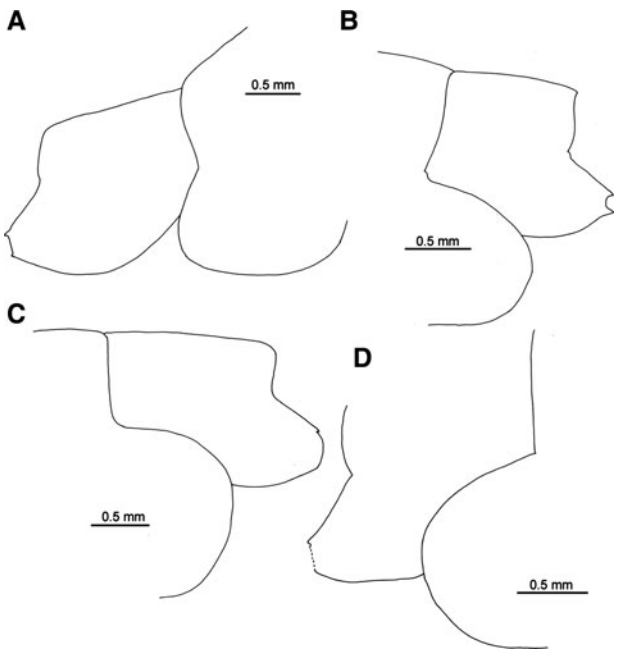

Fig. 6. *Leontocaris smarensis* sp. nov., paratypes, MNRJ 22560, female (5.2): (A) abdominal somites 4–5, right side, lateral view. Ovigerous female (5.3): (B) abdominal somites 4–5, left side, lateral view. Ovigerous female (5.5): (C) abdominal somites 4–5, left side, lateral view; (D) abdominal somites 4–5, right side, lateral view.

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Table 1. Comparison between *Leontocaris smarensis* sp. nov. and its closely related species *Leontocaris lar* and *Leontocaris yarramundi*. Rostral formula: dorsal teeth (epigastric teeth)/ventral teeth.

	L. lar	***L. yarramundi***	***L. smarensis* sp. nov.**
Rostral formula	9–10(3–4)/9–13	5(4)/15–18	9–12(3–6)/11–15
Ratio rostrum:carapace length	1.15	1.05–1.46	1.00–1.58
Teeth on scaphocerite margin	17	17–21	18–24
Scaphocerite distolateral tooth	Not reaching blade distal margin	Reaching blade distal margin	Reaching blade distal margin
Proportion stylocerite distolateral spine:stylocerite total length	0.26 times its length	0.61 times its length	0.40 times its length
Mandibular palp distal setae	None	one	3
Ratio telson:abdominal somite 6 length	1.81	1.5	1.75
Abdominal somite 4 acute posterolateral spine	Absent	Present	Absent
Abdominal somite 5 acute posterolateral spine	Absent	Present	Absent
Abdominal somite 5 acute spines on pleura	1	2	0–2
Spines at uropods margins	17 distal two-thirds	21	17–23

DISTRIBUTION

South Equatorial MAR Sector at 00°26. 18′N/17°03, 57′W. At a depth of 902 m.

REMARKS

The specimens sampled herein are easily discernible from 6 of the 8 species in the genus by the mandibular palp being one-segmented; the absence of a postero-dorsal tooth on abdominal somite 3; and the exopods of uropods being disto-laterally serrate. The remaining two species *L. lar*, from the north-western Atlantic (Ireland) and *L. yarramundi* from the south-western Pacific (Tasmania and New Zealand) show closest affinity to *L. smarensis* sp. nov. A comparison table (Table 1) is presented to clarify the main differences between these species.

Leontocaris smarensis sp. nov. differs from *L. lar* in the scaphocerite distolateral tooth reaching the distal margin of the blade; in the higher proportion between the stylocerite distolateral spine and the stylocerite total length; and in the mandibular palp having three distal setae whereas it is devoid of setae in the latter species. The acute spines on the pleuron of abdominal somite 5 vary in *L. smarensis* sp. nov. from 0–2 (no spine in the holotype); only one paratype presents 1 acute spine, as in *L. lar*. In this case this single spine was observed with certainty only on the left side, because part of the right pleura was lost.

Leontocaris smarensis sp. nov. differs from *L. yarramundi* in the number (higher in *L. smarensis* sp. nov.) and disposition (not distributed to the distal third in *L. yarramundi*) of dorsal teeth on the rostrum and in the absence of an acute posterolateral spine on abdominal somites 4 and 5 (present in *L. yarramundi* sp. nov.). Regarding the acute spines on pleuron of abdominal somite 5, two paratypes present 2 posterolateral spines as *L. yarramundi*, while the holotype shows no spine and one paratype shows only one spine.

As not many specimens of the various species are known it remains difficult to interpret the observed variation in certain characters as being either inter- or intra-specific.

Comparing morphological data from *L. smarensis* sp. nov. with the most recent phylogeny of the genus (Poore, 2009), we observed that the new species described herein is related to clade 2, as it presents one article at mandibular palp; a straight propodus, without setae on pereopod 3 and four or more dorsolateral spines on telson. Inside this clade this species is related with clade 3 (including *L. amplectipes*, *L. lar* and *L. yarramundi*) mainly due to the presence of more than three epigastric spines; but also due to the abdominal somite 3 being midposterodorsally unarmed; the tympanum groove being an elongate slit and the telson with a convex distal margin, with a row of distal spines and four to five dorsolateral spines.

Leontocaris amplectipes and *L. yarramundi* are recorded from Australia and New Zealand while *L. lar* is recorded from the north-western Atlantic and *L. smarensis* sp. nov. occurs in the South Atlantic. So, in this genus species morphologically similar occur in distinct oceans; as stated by Poore (2009) the phylogeny does not reflect geographical distribution. According Poore (2009) as all *Leontocaris* species (except *L. lar*) are found on or near the continental margins of the southern oceans this genus is probably an ancient southern group; the description of a South Atlantic species (*L. smarensis* sp. nov.) confirms this idea.

KEY TO THE SPECIES OF *LEONTOCARIS* STEBBING, 1905

1. Mandibular palp two articulate 2
   Mandibular palp one articulate 3
2. Major pereopod 2 dactyl dorsal margin straight, ending in a triangular projection; scaphocerite with 26 marginal teeth . . . . . *L. bulga* Taylor & Poore, 1998
   – Major pereopod 2 dactyl dorsal margin concave, ending in a rounded projection; scaphocerite with 13 marginal teeth . . . . . *L. vanderlandi* Fransen, 2004
3. Third abdominal somite with postero-dorsal tooth 4
   – Third abdominal somite without postero-dorsal tooth 6
4. Seven dorsolateral spines on telson 5
   – Five dorsolateral spines on telson . . . . . *L. paulsoni* Stebbing, 1905
5. Rostrum 1.0 times as long as carapace; rostrum with four dorsal and 12 ventral teeth; telson 1.8 times as long as dorsal somite 6 . . . . . *L. pacificus* Zarenkov, 1976
   – Rostrum 1.7–1.9 times as long as carapace; rostrum with five dorsal and 8–9 ventral teeth; telson 2.2 times as long as dorsal somite 6 . . . . . *L. alexander* Poore, 2009

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6. Exopods of uropods disto-laterally entire; dactyli of ambulatory pereopods more than 0.5 times propodus length . . . . . *L. amplectipes* Bruce, 1990
   – Exopods of uropods disto-laterally serrate; dactyli of ambulatory pereopods less than 0.5 propodus length 7
7. Abdominal somite 4 with one acute posterolateral spine; abdominal somite 5 with one acute posterolateral spine and two acute spines on pleuron . . . . . *L. yarramundi* Taylor & Poore, 1998
   – Abdominal somite 4 without acute posterolateral spine; abdominal somite 5 without acute posterolateral spine and with 0–2 acute spines on pleuron 8
8. Abdominal somite 5 with one acute spine on pleuron; scaphocerite distolateral tooth not reaching distal blade margin . . . . . *L. lar* Kemp, 1910
   – Abdominal somite 5 with 0–2 acute spines on pleuron; scaphocerite distolateral tooth reaching distal blade margin . . . . . *L. smarensis* sp. nov.

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