Labidocera boxshalli sp. nov., a new calanoid copepod (Crustacea; Pontellidae) from the Red Sea

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2 authors:

Mohsen El-Sherbiny
King Abdulaziz University

Hiroshi Ueda

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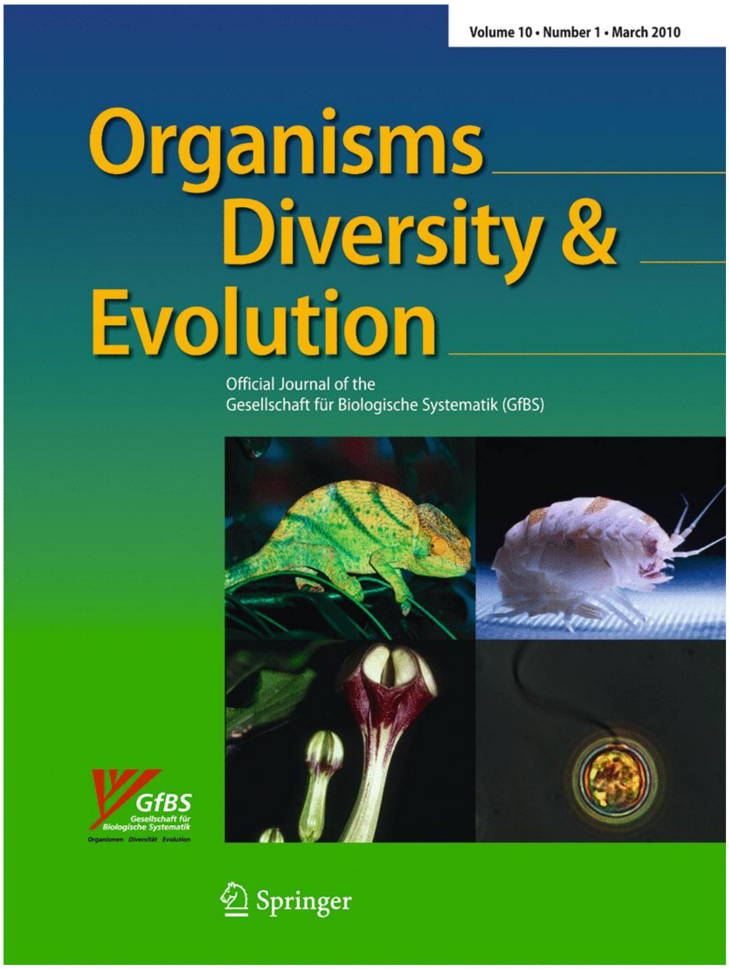

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Labidocera boxshalli sp. nov., a new calanoid copepod (Crustacea; Pontellidae) from the Red Sea

Mohsen M. El-Sherbiny · Hiroshi Ueda

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Abstract A pontellid copepod, *Labidocera boxshalli* sp. nov., is described from the Egyptian coast of the northern Red Sea. This species is most readily distinguished from its congeners by the presence of a mid-dorsal process on the female genital double somite, the female fifth leg exopod terminating in two superimposed processes (the ventral of which is shorter), and by the elongated first exopodal segment of the male right fifth leg carrying a stout, blunt-tipped process and a small papilla laterally near the base of the thumb that bears one seta. The new species belongs to the *L. detruncata* species group, which is distributed mainly in the tropical/subtropical waters of the Indo-West Pacific.

Keywords Copepoda · *Labidocera* · Pontellidae · New species · Red Sea

Introduction

The genus *Labidocera* was established by Lubbock (1853) for the species *L. darwinii* Lubbock, 1853, collected off Argentina. The genus is the largest in the family Pontellidae, currently accommodating 49 valid species (Boxshall and Halsey 2004), the majority of them Indo-Pacific in distribution. Most *Labidocera* species are restricted to waters ranging from warm-temperate to tropical. The biogeographical distribution of the genus is intriguing and can be used as a biological indicator of water masses, inshore-offshore boundaries, and divisions between zoogeographical regions (Fleminger 1957, 1967, 1986; Fleminger and Moore 1977; Fleminger et al. 1982; Sherman 1963, 1964; Voronina 1962).

Most members of the genus *Labidocera* are found day and night in the surface layer usually beneath the neuston, to a depth of about 10–15 m. To date, only four species of *Labidocera* are known to occur in the Red Sea (El-Sherbiny 1997; Halim 1969; Scott 1902): *Labidocera acuta* (Dana, 1849), *L. minuta* Giesbrecht, 1889, *L. orsinii* Giesbrecht, 1889, and *L. pavo* Giesbrecht, 1889. The present paper describes a new species of *Labidocera* sampled from the neritic and oceanic waters off Sharm El-Sheikh in the northern Red Sea.

Material and methods

The new species was obtained during a continuous zooplankton sampling programme in the northern Red Sea area around Sharm El-Sheikh (Fig. 1) on 27 June 2008, using a 40 cm diameter plankton net (325 µm mesh size). The net was towed horizontally close to the surface for 5–10 min at a speed of 1.5–2 knots. Samples were immediately fixed with 5% formalin in seawater, then placed in 70% alcohol. Sorted *Labidocera* specimens were examined whole or dissected using a differential interference microscope (Nikon 600E) and SEM (JOEL, JSM-5600LV). Drawings and all measurements were made with the aid of a camera lucida and an ocular micrometer. Terminology follows Huys and Boxshall (1991). The type specimens are deposited at the Tokyo Natural History Museum, Tokyo, Japan (NSMT).

M. M. El-Sherbiny (✉)
Marine Science Department, Faculty of Science,
Suez Canal University,
Ismailia 41522, Egypt
e-mail: mohsenrussia@yahoo.com

H. Ueda
Usa Marine Biological Institute, Kochi University,
194 Inoshiri, Usa, Tosa,
Kochi 781-1164, Japan

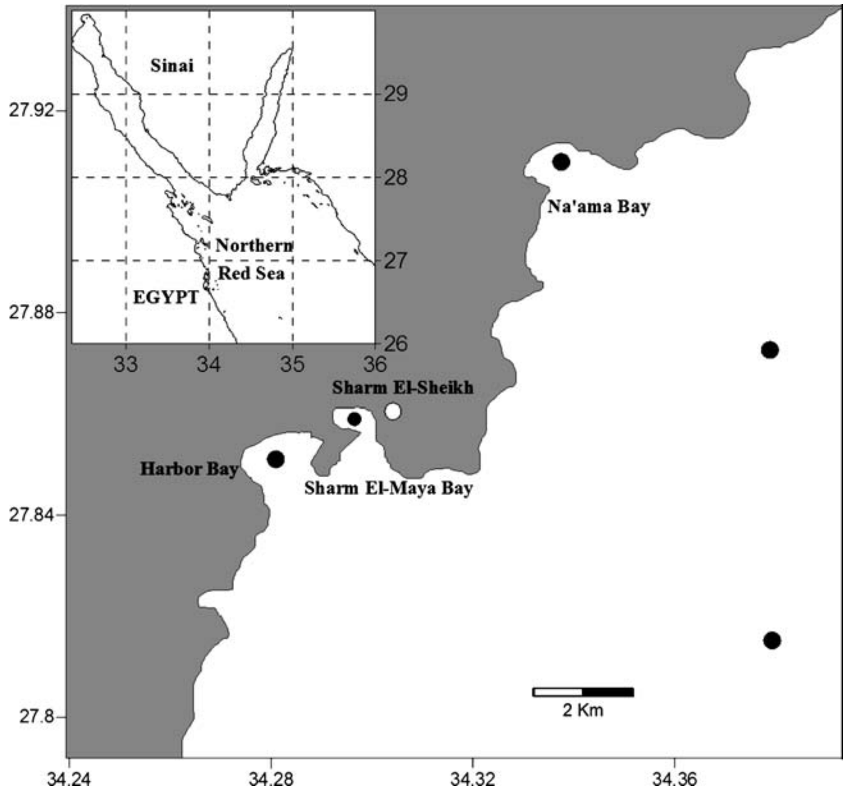


Fig. 1 Sampling sites (closed circles) of *Labidocera boxshalli* sp. nov. in the northern Red Sea area near Sharm El-Sheikh

Taxonomic section

Subclass Copepoda Milne Edwards, 1830
Order Calanoida Sars, 1903
Family Pontellidae Dana, 1853
Genus *Labidocera* Lubbock, 1853

Labidocera boxshalli sp. nov.

(Figs. 2, 4 and 5)

Etymology

The species is named in honor of Prof. Geoffrey A. Boxshall, distinguished copepodologist of the Natural History Museum, London, who led the first author's introduction to taxonomy.

Material

Holotype: Adult female, 2.38 mm, dissected and mounted on 4 glass slides (NSMT-Cr 20429).

Allotype: Adult male, 2.32 mm, partly dissected and mounted on 2 glass slides (NSMT-Cr 20430).

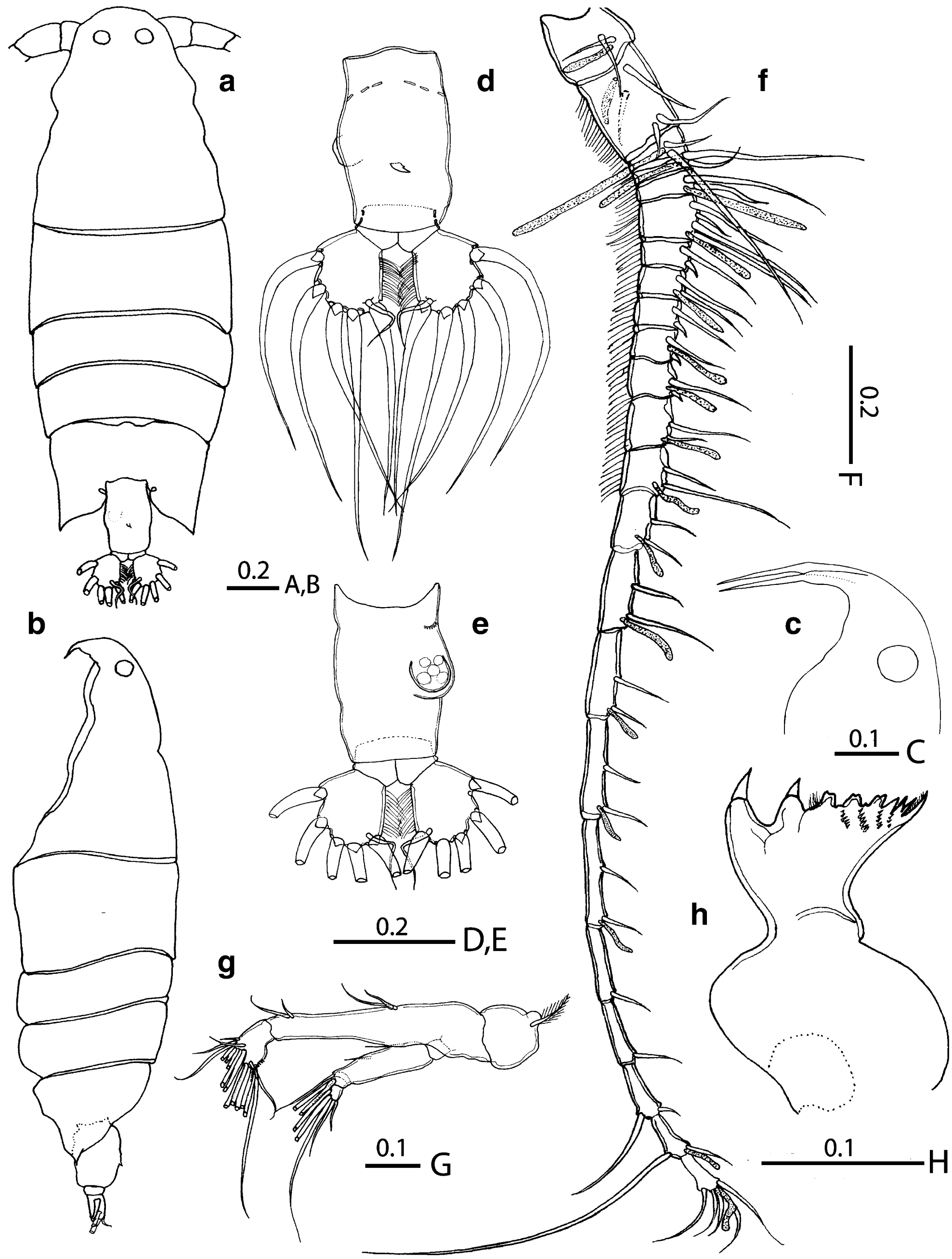
Other paratypes: 8 females (body length: 2.35–2.55 mm; mean ± SD=2.46±0.08 mm), 7 males (2.32–2.43; 2.39± 0.02 mm); all whole specimens in 70% ethanol (NSMT-Cr 20431).

Description

Female Body (Fig. 2A, B) robust; prosome about 4.2 times as long as urosome; cephalosome without lateral hooks and with pair of dorsal lenses; posterior corner of last pediger produced posteriorly into nearly symmetrical, strong spiniform processes, reaching nearly two-thirds of genital double somite. Rostrum (Fig. 2C) bifid, directed posteroventrally; 2 filaments delicate, tapered at distal two-thirds and widely separated proximally. Urosome (Fig. 2D, E) comprising 2 free somites. Genital double somite asymmetrical, with pointed process middorsally (Fig. 2D; see also Fig. 3A); genital operculum (Fig. 2E; see also Fig. 3B) located on left ventrolateral side. Anal somite very short. Caudal rami symmetrical; each ramus bearing 5 plumose setae and small dorsal seta.

Antennule (Fig. 2F) 23-segmented, not extending beyond third pedigerous somite. Posterior margins of segments 2–13 fringed with fine hairs. Ancestral segments II–IV and XXVII–XXVIII completely fused; segments 10 (XIII) and 11 (XIV) partially fused posteriorly. Segmentation pattern and setal armature as follows: I (1)=2+1 aesthetasc (ae), II–IV (2)=4+ae, V (3)=2+ae, VI (4)=2+ae, VII (5)=2+ae, VIII–IX (6)=4+ae, X (7)=2, XI (8)=2+ae, XII (9)=2, XIII (10)= 2+ae, XIV (11)=2+ae, XV (12)=2+ae, XVI (13)=2+ae, XVII (14)=2+ae, XVIII (15)=2+ae, XIX (16)=2+ae, XX (17)= 2+ae, XXI (18)=2+ae, XXII (19)=1, XXIII (20)=1, XXIV (21)=1+1, XXV (22)=1+1+ae, XXVI–XXVIII (23)=5+ae.

Fig. 2 *Labidocera boxshalli* sp. nov., holotype female. (**a**) Habitus, dorsal view. (**b**) Habitus, lateral view. (**c**) Rostrum, lateral view. (**d**) Urosome, dorsal view. (**e**) Urosome, ventral view. (**f**) Antennule. (**g**) Antenna. (**h**) Mandibular gnathobase. Scale bars in mm



Antenna (Fig. 2G) biramous; coxa with 1 plumose seta posteriorly; basis fused to first endopodal segment carrying 2 setae proximally and 2 setae distally; second endopodal segment lamellar, produced into two lobes; proximal and distal lobes with 9 and 8 setae, respectively; exopod 5-segmented with setal formula of 0, 2, 1, 2, 5.

Mandible gnathobase (Fig. 2H) with cutting edge bearing 8 teeth and setulose seta; third to fifth teeth bicuspidate; third teeth with some hairs on posterior surface; anterior surface with four transverse row of spinules; palp biramous (Fig. 4A); basis long, with 4 setae on medial margin; exopod 5-segmented with setal formula of 0, 1, 1, 1, 3; endopod 2-segmented, with 4 setae on segment 1 and 6 long terminal and 1 short dorsal seta on segment 2.

Maxillule (Fig. 4B) praecoxal arthrite with 9 marginal, 4 posterior and 2 anterior setae; coxal endite with 4 unequal apical setae; coxal epipodite with 9 plumose setae; basal endite with 3 unequal setae; basis with long seta representing exite; basis fused to endopod with total of 12 setae distributed as figured; exopod fused to basis, with 10 setae along distal margin.

Maxilla (Fig. 4C) praecoxa with proximal endite carrying 6 setae and patch of spinules; distal praecoxal endite with 2 long and 1 short seta and 4 long spinules; first and second

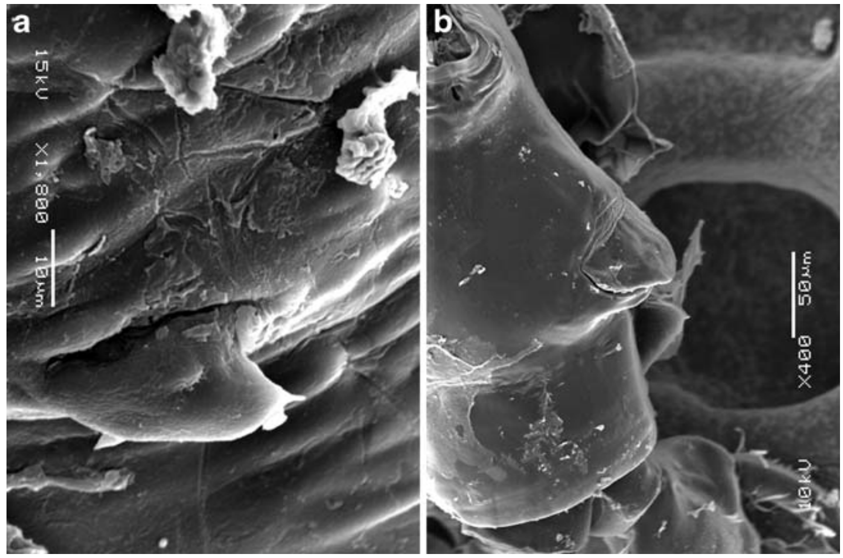


Fig. 3 *Labidocera boxshalli* sp. nov., SEM photographs. (**a**) Mid-dorsal process on female genital double somite. (**b**) Genital operculum, ventrolateral view

coxal endites as well as basal endite each with 2 long and 1 short seta; endopod reduced, indistinctly segmented, bearing 6 setae.

Maxilliped (Fig. 4D) with syncoxa bearing 2, 3 and 3 setae on first to third endites, respectively; basis without seta and fringed with row of spinules on medial margin. Endopod 5-segmented; segments 1 and 2 each with 2 long setae distally; segments 3 and 4 each with distal seta; segment 5 with 3 setae.

Swimming legs 1–4 (Fig. 4E–H) progressively longer, with 3-segmented exopod and 2-segmented endopod. For spines and setal formulae of legs 1–4, see Table 1.

Leg 5 (Fig. 4I) asymmetrical, biramous; basis with plumose seta proximally; both exopod and endopod 1-segmented; left rami slightly longer than right; exopod smoothly curved inwards, ending with 2 superimposed, unequal processes, ventral one smaller than dorsal, and with 3 minute processes along lateral margin; endopod not furcated and nearly one-third of length of exopod.

Male Body (Fig. 5A) robust, prosome about 3.3 times as long as urosome; cephalosome and first pediger separated, with 2 dorsal eye lenses. Fourth and fifth pedigers fused, posterolateral ends produced into asymmetrical lappets, left side slightly longer than right. Rostrum (Fig. 5B) bifid in frontal view, pronounced, directed ventrally, filaments more robust than in female. Urosome (Fig. 5C) 5-segmented; genital somite asymmetrical and wider than other urosomites; weakly swollen at left side, with genital aperture posteriorly; second urosomite slightly swollen at left side; third urosomite nearly as long as fourth and fifth urosomites combined; caudal rami symmetrical, each armed with 5 plumose setae and small dorsal seta.

Right antennule (Fig. 5D) geniculate, 21-segmented; segments 6–7, 8–9, and 10–12 incompletely fused, respectively; segments 2–7 with longitudinal row of hairs posteriorly; fusions and armature elements as follows: I (1)=2+ae, II–III (2)=5+ae, IV (3)=2+ae, V (4)=2+ae, VI (5)=2+ae, VII (6)=2, VIII (7)=2 +ae, IX (8)=2, X (9)=2+ae, XI (10)=2, XII (11)=2 +ae, XIII (12)=2+ae, XIV–XV (13)=4+2ae, XVI (14)=2+ae, XVII (15)=2+ae, XVIII (16)=1+ae, XIX–XX (17)=1+ae, XXI–XIII (18)=2+ae, XXIV (19)=1+1+process, XXV (20)=1+1+ae, XXVI–XXVIII (21)=6+ae. Left antennule as in female.

Leg 5 (Fig. 5E) uniramous, asymmetrical. Left leg (Fig. 5E) with short coxa; basis 2.5 times longer than coxa, with plumose seta posteriorly near proximal end. Exopod 2-segmented; segment 1 somewhat rectangular, with pointed process near distolateral corner; segment 2 nearly as long as first, hirsute on postero-medial surface, with curved long spine on posterior surface and 3 stout, unequal setae along distal margin. Right leg (Fig. 5E, F) longer than left; basis with plumose seta laterally. Exopod 2-segmented, forming chela with long, curved, pointed process (thumb) at one-third length of lateral margin of segment 1, and curved segment 2 (finger); first segment elongated and subcylindrical, with 2 blunt conical processes posteriorly near base of thumb and 1 distal seta, stout, blunt-tipped process and small papilla laterally near base of thumb, and short seta on papilla; second segment long, somewhat flattened at proximal one-third, with 2 setae nearly at midlength and 1 subterminal and 1 apical spinule.

Variation

The shape of the mid-dorsal process on the female genital double somite varies among individuals. It can be acute with a broad base (Fig. 6A), show two or three tips (Fig. 6B, C), or a two-tipped process and a small anterior

Fig. 4 *Labidocera boxshalli* sp. nov., holotype female. (**a**) Mandibular palp. (**b**) Maxillule. (**c**) Maxilla. (**d**) Maxilliped. (**e**–**i**) Legs 1–5, posterior views. Scale bars in mm

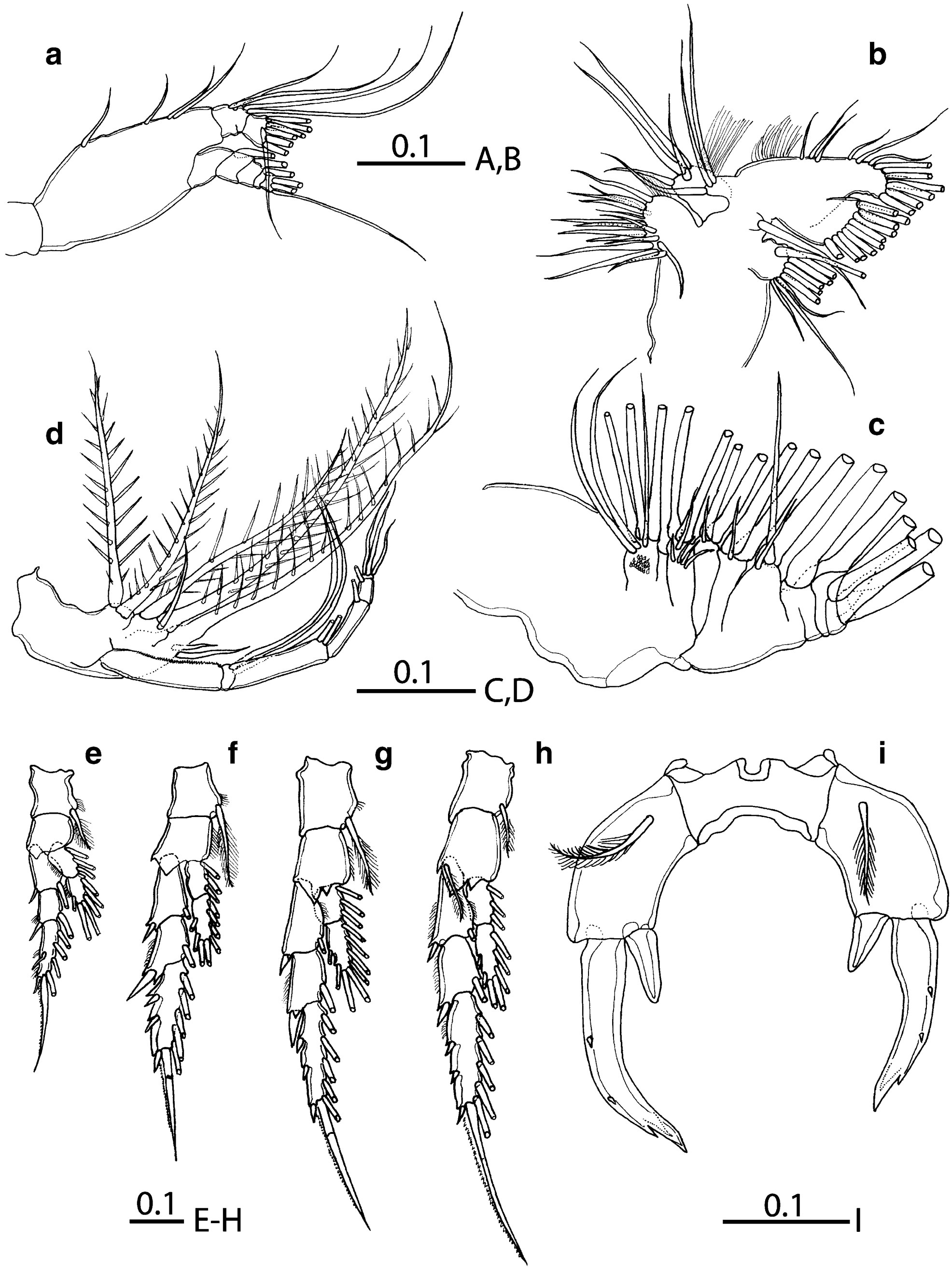


Table 1 Seta and spine formula of legs 1–4 of female *Labidocera boxshalli* sp. nov. from the Red Sea

Leg	Coxa	Basis	Exopod 1	Exopod 2	Exopod 3	Endopod 1	Endopod 2
1	0–1	0–0	I–1	I–1	II, I, 5	0–3	1, 2, 3
2	0–1	0–0	I–1	I–1	III, I, 5	0–3	2, 2, 4
3	0–1	0–0	I–1	I–1	III, I, 5	0–3	2, 2, 4
4	0–1	1–0	I–1	I–1	III, I, 5	0–3	2, 2, 3

Roman numerals indicate spines; Arabic numerals represent setae.

protrusion (Fig. 6D). No notable variation was detected among the male specimens, except in body length.

Discussion

Labidocera boxshalli sp. nov. belongs to the *L. detruncata* group, which was established by Fleminger (1967) as a superspecies, by sharing the following characteristics: female urosome composed of 2 somites; female leg 5 asymmetrical, with 3 lateral processes on exopod, endopod

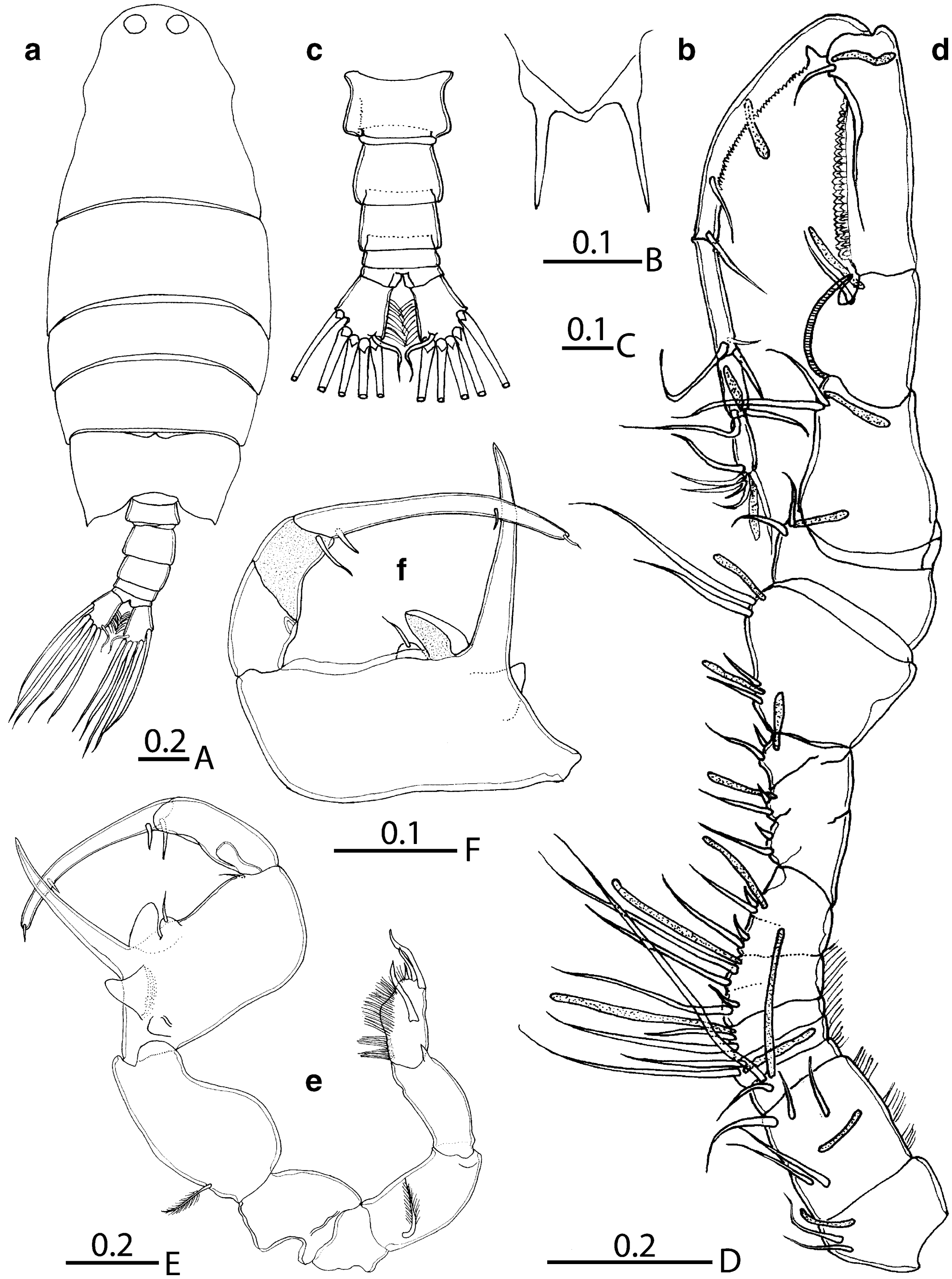


Fig. 5 *Labidocera boxshalli* sp. nov., allotype male. (**a**) Habitus, dorsal view. (**b**) Rostrum, frontal view. (**c**) Urosome, dorsal view. (**d**) Right antennule. (**e**) Fifth leg, posterior view. (**f**) Fifth leg second exopodal segment, anterior view. Scale bars in mm

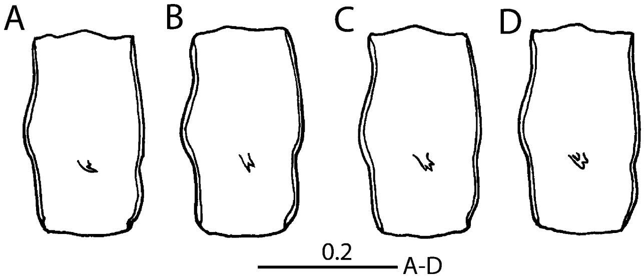


Fig. 6 *Labidocera boxshalli* sp. nov. (**a**–**d**) Variation in middorsal process on female genital double somite. Scale bar in mm

not furcated but rounded at apex; first exopodal segment of male right leg 5 with stout, elongated thumb and with blunt-tipped process near base of thumb; second exopodal segment of male left leg 5 with long spine on posterior surface and 3 setae along distal margin. The *L. detruncata* group comprises 14 species, 7 of which (*L. bataviae* A. Scott, 1909, *L. detruncata* (Dana, 1849), *L. jaafari* Othman, 1986, *L. gangetica* Sewell, 1934, *L. madurae* A. Scott, 1909, *L. pavo*, and *L. sinilobata* Shen & Lee, 1963) are distributed in the tropical/subtropical waters of the Indo-

West Pacific (Mulyadi 2002; Silas and Pillai 1973). *Labidocera cervi* Krämer, 1895, *L. caudate* Nicholls, 1944*, L. farrani* Greenwood & Othman, 1979, and *L. tasmanica* Taw, 1974 are restricted to Australian waters (Greenwood 1979; Greenwood and Othman 1979); *L. detruncata* and *L. nerii* (Kröyer, 1849) are Atlantic species (Owre and Foyo 1967); whereas *L. orsinii* was recorded from the Red Sea (El-Sherbiny 1997; Halim 1969).

Labidocera boxshalli sp. nov. very closely resembles some species in the *L. detruncata* group (*L. jaafari* from Peninsular Malysia, *L. nerii* from the Atlantic Ocean, *L. orsinii* from the Red Sea, and *L. sinilobata* from East China Sea). They are similar in shapes of the prosomal ends in both sexes, shape of female genital double somite, location of genital operculum, symmetry of caudal rami, asymmetry of female legs 5 (terminating in 2 processes and with 3 lateral processes), elongated first exopodal segment of male right leg 5 (with 1 slender elongated thumb and 1 blunt-tipped process posteriorly near thumb base), and in the curvature of the second exopodal segment. However, *L. jaafari* and *L. sinilobata* lack the endopod of the female leg 5. In this regard, division of these species into subgroups is rather difficult.

The new species can be distinguished from those four species, as well as from all members of the *L. detruncata* group, by the following combination of characteristics: (1) posterior corner of female fifth pediger extending to about two-thirds of genital double somite; (2) presence of middorsal process on female genital double somite; (3) female fifth leg asymmetrical, with left leg longer than right, and with each exopod terminating in 2 superimposed processes, the dorsal one being longer; (4) first exopodal segment of male right leg 5 elongated and with 2 blunt conical processes posteriorly near base of thumb, 1 stout, blunt-tipped process and 1 small, papilla-like process (bearing one seta terminally) on medial surface.

Although the Red Sea plankton originating from the Indian Ocean consists of 71 species of pontellid copepods (Silas and Pillai 1973), the diversity of this group in the Red Sea is relatively low, comprising 13 species only (El-Sherbiny and Ueda 2008; Halim 1969; Ünal and Shmeleva 2002). The low number of pontellid species recorded in the Red Sea may be explained by the characteristic neustonic nature of this group (Mauchline 1998), sampling methods and time, and/or by limited sampling effort.

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