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A new species of the hippolytid genus *Paralebbeus* Bruce & Chace, 1986 (Crustacea: Decapoda: Caridea) from the Coral Seamount, southwestern Indian Ocean

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Abstract

The hippolytid genus *Paralebbeus* Bruce & Chace, 1986, is only known from two species, *P. zotheculatus* Bruce & Chace, 1986 (type species) and *P. zygus* Chace, 1997. Both are known from the western Pacific, though *P. zotheculatus* was originally described from the Australian Northwest Shelf in the Indian Ocean. In this paper, a new species, *P. mollis*, is described and illustrated on the basis of a single ovigerous female from the Coral Seamount, southwestern Indian Ocean, at a depth of 952 m as the third representative of the genus. The new species is readily distinguished from its congeners by the rostrum being armed with one tooth on both the dorsal and ventral margin and the conspicuous pterygostomial tooth on the carapace. Because of these characteristics of the new species, the diagnosis of *Paralebbeus* is slightly emended. The holotype of *P. mollis* n. sp. was associated with an unidentified hexactinellid sponge, like the other two known species.

Key words: *Paralebbeus mollis*, *Paralebbeus zotheculatus*, *Paralebbeus zygus*, hexactinellid sponge

Introduction

Bruce & Chace (1986) established a new hippolytid genus *Paralebbeus* to accommodate a new species, *P. zotheculatus*, associated with a deep-water hexactinellid sponge, collected from the Australian Northwest Shelf. *Paralebbeus* was differentiated from its closest relative, *Lebbeus* White, 1847, by some morphological characters, including the reduced, toothless rostrum, the minute pterygostomial tooth of the carapace, and the unarmed meri of the last three pairs of pereopods (Bruce & Chace 1986). Subsequently, Chace (1997) described a new species from Indonesia, *P. zygus*, as the second representative of the genus. Literature records suggest that these two species are rather widely distributed in the western Pacific (Chace 1997; Hayashi & Mitsuhashi 2003), with *L. zotheculatus* extending to the Indian Ocean side of Australia.

Research efforts describing the biological community and biodiversity of seamounts have been increasing in recent years (e.g., Clark *et al.* 2010), because there is a growing interest in the existence of unexploited fishery resources. Nevertheless, documentation of the fauna of seamounts is far from satisfactory in spite of high biodiversity and possible endemism. The present paper serves to describe a new species assigned to *Paralebbeus*, *P. mollis*, on the basis of a single ovigerous female collected from the Coral Seamount in the southwestern Indian Ocean during the 66th voyage of the RRS ‘James Cook’ in November 2011. The new species was also found to be associated with an unidentified hexactinellid sponge, like the previous species. A brief note on the taxonomic status of *Paralebbeus* is given.

Information on the outline of the 2011 cruise of the RRS ‘James Cook’ is available at http://www.iucn.org/about/work/programmes/marine/marine_our_work/marine_governance/seamounts/cruises/2011/. The holotype of the new species is deposited in the Oxford University Museum of Natural History, UK (OUMNH). Carapace length (cl) represents specimen size, measured from the posterior margin of the orbit to the midpoint of the posterodorsal margin of the carapace.

Taxonomy

Family Hippolytidae

Genus *Paralebbeus* Chace & Bruce, 1986

Paralebbeus mollis n. sp.

(Figs. 1–5A)

Material examined. Holotype: ovigerous female (cl 15.3 mm), Coral Seamount, southwestern Indian Ocean, 41°21.41264'S, 42°55.09195'E, 952 m, November 2011, manipulator installed on ROV 'Keel 6000', OUMNH.ZC.2013-01-001.

Description. Body (Fig. 1) robust; integument thin, soft, surface glabrous.

Rostrum (Figs. 2A, B) nearly straight, directed forward, not reaching distal margin of first segment of antennular peduncle, about 0.3 times as long as carapace; dorsal margin armed with 1 small tooth located at midlength; ventral margin with 1 small subterminal tooth, ventral lamina absent; lateral carina sharply defined, extending to base of supraorbital tooth. Carapace (Figs. 1; 2A, B) without postrostral median carina or postrostral teeth; dorsal surface elevated, dorsal outline in lateral view strongly convex; supraorbital tooth conspicuous, directed forward, arising at level of posterior margin of orbit; orbital margin with slight convexity posteriorly; moderately deep, U-shaped notch present below base of supraorbital tooth; suborbital lobe prominent, triangular, reaching nearly as far as antennal tooth; anterolateral margin between antennal and pterygostomial teeth strongly sinuous with deep concavity just inferior to antennal tooth; pterygostomial tooth small but conspicuous.

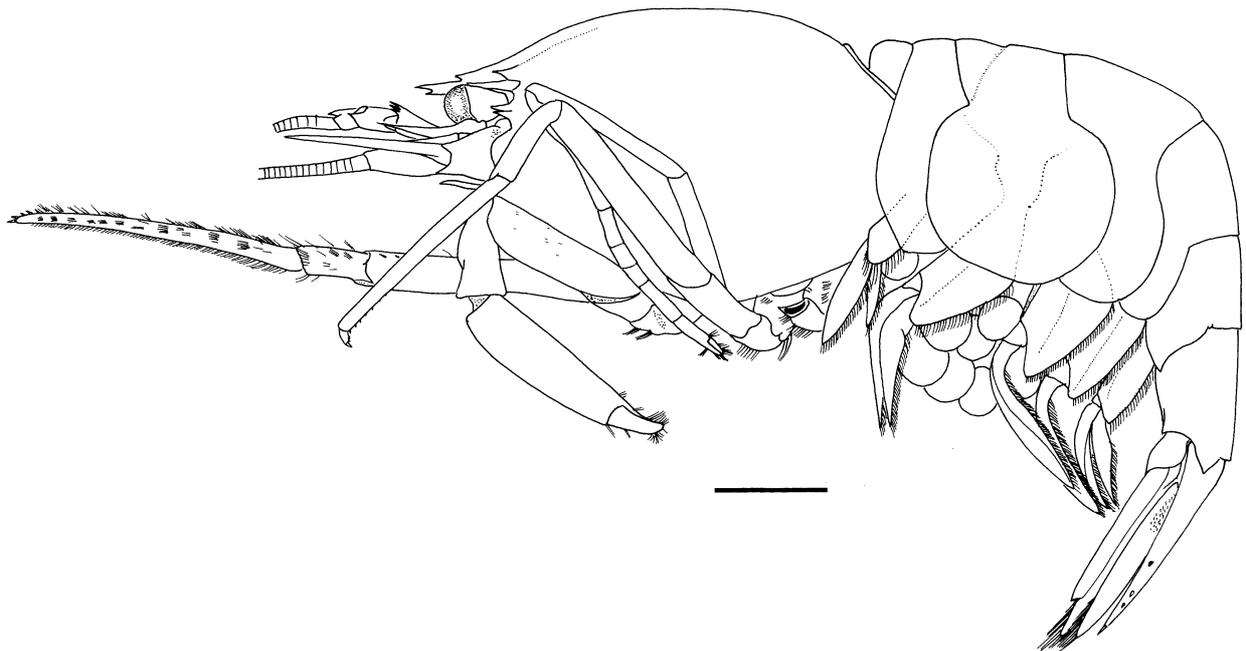


FIGURE 1. *Paralebbeus mollis* n. sp., holotype, ovigerous female (cl 15.3 mm), OUMNH.ZC.2013-01-001, entire animal in lateral view (antennular flagella damaged; fourth and fifth pereopods detached). Scale bar: 5 mm.

Pleon (Fig. 1) dorsally rounded. Second pleomere with shallow transverse groove on tergum. Pleura of anterior four pleomeres rounded; fifth pleuron with moderately strong posteroventral tooth, lateral margin noticeably sinuous. Sixth pleomere about 1.5 times longer than fifth pleomere and 1.6 times longer than high, bearing tiny posteroventral tooth; posterolateral process terminating acutely. Telson (Fig. 2C) 1.5 times longer than sixth pleomere, 2.7 times longer than greatest width, tapering to broad, roundly truncate posterior margin, bearing 3 pairs of dorsolateral spines (anteriormost spine located at posterior 0.4 of telson length); dorsal surface with scattered

shallow pits; posterior margin with 2 pairs of markedly unequal lateral spines and 7 setulose spiniform setae (Fig. 2D).

Eye (Fig. 2A, B) subpyriform with eyestalk not markedly narrowing proximally. Cornea slightly wider and shorter than eyestalk, its maximum width 0.15 of carapace length; ocellus absent.

Antennular peduncle (Fig. 2A, B) reaching distal one-fourth of antennal scale. First segment distinctly longer than distal two segments combined, slightly falling short of midlength of antennal scale, dorsodistal margin armed with 3 acute teeth laterally; stylocerite overreaching distolateral margin of first peduncular segment, acuminate, mesial margin gently convex, approximated to lateral surface of first segment. Second segment with 1 strong dorsolateral distal tooth; articulating membrane between second and third segments broad. Third segment bearing 1 small dorsodistal tooth. Lateral and mesial flagella damaged in both sides.

Antenna (Fig. 2A, B, E) with basicerite bearing moderate ventrolateral tooth; carpoperite reaching midlength of antennal scale. Antennal scale 0.5 times as long as carapace and 2.5 times longer than wide; lateral margin nearly straight; distolateral tooth slightly falling short of broadly rounded distal margin of lamella.

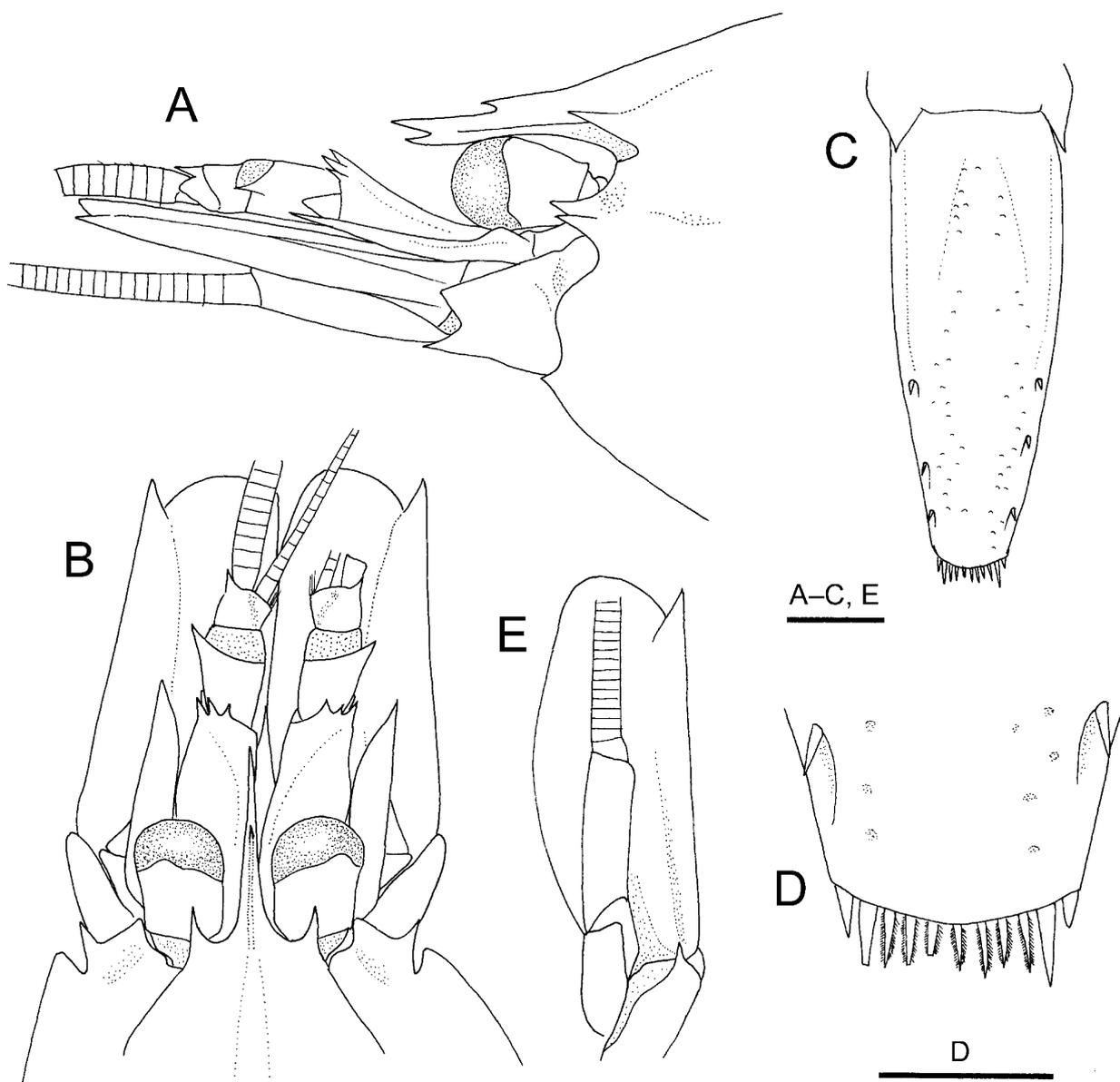


FIGURE 2. *Paralebbeus mollis* n. sp., holotype, ovigerous female (cl 15.3 mm), OUMNH.ZC.2013-01-001. A, anterior part of carapace and cephalic appendages, lateral view (setae omitted; antennular flagella damaged); B, same, dorsal view (setae omitted; antennular flagella damaged); C, telson, dorsal view; D, same, close up of posterior margin, dorsal view; E, left antenna, ventral view (setae omitted). Scale bars: 2 mm for A–C, E; 1 mm for D.

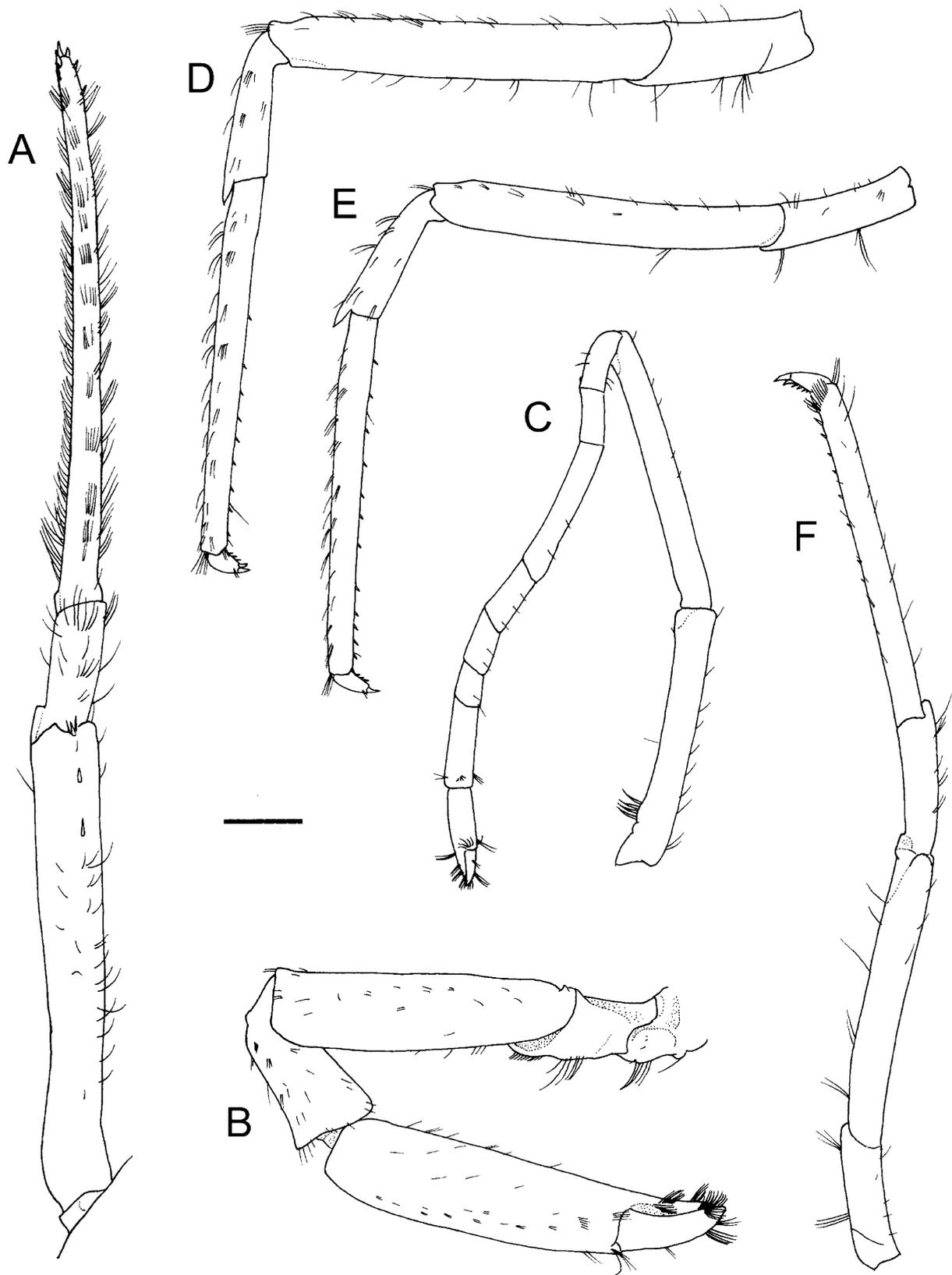


FIGURE 3. *Paralebbeus mollis* n. sp., holotype, ovigerous female (cl 15.3 mm), OUMNH.ZC.2013-01-001. Left thoracic appendages, lateral view. A, third maxilliped; B, first pereopod; C, second pereopod; D, third pereopod; E, fourth pereopod; F, fifth pereopod. Scale bar: 2 mm.

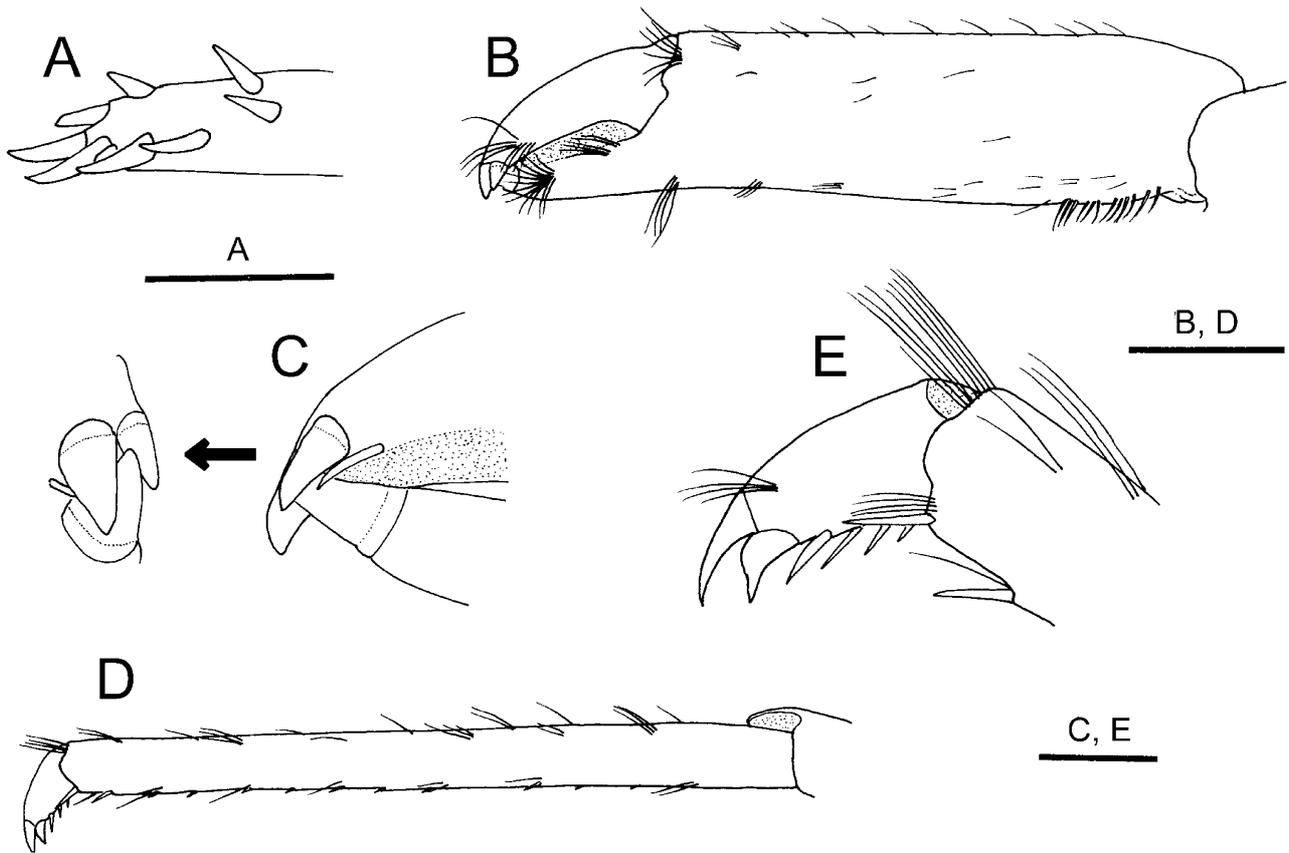


FIGURE 4. *Paralebbeus mollis* n. sp., holotype, ovigerous female (cl 15.3 mm), OUMNH.ZC.2013-01-001. A, distal part of ultimate segment of right third maxilliped, mesial view; B, chela of left first pereopod, flexor view; C, terminal claws of fingers of first pereopod, lateral view (setae omitted); inset, distal view; D, dactylus and propodus of left third pereopod, showing accurate proportion of these segments; E, dactylus and distal part of propodus of left third pereopod, lateral view. Scale bars: 2 mm for B, D; 1 mm for A; 0.5 mm for C, E.

Mouthparts not dissected.

Third maxilliped (Fig. 3A) somewhat elongate, overreaching antennal scale by nearly full length of ultimate segment. Ultimate segment about 0.8 times as long as carapace, 4.4 times as long as penultimate segment, very slender, gradually tapering distally, with 9 distal spines arranged in nearly circle (Fig. 4A); lateral surface with short transverse rows of stiff setae. Penultimate segment short. Antepenultimate segment with minute spinule on distolateral margin, followed by 2 longer spinules on lateral surface. Exopod absent.

Strap-like, terminally hooked epipods present on third maxilliped to third pereopod, corresponding setobranchs present on first to fourth pereopods.

First pereopod (Fig. 3B) stout, overreaching distal margin of antennal scale by about half length of chela. Dactylus (Fig. 4B) about 0.4 times as long as palm, bearing 2 terminal corneous claws arising from nearly same levels and reaching unequal distances distally, and 1 additional slender, rod-like accessory spine proximal to base of each claw (Fig. 4C). Fixed finger bearing single corneous claw (Fig. 4C). Palm elongate, about 3.2 times as long as wide. Carpus cup-shaped, about half-length of palm. Merus about 3.8 times longer than wide, with minute tubercle proximodorsally.

Second pereopod (Fig. 3C) overreaching antennal scale by about 0.3 length of carpus; anteriorly extended merus extending as far as merus of anteriorly extended third pereopod. Carpus divided into 7 articles, third article longest. Merus slightly longer than ischium.

Third to fifth pereopods moderately long and slender, similar in shape but decreasing in length and width toward posterior (Fig. 3D–F). Third pereopod (Fig. 3D) overreaching antennal scale by 0.2 length of propodus; dactylus (Fig. 4D, E) less than 0.2 times as long as propodus, stout (about 2.5 times as long as wide), terminating in acute, curved unguis, armed with 5 accessory spinules on flexor margin, distalmost accessory spinule longer and

much wider than others, blade-like with strongly convex upper margin, making tip of dactylus appearing biunguiculate; propodus with 2 rows of minute spinules on flexor surface (Fig. 4D); carpus about half length of propodus; merus slightly narrowing distally, unarmed. Fourth pereopod (Fig. 3E) reaching antennal scale by dactylus; merus unarmed. Fifth pereopod (Fig. 3F) not reaching distal margin of antennal scale; propodus with grooming setae distally; merus unarmed.

Protopods of second to fifth pleopods each with fairly expanded ventrolateral lobe (Fig. 1). Uropods exceeding telson (Fig. 1).

Eggs large, 2.2×2.3 mm.

Coloration in life. Body and appendages entirely red; cornea dark brown, reflective; claws of fingers of first pereopod and unguis of ambulatory dactyli dark brown. Eggs greenish gray. See Fig. 5A.

Distribution. Known only from Coral Seamount, southwestern Indian Ocean, at a depth of 952 m.

Ecology. The shrimp was associated with an unidentified hexactinellid sponge (Fig. 5B), inhabiting the atrium inside.

Etymology. The specific name is derived from the Latin *mollis* (= soft) in reference to the soft body integument.

Remarks. The present new species is assigned to *Paralebbeus* because of the absence of postrostral teeth on the carapace and the lack of lateral spines on the meri of the last three pairs of pereopods, though it is readily distinguished from the two known congeners, *P. zotheculatus* and *P. zygius*, by the dorsally and ventrally dentate rostrum and the small but distinct pterygostomial tooth on the carapace. Other differentiating characters between *P. mollis* n. sp. and the latter two species are summarized in Table 1. The assignment of the present new species requires minor emendation to the original generic diagnosis: rostrum feebly developed, acute, edentate or weakly dentate with 1 tooth on each dorsal and ventral margin.

Paralebbeus zotheculatus was originally described from the Australian Northwest Shelf at depths of 452–506 m and subsequently recorded from the Philippines at a depth of 720 m (Chace 1997). *Paralebbeus zygius* was originally described from Indonesia (Halmahera and Sulawesi) at depths of 763–1023 m and subsequently recorded from Japan (depth not recorded) (Hayashi & Mitsuhashi 2003). The present new species greatly extends the geographical range of the genus to the southwestern Indian Ocean.

TABLE 1. Comparison between *Paralebbeus mollis* n. sp. with the two known congeneric species.

Characters/Species	<i>P. mollis</i> n. sp.	<i>P. zotheculatus</i>	<i>P. zygius</i>
Rostral armature	armed with 1 tooth on each dorsal and ventral margin	unarmed	unarmed
Supraorbital tooth on carapace	conspicuous	conspicuous	rudimentary or absent
Anterolateral margin of carapace	strongly sinuous, with deep concavity just inferior to antennal tooth	faintly sinuous, without concavity inferior to antennal tooth	strongly sinuous, with deep concavity just inferior to antennal tooth
Pterygostomial tooth	moderately strong	minute	rudimentary or absent
Telson dorsolateral spines	3 on each side	4–6 on each side	1–3 on each side
Ultimate segment of third maxilliped	very slender	moderately stout	moderately stout
Distal spines on ultimate segment of third maxilliped	9 spines arranged nearly in circle	10–12 spines arranged in nearly circle	about 18 spines arranged in compressed oval pattern
Dactylus of first pereopod	bearing 2 terminal corneous claws arising from nearly same levels and reaching unequal distances distally	bearing 2 terminal corneous claws arising from nearly same levels and reaching about same distances distally	bearing 2 terminal corneous claws arising from difference levels and reaching unequal distances distally
Extension of merus of anteriorly extended second pereopod	reaching as far as merus of anteriorly extended third pereopod	distinctly overreaching merus of anteriorly extended third pereopod	reaching as far as merus of anteriorly extended third pereopod

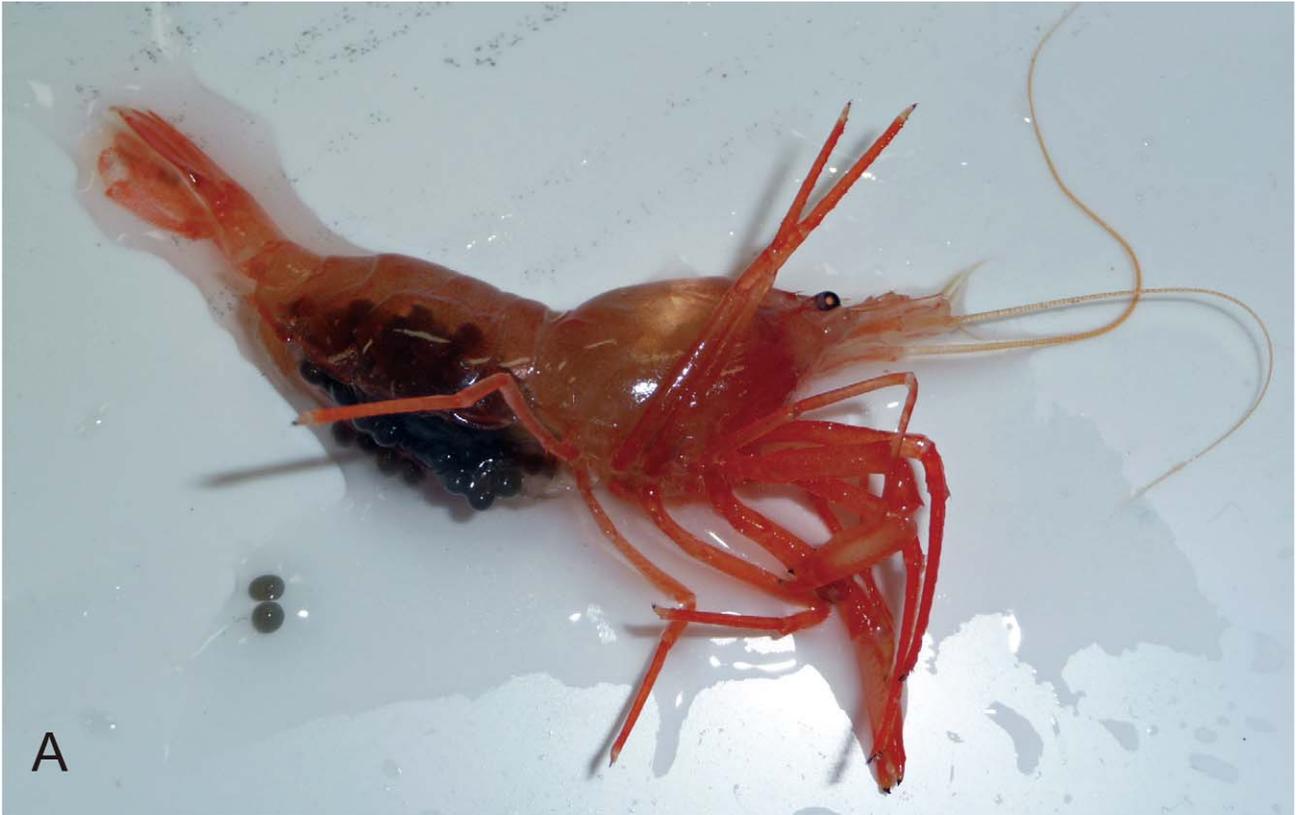


FIGURE 5. A, *Paralebbeus mollis* n. sp., holotype, ovigerous female (cl 15.3 mm), OUMNH.ZC.2013-01-001, showing color in life; B, host sponge, unidentified species of Hexactinellidae (Photo credits: A. Rogers, M. Taylor).

Discussion

As mentioned before, Bruce & Chace (1986) differentiated *Paralebbeus* from *Lebbeus* White, 1847 by the markedly reduced, unarmed rostrum, the lack of postrostral teeth on the carapace, the presence of a minute pterygostomial tooth on the carapace, and the unarmed meri of the ambulatory pereopods (third to fifth pereopods). The reduction of armature on the body parts and appendages is considered to represent the evolutionary trend of adaptation to a life using narrow spaces in host animals, such as sponges, bivalves, and tunicates (Bruce 1976). However, critical examination of these supposedly diagnostic characters shows that most of them are not unique for *Paralebbeus*. For example, a short, unarmed rostrum is seen also in *L. brevirostris* Chang, Komai & Chan, 2010 (cf. Chang *et al.* 2010: Fig. 1A), *L. catalepsis* Jensen, 1987 (cf. Jensen 1987: Fig. 2A), *L. lagunae* (Schmitt, 1921) (cf. Wicksten 1978: 2, Fig. 1), and *L. nudirostris* Komai & Takeda, 2004 (cf. Komai & Takeda 2004: Fig. 2B), although association with other invertebrates is not known for those species. The developmental degree of the pterygostomial tooth on the carapace is quite variable in *Lebbeus*, and the tooth is sometimes absent in *L. comanathi* Hayashi & Okuno, 1997 (cf. Hayashi & Okuno 1997: Fig. 2B). The number of meral spines of the third to fifth pereopods is also substantially variable in species of *Lebbeus*, and in *L. eludus* Jensen, 2006, the meri are unarmed (Jensen 2006: Fig. 3B).

It is therefore concluded that the only definitive difference between *Paralebbeus* and *Lebbeus* is the presence or absence of postrostral teeth on the carapace (absent in *Paralebbeus* versus present in *Lebbeus*). It thus seems highly likely that *Paralebbeus* is a derived lineage within the genus *Lebbeus* adapted to a commensal life with hexactinellid sponge. Although for the moment, *Paralebbeus* is maintained as a valid genus, future phylogenetic study may eventually reveal that the genus is a synonym of *Lebbeus*.

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