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PARALEBBEUS ZOTHECULATUS, N. GEN.,
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THE AUSTRALIAN NORTHWEST SHELF

A. J. BRUCE AND F. A. CHACE, JR.

**PARALEBBEUS ZOTHECULATUS, N. GEN.,
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Abstract.—A new species of hippolytid shrimp found in association with hexactinellid sponges on the Australian Northwest Shelf at depths of 450–500 m is described, and a new genus designated for its accommodation. *Paralebbeus zotheculatus*, n. gen., n. sp., represents the first record of an association between a caridean shrimp and a hexactinellid sponge. *Paralebbeus* is most closely related to *Lebbeus* White, 1847, and is distinguished by the reduced, unarmed rostrum, and absence of lateral spines on the meri of the ambulatory pereopods.

A survey of the Australian Northwest Shelf area, off Port Hedland, Western Australia, carried out by the F.R.V. *Soela* of the Fisheries Laboratory, Commonwealth Scientific and Industrial Research Organizations, has produced, from this little-studied region, numerous examples of crustacean taxa that are new to science or new to the Australian fauna. Among the caridean material collected were several examples of a commensal hippolytid shrimp. This could be referred to none of the described genera, and a new genus is proposed for its accommodation.

CL. refers to the postorbital carapace length. NTM refers to the Northern Territory Museum, Darwin, Australia.

Paralebbeus, new genus

Diagnosis.—Carapace smooth; rostrum feebly developed, acute, edentate; supraorbital, antennal, and pterygostomial spines present, branchiostegal and hepatic spines absent. Abdomen smooth, segments dorsally rounded, sixth with posteroventral angle without moveable plate; first 3 pleura rounded, fourth convexly produced, fifth acutely produced; telson with 4–6 pairs of dorsal spines, about 6 pairs of posterior spines. Eyes pigmented. Antennule without

statocyst, stylocerite large, peduncle without mobile distal plate; upper flagellum uniramous. Mandible with 2-segmented palp, molar and incisor processes present. First and second maxillipeds with exopods; epipod of second maxilliped with podobranch; third maxilliped without exopod, with epipod. All pereopods without arthrobranches; first and second pereopods chelate, first pair with robust, similar, subequal chelae, second with chela small, carpus 7-segmented; ambulatory legs with dactyl biunguiculate, merus unarmed, first 3 pereopods with epipod, all 5 pairs with mastigobranchs. Uropods normal.

Type species.—*Paralebbeus zotheculatus*, n. sp.

Etymology.—From *para* (Greek) beside, and *Lebbeus*, a hippolytid generic name cited by White, 1847, from a manuscript by Leach. The etymology of the name *Lebbeus* is unknown. The gender is masculine.

Systematic position.—*Paralebbeus* is most closely related to the genus *Lebbeus* White, 1847, and shares with it the following major characteristics:

1. Supraorbital and antennal spines present on carapace, branchiostegal spines absent; pterygostomial spines generally present, minute.



Fig. 1. *Paralebbeus zotheculatus* in host sponge.

2. Abdominal segments smooth, dorsally rounded.
3. Posteroventral angle of sixth abdominal segment without moveable plate.
4. Mandible with incisor process and 2-segmented palp.
5. Third maxilliped without exopod, with epipod.
6. Arthrobranchs absent.

One of the features that distinguish *Paralebbeus* from *Lebbeus* is the markedly reduced and toothless rostrum in *Paralebbeus*; most species of *Lebbeus* show a well developed, strongly toothed rostrum, often continuous posteriorly with a very marked, strongly dentate postrostral carina. Also, *Paralebbeus* generally has only a minute pterygostomial spine, which is well developed in all species of *Lebbeus*. *Lebbeus* has the meri of the ambulatory pereopods strongly armed with spines laterally, which are completely absent in *Paralebbeus*. The commensal association of *Paralebbeus* with hexactinellid sponges is probably also a

characteristic feature; some species of *Lebbeus* are known to be commensals but they are apparently associated with coelenterates, particularly actinarians.

Paralebbeus zotheculatus, n. sp.

Figs. 1–6

Material examined.—(i) 1 ♀, F.R.V. *Soela*, cruise 0184, sta NSW/57, 17°30.1'S, 118°28.9'E, 505–506 m, 3 Feb 1984, coll. A. J. Bruce. Holotype, NTM Cr. 00574A (ii) 1 ovig. ♀, collected with above. Paratype, NTM Cr. 00574B. (iii) 1 ♀, F.R.V. *Soela* cruise 0184, sta NWS/68, 16°14.0'S, 120°20.4'E, 456–452 m, 5 Feb 1984, coll. A. J. Bruce, NTM Cr. 00577 (iv) 1 ♀(?), F.R.V. *Soela* cruise 0784, sta NWS/66, 16°45.3'S, 119°46.4'E, 502–504 m, 5 Feb 1984, coll. A. J. Bruce, NTM Cr. 00575. All specimens collected by prawn trawl.

Description.—Adult female paratype. Body of stout, subcylindrical form, generally glabrous (Fig. 2).

Carapace with stout, acute, straight, lat-

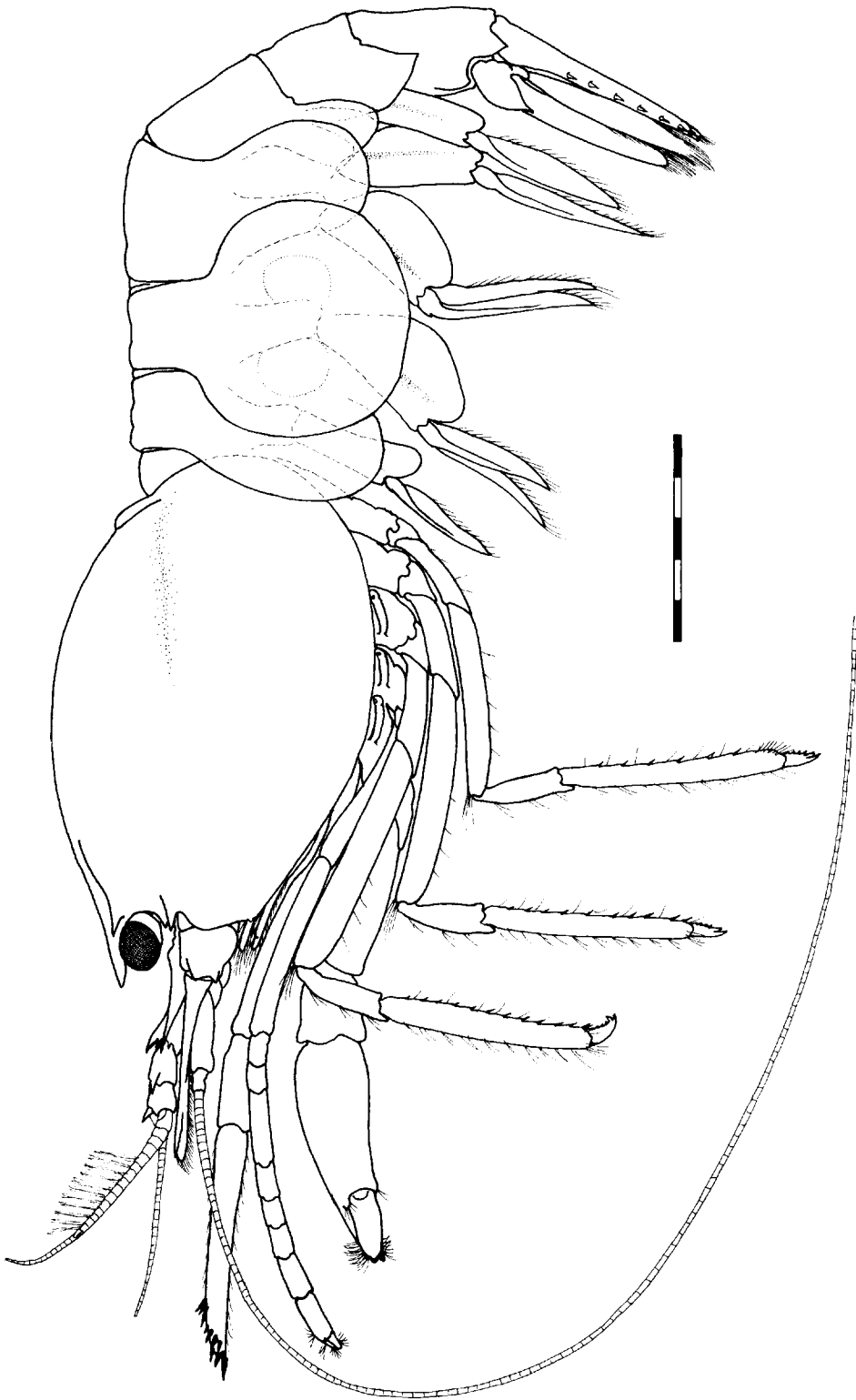


Fig. 2. *Paralebbeus zolheculatus*, ovigerous female paratype (NTM Cr. 000574B).

erally compressed, toothless rostrum reaching slightly beyond eyes; smooth, with acute supraorbital and antennal spines, inferior orbital angle produced, subacute, anterolateral angle rounded, not produced, with minute pterygostomial spine present on right, absent on left side of carapace (Fig. 3A).

Abdomen with segments dorsally rounded, not carinate or produced; pleura of first 3 segments broadly rounded, fourth convexly produced, fifth acutely produced. Sixth segment about 1.5 times length of fifth, 1.5 times longer than deep, posterolateral angle acutely produced, posteroventral angle bluntly produced. Telson (Fig. 3F) about 1.7 times length of sixth abdominal segment, about 2.7 times longer than anterior width, sides subparallel anteriorly, convergent posteriorly to broadly rounded posterior margin, equal to about 0.5 of anterior width; with 5–6 lateral dorsal spines and 13 posterior spines, sublateral spines longest, about 1.7 times length of lateral spines and 1.3 times length of submedian spines (Fig. 6L).

Eyes prominent, cornea hemispherical, well pigmented, without accessory pigment spot; stalk slightly flattened, central length subequal to corneal diameter (Fig. 3D).

Antennular peduncle (Fig. 3B) with large, broad acute stylocerite reaching to base of intermediate segment, proximal segment about 2.2 times longer than central width, medial border setose, distolateral angle tridentate, with small distal ventromedial tooth; statocyst obsolete; intermediate segment 1.5 times longer than distal width, tapered proximally, with acute distolateral tooth; distal segment shorter than width, half length of intermediate segment, with upper and lower distolateral teeth. Upper flagellum uniramous, short, proximal 18 segments stout with about 10 groups of aesthetascs, 8 distal segments slender; lower flagellum short and slender, with 28 segments.

Antenna (Fig. 3C) with basicerite bearing

small distolateral tooth, carpocerite about 3.0 times longer than wide, exceeding middle of scaphocerite, flagellum slender, about 3.5 times postorbital carapace length; scaphocerite extending well beyond antennular peduncle, lamella about 2.7 times longer than broad, distal margin bluntly angular, exceeding tip of distolateral tooth, lateral margin straight.

Mandible (Fig. 4A) with corpus stout, with feebly setose 2-segmented palp laterally; left molar process (Fig. 6A, B) robust, obliquely truncate distally, well developed marginal setose fringe dorsally and row of small teeth ventrally; incisor process (Fig. 6C) feeble, with 4 small, irregular acute teeth distally. Maxillula (Fig. 4B) with well developed, feebly bilobed palp (Fig. 6D), upper lobe with 2 slender simple setae, lower lobe with 1 stouter setulose seta; upper lacinia broad, with about 14 short stout simple spines distally, upper and lower borders sparsely setose; lower lacinia slender, setose, with few slender spines distally (Fig. 6E). Maxilla (Fig. 4C) with well developed, distally narrowed palp, lateral border with short plumose setae, 3 longer simple setae distally; basal endite large, deeply bilobed, medially setose on both lobes, coxal endite small, simple, with sparser, longer setae medially, scaphognathite about 3.5 times longer than central width, posterior lobe short and rounded, anterior lobe distally narrowed. First maxilliped (Fig. 4D) with 2-segmented palp, distal segment 2.0 times longer than wide and 2.0 times length of proximal, both sparsely setose medially; basal endite short and broad, medially setose, coxal endite feebly convex medially, sparsely setose; exopod with flagellum normally developed, numerous plumose setae distally and small caridean lobe proximally; epipod large, feebly bilobed, with triangular lobes. Second maxilliped endopod (Fig. 4E) with distal segment narrow, 3.0 times longer than wide, with numerous long finely setulose setae medially, propodal segment distomedially

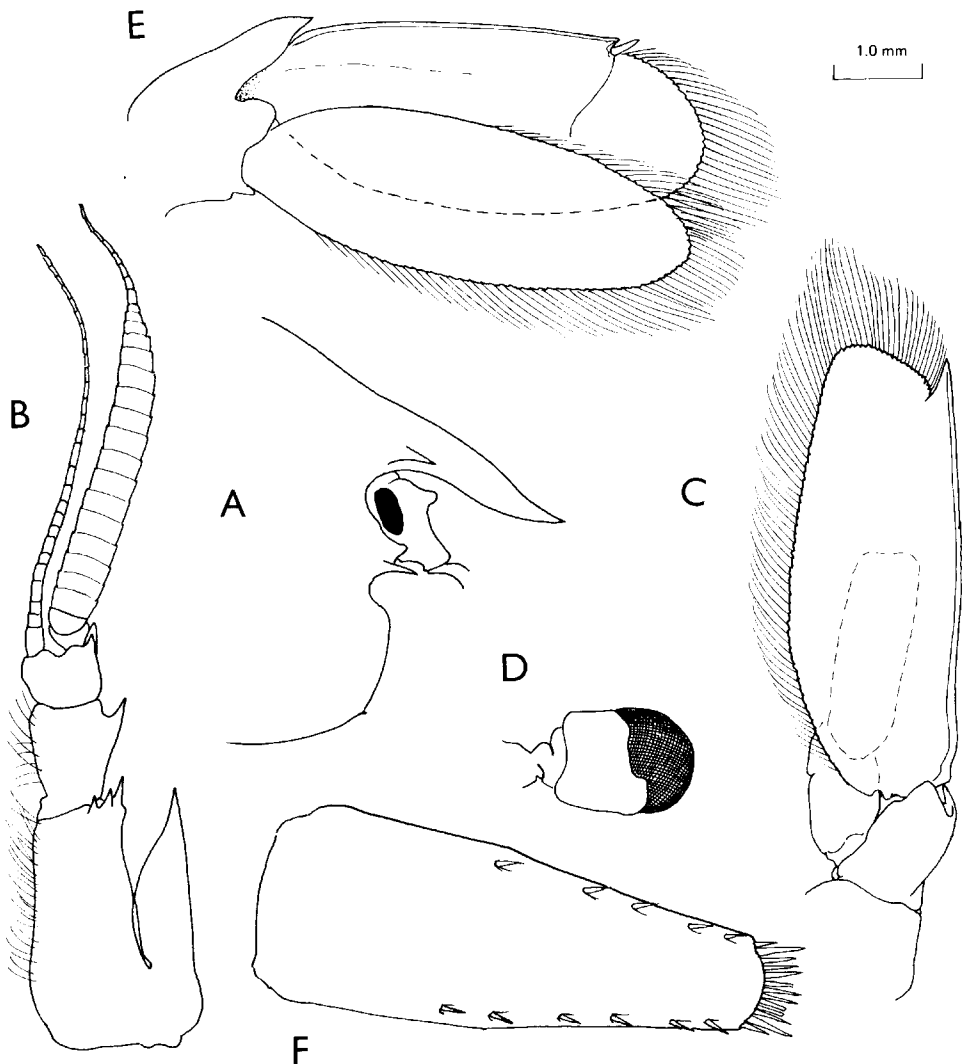


Fig. 3. *Paralebbeus zotheclusatus*: A, Anterior carapace and rostrum, lateral aspect; B, Antennule; C, Antenna; D, Eye; E, Uropod; F, Telson. A, D, Female holotype; B, C, E, F, Female paratype.

angulate with medial margin setose; carpus and merus normal; ischiomerus medially excavate; coxa not medially produced, non-setose; with large oval epipod bearing small podobranch with 5 pairs of lamellae proximally; exopod damaged on left, normal on right. Third maxilliped (Fig. 4F) elongate and slender, exceeding antennular peduncle by length of distal segment, reaching anteriorly about as far as extremity of second

pereiopod; terminal segment about 8.0 times longer than proximal width, subcylindrical and tapering distally, laterally setose, with numerous short robust cornified spines (Fig. 6F); penultimate segment short, twice as long as wide and 0.3 times length of antepenultimate segment, medially setose; ischiomerus and basis completely fused, combined segment about 5.0 times longer than wide, slightly narrowed proximally; coxa not

medially produced, without oval lateral plate, small hooked epipod present.

Branchiae as follows:

	Maxillipeds			Pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	-	-	-	+	+	+	+	+
Arthrobranchs	-	-	-	-	-	-	-	-
Podobranchs	-	+	-	-	-	-	-	-
Mastigobranchs	-	-	-	+	+	+	+	+
Epipods	+	+	+	+	+	+	-	-
Exopods	+	+	-	-	-	-	-	-

Thoracic sternites narrow and armed with slender acute submedian spines on sixth to eighth thoracic segments.

First pereiopods (Fig. 5A) robust, short, subequal and similar, exceeding carpuce by chela and carpus. Chela (Fig. 5B) robust with palm subcylindrical, smooth, about 2.4 times longer than wide, slightly tapered distally, with grooming setae proximally, dactyl (Fig. 6G) strongly curved, acute, 3.2 times longer than deep, about 0.5 of palm length, with 2 strongly cornified teeth distally, medial and lateral cutting edge entire; fixed finger (Fig. 6H) similar, with 1 cornified distal tooth; carpus short and stout, about as wide as long, subcylindrical, distal end feebly excavate, unarmed but provided with grooming setae; merus about 2.4 times length of carpus and 2.8 times longer than central width, subcylindrical and unarmed, obliquely articulated with ischium; ischium about 2.0 times longer than wide and twice length of basis, with short longitudinal row of 5 spines proximally; coxa robust, without processes but with hooked epipod.

Second pereiopods (Fig. 5C) slender, subequal and similar, reaching to tip of third maxilliped. Chela (Fig. 5E) small with palm subcylindrical, about 2.2 times longer than deep, dactyl 0.65 of palm length, acute, feebly curved, with unarmed cutting edge, 2 strongly compressed cornified teeth distally, fixed finger similar, with single distal tooth only; carpus (Fig. 5D) slender, 3.5 times length of chela, 7-segmented, with segments

in following ratios from proximal end 2.0:1.0:3.3:1.8:1.0:1.0:2.0, merus undivided, about 0.6 of carpus length, 7.0 times longer than wide, uniform and unarmed; ischium subequal to merus, about 7.6 times longer than deep, ventral border sparsely setose, with 3 conspicuous spines proximally; basis short, without special features; coxa robust, with hooked epipod and small setose process ventrally.

Ambulatory pereiopods moderately slender. Third pereiopod (Fig. 5F) extending to about 0.6 of terminal segment of third maxilliped and exceeding carpuce by propod and dactyl; dactyl (Fig. 6I) with corpus compressed, about 1.8 times longer than deep, about 0.15 of propod length, unguis distinct from corpus, about 3.0 times longer than wide, ventral border of corpus with 6 spines, distal spine shorter but more robust than unguis, other spines decreasing in size proximally; propod (Fig. 5G) about 6.5 times length of dactyl, 8.0 times longer than wide, with 2 rows of about 12 spines ventrally and tufts of setae dorsally; carpus barely 0.5 of propod length, about 6.3 times longer than wide, unarmed; merus about 1.2 times propod length, 6.3 times longer than deep, unsegmented, without lateral spines or distoventral tooth; ischium about 0.45 of merus length; basis and coxa without special features, latter with hooked epipod (Fig. 6J). Fourth pereiopod similar to third. Fifth pereiopod (Fig. 5H) similar, more slender than third, dactyl (Fig. 6K) with 7 ventral spines, propod 1.1 times length of third and 10.5 times longer than deep, with fewer ventral spines, transverse rows of short, serrate setae distolaterally.

Pleopods (Fig. 5I, J) normally developed, biramous, with protopodite broadly expanded laterally on second to fourth abdominal segments, endopods of second to fifth segments with appendix interna.

Uropods (Fig. 3E) with protopodite acutely angulate posterolaterally; exopod 2.5 times longer than broad, lateral margin feebly convex, with small acute distal tooth

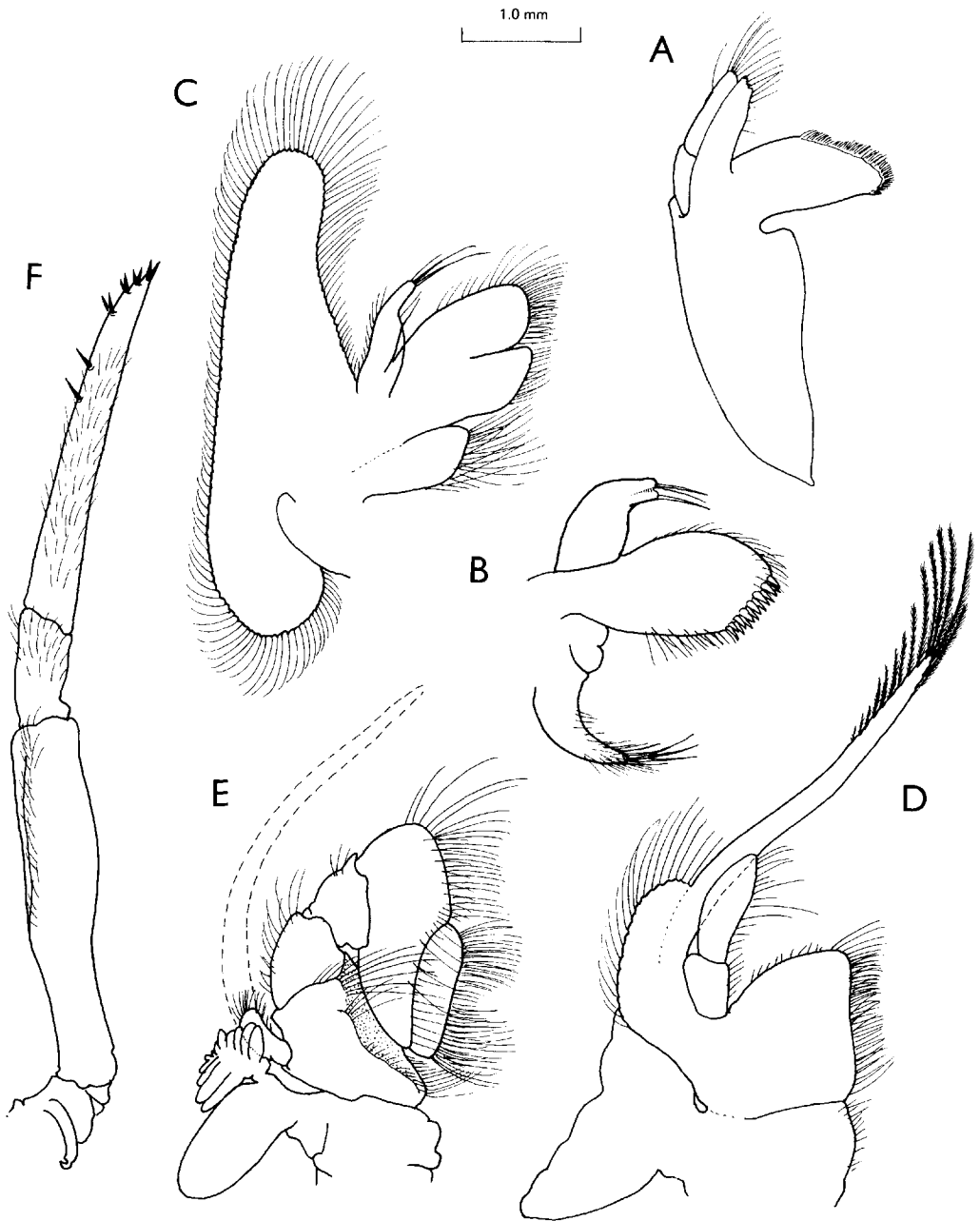


Fig. 4. *Paralebbeus zotheerculatus*, ovigerous female paratype: A, Left mandible; B, Maxillula; C, Maxilla; D, First maxilliped; E, Second maxilliped; F, Third maxilliped.

accompanied medially by larger mobile spine; endopod subequal to exopod, about 3.1 times longer than broad.

Ova few and large, length about 1.5 mm.

Adult female holotype.—Generally very similar to described paratype, smaller and less robust. Rostrum slightly longer relatively and more acute, distally slightly up-

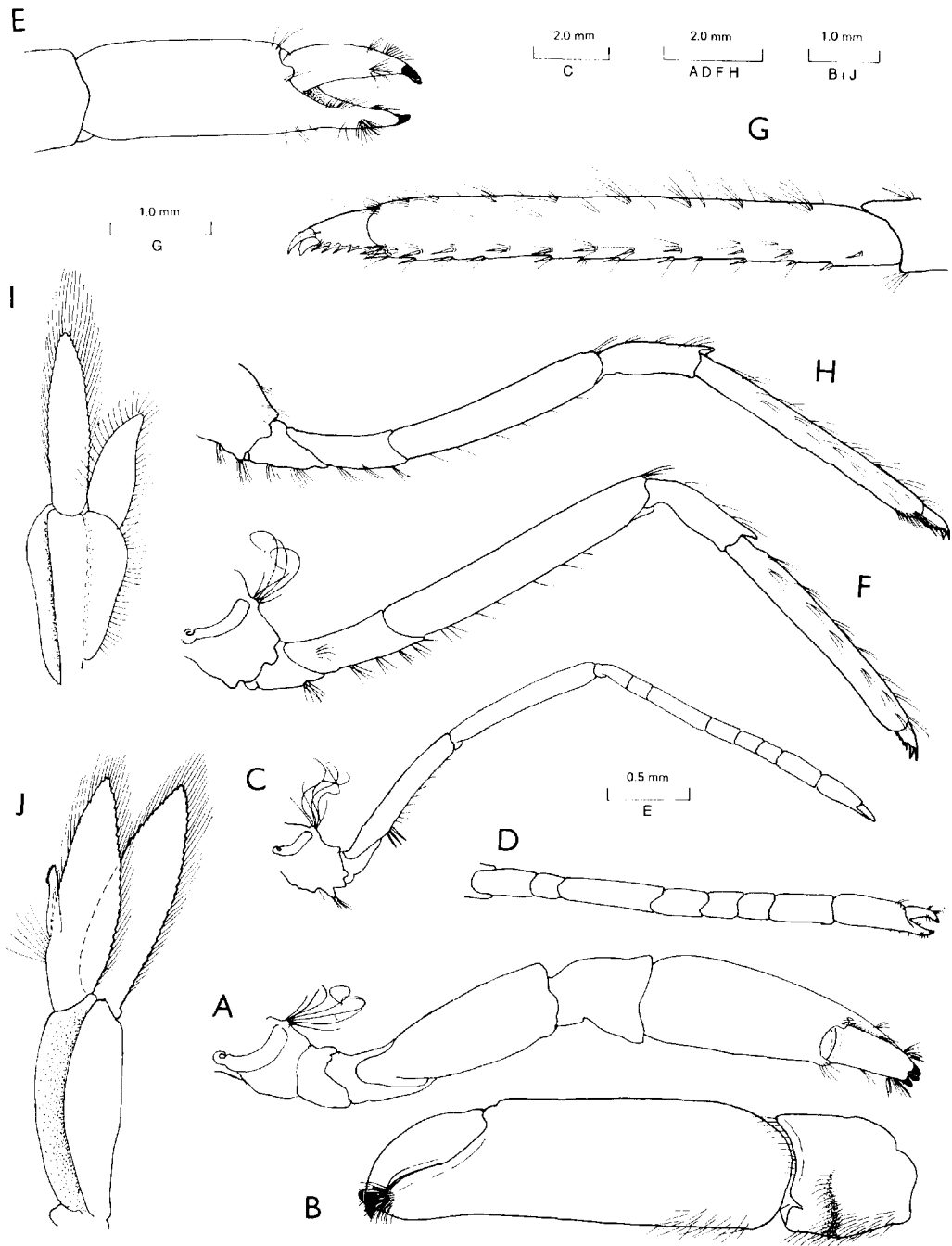


Fig. 5. *Paralebbeus zotheerculatus*: A, First pereiopod; B, Same, chela; C, Second pereiopod; D, Same, carpus and chela; E, Same, chela; F, Third pereiopod; G, Same, propod and dactyl; H, Fifth pereiopod; I, First pleopod; J, Second pleopod. A-H, Female paratype; I, J, Female holotype.

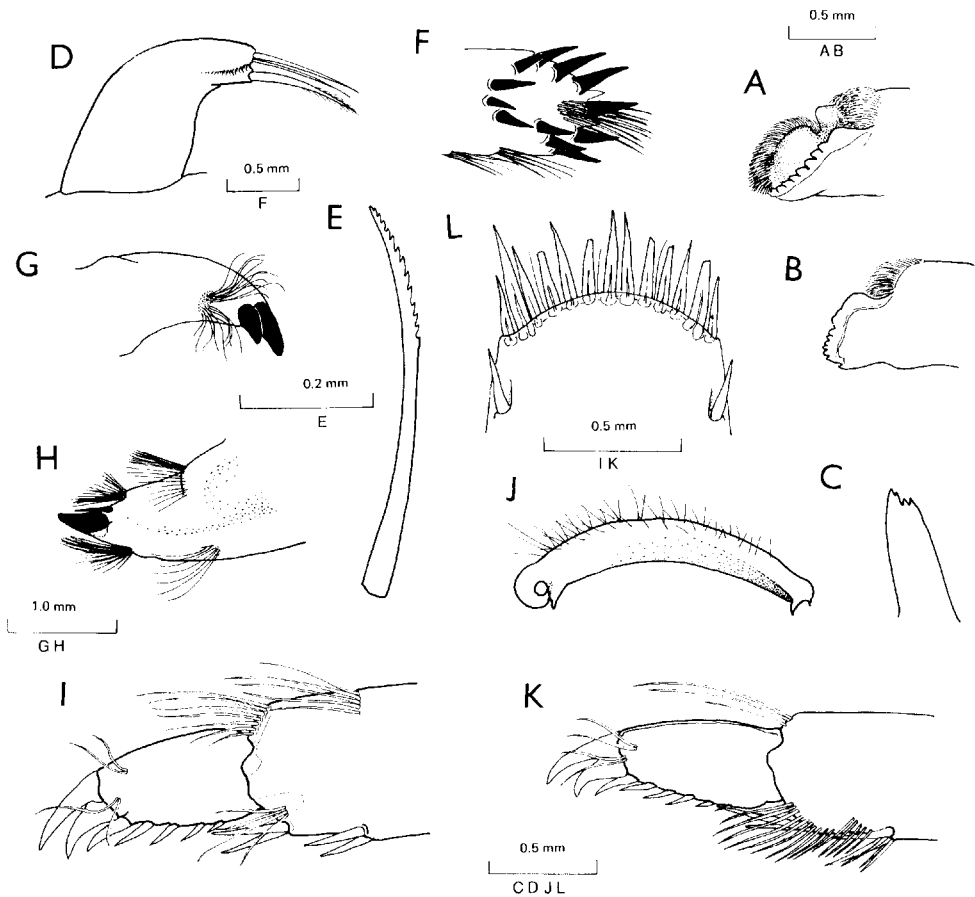


Fig. 6. *Paralebbeus zothecculatus*, female paratype: A, Molar process of mandible, anterior aspect; B, Same, posterior aspect; C, Incisor process of mandible; D, Palp of maxillula; E, Lower lacinia of maxillula, distal spine; F, Third maxilliped, distal end of terminal segment; G, First pereiopod, dactyl; H, Same, fixed finger; I, Third pereiopod, dactyl and distal end of propod; J, Same, epipod; K, Fifth pereiopod, dactyl and distal end of propod; L, Telson, posterior margin.

turned. Small pterygostomial spine present on each side of carapace.

Additional paratypes.—In close agreement with holotype. Specimen from NWS/68 lacking first and fifth pereiopods and one of fourth pereiopods. Pterygostomial spines absent from both sides. Telson with 4 dorsal spines on one side, 5 on other. Specimen from NWS/66 complete and also with 4 dorsal spines on one side of telson and 5 on other. Pterygostomial spines present on both sides of carapace.

Coloration.—Body mainly transparent,

abdomen whitish speckled with small red chromatophores increasing in density posteriorly, caudal fan reddish; antennae whitish; third maxilliped deep red; fingers of first pereiopod reddish, third to fifth pereiopods red, especially distally. Cornea black. Intra-thoracic organs orange. Ova turquoise.

Host.—All specimens collected from small chambers in hexactinellid sponges, probably of the genus *Euplectella*.

Habitat.—Bottom temperatures 7.88°–8.70°C.

Parasites.—One specimen with pair of

bopyrid isopods in right branchial chamber. These have been identified as *Bopyroides lamellatus* (Krøyer), a species not previously recorded from Southern Hemisphere.

Etymology.—The specific epithet is derived from “zothecula” (Latin), a small chamber.

Discussion

The specimens of *Paralebbeus zotheculatus* described above were all obtained from inside trawl-caught hexactinellid sponges, in small closed chambers only found on breaking up the sponges, leaving their association with the sponge beyond any doubt (Fig. 1). Most of the sponges collected were damaged and incomplete, which probably accounts for only single specimens of shrimps being found; it seems probable that they were originally in heterosexual pairs.

The discovery of *Paralebbeus zotheculatus* is of particular interest as it represents the first established example of an association between a caridean shrimp and a hexactinellid sponge. This niche has been largely taken over by stenopodid shrimps, such as *Spongicola*, *Spongiocaris*, and *Spongiocoloides* (Saint Laurent and Cleva 1981).

The genus *Lebbeus* White contains about 25 species (Wicksten and Méndez 1982, Butler 1980) which occur predominantly in northern seas, although one species, *L. indicus*, has been described from Indonesian waters (Holthuis 1947). Most of these have been trawl-caught specimens and no details of their associations, if any, have been preserved. One of the boreal species found in shallow waters has been observed to live in association with sea anemones (Butler 1980, *L. grandimanus* [Brazhnikov] on *Cribriopsis* and *Tealia* spp.) but none have been reported in association with hexactinellid or any other sponges. The only hippolytid shrimp so far recorded as an associate of Porifera is *Gelastocaris paronae* Nobili, which lives on the external surface of shallow-water Indo-West Pacific sponges.

Three specimens of a hippolytid shrimp that probably belongs to this genus and possibly to the same species were collected during the *Albatross* Philippine Expedition, 1907–1910, but, as each specimen differs in some respects from the above description, they are not considered to be part of the type series of *Paralebbeus zotheculatus*. A female (CL 9.7 mm) from Verde Island Passage, Philippines, agrees most closely with the Australian series but it has a more slender rostrum, the anterior margin of the carapace not deeply recessed below the antennal spine, the scaphocerite with the lateral margin slightly concave rather than faintly convex at midlength, and the chela of the first pereopod with the distal corneous teeth on the dactyl subequal rather than staggered. A male (CL 6.9 mm) from west of Halmahera, Indonesia, has a small supraorbital spine on the left side and none on the right, no pterygostomial denticle on either side, the telson with only two and three left and right lateral dorsal spines, and the corneous subdistal spines on the third maxilliped more numerous and extending somewhat farther proximally on the terminal segment. A female (CL 11.7 mm) from southern Celebes, Indonesia, resembles the male in the spination on the third maxilliped but it has no supraorbital spine on either side, a vestige of a pterygostomial denticle on the left side of the carapace but none on the right, the telson with two lateral dorsal spines on the left side and one on the right, and the right scaphocerite shorter than the left. These specimens will be discussed in greater detail in the report now in preparation by the junior author on the alpheoid families of the *Albatross* Philippine Expedition.

Acknowledgments

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