

*LYSMATA LIPKEI*, A NEW SPECIES OF PEPPERMINT SHRIMP  
(DECAPODA, HIPPOLYTIDAE) FROM WARM TEMPERATE AND  
SUBTROPICAL WATERS OF JAPAN

BY

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ABSTRACT

A new hippolytid shrimp species of the genus *Lysmata* Risso, 1816, *L. lipkei* sp. nov., is described and illustrated on the basis of 13 specimens from intertidal and sublittoral zones of the Boso Peninsula, Honshu and the Ryukyu Islands, Japan. Morphologically, *L. lipkei* is closely related to the eastern Indian Ocean species, *L. dispar* Hayashi, 2007, but differs from the latter by the structure of the rostrum, the armature of the antennular peduncle, and the number of articulations of the second pereopods.

RÉSUMÉ

Une nouvelle crevette Hippolytidae du genre *Lysmata* Risso, 1816, *L. lipkei* sp. nov., est décrite et illustrée en se fondant sur l'examen de 13 spécimens intertidaux et subtidaux de la péninsule de Boso, Honshu et des îles Ryukyu, Japon. D'un point de vue morphologique, *L. lipkei* est étroitement apparentée à l'espèce de l'Océan Indien oriental, *L. dispar* Hayashi, 2007, mais en diffère par la structure du rostre, l'armature du pédoncule antennulaire, et le nombre d'articulations des seconds péreiopodes.

INTRODUCTION

The hippolytid genus *Lysmata* Risso, 1816 can be distinguished from other genera of the Hippolytidae by their moderately slender body, the long and

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thickened second pereopod with a multi-articulated carpus, the rostrum armed with teeth on both dorsal and ventral margins, the well developed arthrobranchs and exopods on the third maxilliped, the first to fourth pereopods with epipods, the absence of a supraorbital spine, suborbital tooth and a longitudinal ridge on the carapace, no movable plate on the sixth abdominal somite, and the absence of both the incisor process and the palp on the mandible (Chace, 1997). In the checklist of the known hippolytid shrimps at that time, Chace (1997) recognized 25 *Lysmata* species worldwide. During this decade, numerous species of *Lysmata* were additionally described as new to science: 2 from the Indian Ocean, 5 from the Eastern Pacific, and 8 from the Western Atlantic Ocean (Wicksten, 2000a, b; Burukovsky, 2000; Rhyne & Lin, 2006; Rhyne & Anker, 2007; Hayashi, 2007; Baeza & Anker, 2008; Anker et al., 2009; Baeza et al., 2009; Laubenheimer & Rhyne, 2010).

The specimens examined for this report were fortuitously obtained as a result of independent research efforts. During collections for studies on hermaphroditism among the western Pacific *Lysmata*, one of us (GCF) collected several specimens of *Lysmata* from the vicinity of the Tropical Biosphere Research Center (former Sesoko Marine Biological Station), University of the Ryukyus, and Tokashiki Island of Kerama Group, the Ryukyu Islands. Among these specimens, an unfamiliar *Lysmata* species was found. Independently, the first author collected two specimens of the same species during a survey on the decapod crustacean fauna of Boso Peninsula, Pacific coast of central Honshu, Japan. Moreover, we were able to obtain additional specimens of the same species from other localities on Okinawa Island. Detailed examination of these specimens revealed that the species in question differed from any previously described, both in morphology and colour in life. It is described herein as a new species under the name of *L. lipkei*.

## MATERIALS AND METHODS

All specimens of the new species were collected recently from the intertidal and sublittoral zones. Illustrations were made with the aid of a drawing tube mounted on a LEICA MZ 12 stereomicroscope. The abbreviation CL indicates the postorbital carapace length. The specimens examined here are deposited in the Coastal Branch of Natural History Museum and Institute, Chiba (CMNH), Natural History Museum and Institute, Chiba (CBM), the Zoological Collection of the Oxford University Museum of Natural History (OUMNH-ZC) and the Ryukyu University Museum, Fujukan (RUMF).

## TAXONOMIC ACCOUNT

***Lysmata lipkei* sp. nov.**

(figs. 1-4)

Material examined. — Holotype: CMNH-ZC 02380, male, 5.8 mm CL, Ubara-jima Islet, Katsuura, Boso Peninsula, Honshu, Japan, 35°07.7'N 140°16.7'E, 15 m, with SCUBA, 7 December 2001, leg. J. Okuno. Paratypes: Pacific coast of Honshu. CMNH-ZC 00660, 1 male, 5.8 mm CL, same locality as holotype, 17 m, with SCUBA, 24 October 2001, leg. J. Okuno, H. Tachikawa & K. Yanagi. Ryukyu Islands. CBM-ZC 8215, 1 hermaphrodite, 4.4 mm CL, 1 ovigerous hermaphrodite, 5.7 mm CL, Bise, Motobu Peninsula, Okinawa Island, 26°42.5'N, 127°53.0'E, intertidal, 23 March 2004, leg. T. Komai; OUMNH-ZC.2010-09-001, 1 ovigerous hermaphrodite, 5.9 mm CL, Sesoko Island, off Motobu Peninsula, Okinawa Island, 26°38.2'N, 127°52.0'E, 1-2 m, 5 September 2001, leg. G.C. Fiedler; CMNH-ZC 02376, 1 male, 5.0 mm CL & 1 ovigerous hermaphrodite, 5.6 mm CL, same locality as the OUMNH paratype, May 2003, leg. G.C. Fiedler; RUMF-ZC-1082, 1 hermaphrodite, 9.5 mm CL, submarine cave at Mizugama, Kadena, Okinawa Island, 26°21.6'N 127°44.3'E, 10 m, with SCUBA, 6 January 2005, leg. H. Onaga; RUMF-ZC-1083, 1 hermaphrodite, 5.4 mm CL, Miyagi Island, off Katsuren Peninsula, eastern coast of Okinawa Island, 26°21.9'N 127°59.6'E, intertidal, 9 January 2005, leg. M. Obuchi; RUMF-ZC-1084, 2 males, 2.2, 3.5 mm CL, 1 hermaphrodite, 2.6 mm CL & 1 ovigerous hermaphrodite, 4.9 mm CL, Aharen, Tokashiki-jima Island, Kerama Group, 26°10.2'N 127°20.5'E, 1-2 m, October 2002, leg. G.C. Fiedler.

Description. — Carapace (fig. 1A) smooth, glabrous; orbit feebly developed, inferior orbital angle bluntly triangular; antennal spine developed, supported with short carina, marginal, fused with tip of inferior orbital angle (fig. 1B); epigastric spine well developed, feebly demarcated from median carina, situated at 0.4 of the carina; pterygostomial angle with acute tooth; hepatic spine absent.

Rostrum (fig. 1C) straight, horizontal throughout the length, slightly compressed, 0.5-0.6 times as long as postorbital carapace length, reaching or slightly overreaching level of distal margin of intermediate segment of antennular peduncle; dorsal margin armed with 4-5 acute teeth, equidistantly spaced, subequal in size, 2-3 on rostrum proper, first tooth situated posterior to posterior margin of orbit, with setose interspaces; ventral margin with distinct distal blade, armed with 2-4 (usually 3) small acute teeth, all distal to level of penultimate dorsal tooth; lateral carina distinct.

Thoracic sternites narrow; eighth sternite with broad median plate armed with one pair of blunt triangular submedian teeth and each with acute terminal tooth anterolaterally (fig. 1D).

Abdomen (fig. 1E) smooth, glabrous; pleura of first to third somites rounded, posteroventral margin of fourth somite angular, blunt, fifth somite slightly

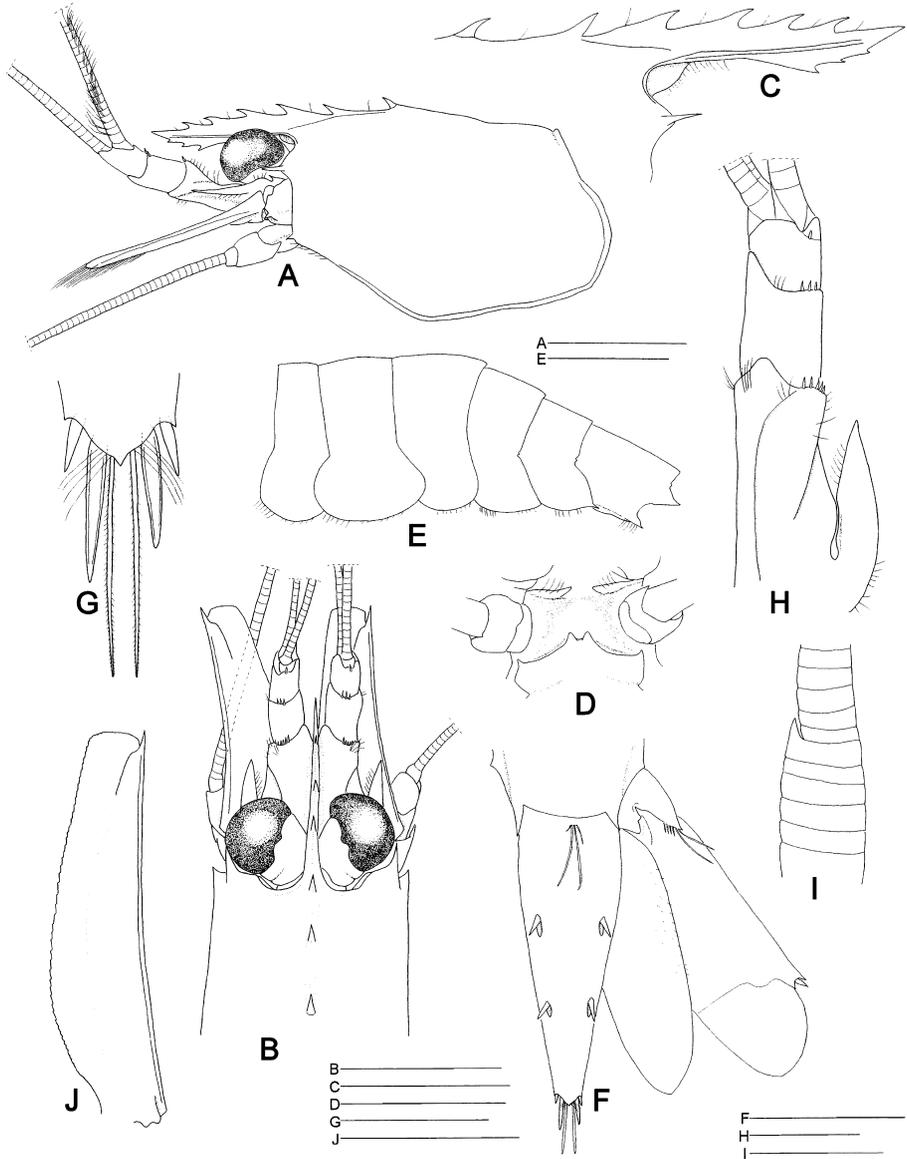


Fig. 1. *Lysmata lipkei* sp. nov. Holotype, CMNH-ZC 02380 (A-C, E-J), male paratype, CMNH-ZC 02376 (D). A, carapace and cephalic appendages, lateral; B, anterior part of carapace and cephalic appendages, dorsal; C, orbit region of carapace and rostrum, lateral; D, posterior-most of seventh thoracic sternite and anterior half of eighth sternite, ventral; E, first to sixth abdominal somites, lateral; F, telson and right uropod, dorsal; G, tip of telson, dorsal; H, right antennular peduncle, dorsal; I, accessory branch of dorsolateral flagellum of antennule, ventral; J, right scaphocerite, dorsal. B, F, marginal setae omitted; I, aesthetascs omitted. Scales: A, B, E, 3.0 mm; C, D, F, H, J, 2.0 mm; G, I, 0.5 mm.

produced posteroventrally, with acute tooth, sixth somite with acute, setose posteroventral angle and acutely produced posterolateral angle. Telson (fig. 1F) 1.4-1.9 times as long as sixth abdominal somite, lateral margins feebly convex in anterior 0.4 of length, and thereafter tapering posteriorly, posterior margin (fig. 1G) angular, with small acute median point, armed with two pairs of spines laterally, lateral-most spines small, mesial spines long, robust, with more slender and longer submedian plumose setae; dorsal surface armed with two pairs of stout spines, anterior pair at about 0.3, posterior pair at about 0.7 of telson length respectively, proximal midlength furnished with short transverse row of both short and considerably long setae.

Eye (fig. 1B) short, stout; cornea longer and broader than stalk.

Antennular peduncle (fig. 1H) with proximal segment slightly longer than distal two segments combined, tapering distally, with transverse row of 2-5 (usually 3) dorsolateral spinules on the distal margin, ventromesial carina armed with a single spine, stylocerite well developed, acute, overreaching level of midlength of proximal segment, but falling short of distal margin of the segment, mesial margin furnished with setae; intermediate segment subcylindrical, obliquely articulated with distal segment, distally with transverse row of 2-4 dorsolateral spinules; distal segment slightly shorter than intermediate segment, armed distally with a single dorsolateral spinule. Dorsolateral flagellum with short accessory branch consisting of one unguis-shaped segment (fig. 1I).

Antenna with stout basicerite, armed ventrolaterally with acute tooth (fig. 1A). Scaphocerite (fig. 1J) overreaching distal margin of antennular peduncle, 2.7-3.6 times as long as maximum width, distal blade truncate, lateral margin slightly concave, terminating in strong tooth slightly overreaching distal blade. Carpocerite reaching level of proximal fourth of length of scaphocerite (fig. 1A).

Epistome unarmed.

Mandible (fig. 2A) completely without palp and incisor process; molar process robust, subcylindrical, distally truncate, with 5 stout acute teeth dorsally. Maxillule (fig. 2B) with palp distinctly bilobed, upper lobe slender, with 3 simple long setae, lower lobe with spiniform seta with setules; upper lacinia broad, oval, mesially with numerous simple spines and dense setae marginally; lower lacinia slender, tapering, distally with long tuft of spiniform setae with setules. Maxilla (fig. 2C) with palp slender, simple, sparsely furnished with terminal long setae; distal endite deeply bilobed, both subquadrate, densely setose marginally, distal lobe broader than proximal lobe; proximal endite short, subquadrate, sparsely setose marginally; scaphognathite well developed,

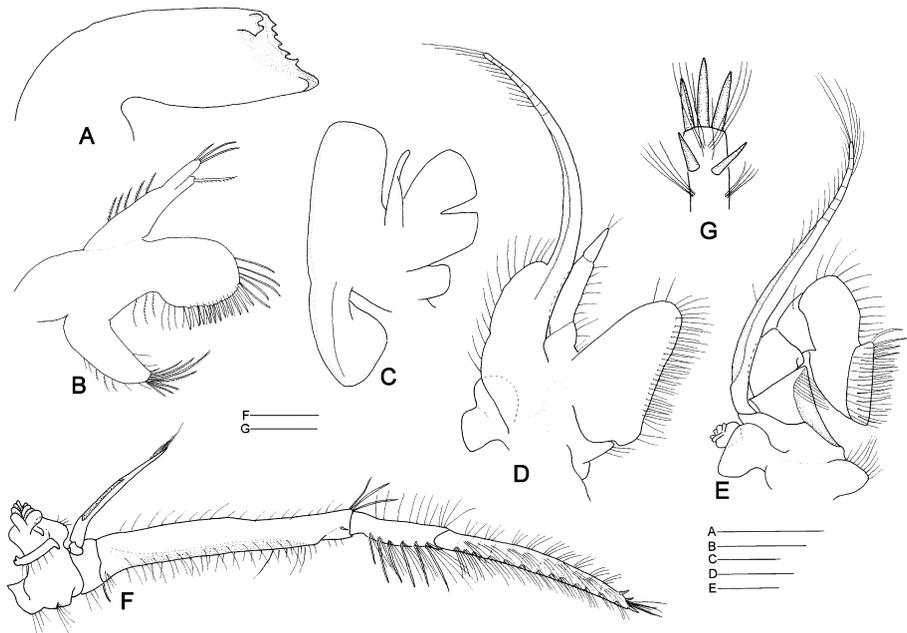


Fig. 2. *Lysmata lipkei* sp. nov. Right mouthparts. Holotype, CMNH-ZC 02380 (A, B, D-G), hermaphrodite paratype, RUMF-ZC-1083 (C). A, mandible, external; B, maxillule, external; C, maxilla, external (setae omitted); D, first maxilliped, external; E, second maxilliped, external; F, third maxilliped, lateral; G, same, tip of ultimate segment, dorsal. Scales: A-E, 0.5 mm; F, 1.0 mm; G, 0.25 mm.

densely setose marginally, anterior lobe broad, subquadrate, mesial margin of posterior lobe strongly convex. First maxilliped (fig. 2D) with elongated, three-segmented palp, distally with simple setae, overreaching distal margin of distal endite; distal endite broad, mesial margin straight, with marginal and submarginal rows of dense setae; proximal endite short, feebly bilobed; exopod with well developed flagellum, distally segmented, setose, with caridean lobe narrow; epipod small, bilobed. Second maxilliped (fig. 2E) with normal endopod; dactylus narrow, densely setose mesially; propodus elongate, distomesial margin rounded, with sparse long setae; ischium distinctly demarcated from both merus and basis, mesial surface concave; basis fused to coxa; exopod with well developed flagellum, distally segmented, setose; endopod broad, with small podobranch. Third maxilliped (fig. 2F) with slender endopod overreaching level of terminal blade of scaphocerite by midlength of ultimate segment; ultimate segment 1.8-2.6 times as long as penultimate segment, tapering distally, armed distodorsally with 5-7 strong spines (fig. 2G), medial surface with 13 transverse rows of dense setae, lateral surface furnished with dense setae;

penultimate segment with medial surface with 6 transverse rows of long setae; ischiomerus furnished medially with long setae, dorsal surface sparsely with short setae; basis demarcated from ischiomerus, medial surface sparsely with short setae; exopod slender, short, reaching level of proximal two-fifths of ischiomerus, with numerous long setae; coxa feebly produced proximomedially, with conspicuous subquadrate coxal plate, bearing epipod on lateral surface; well developed arthrobranch and small pleurobranch present.

First pereopod (fig. 3A) robust, reaching or slightly overreaching level of terminal blade of scaphocerite. Chela (fig. 3B) 1.0-1.2 times as long as carpus, with palm subcylindrical, slightly tapered proximally, 1.4-2.0 times as long as dactylus; dactylus slender, proximal narrow gap appeared when fingers closed. Carpus with oblique row of long setae distomesially (fig. 3B), ventral surface with sparse setae. Merus 1.0-1.4 times as long as carpus, obliquely articulated with ischium. Coxa robust, with epipod and setobranch furnished with several setae.

Second pereopods longest and most slender of all pereopods, considerably unequal in length. Major second pereopod (fig. 3C) overreaching level of terminal blade of scaphocerite by lengths of carpus and chela; chela (fig. 3D) with palm slightly compressed, slightly longer than dactylus; carpus elongate, 1.2-1.5 times as long as same segment of minor pereopod, composed of 27-32 segments, distal segment slightly shorter than palm; merus elongate, 1.2-1.4 times as long as same segment of minor pereopod, composed of 23-27 segments, distal segments ventrolaterally with sparse setae; ischium elongate, 1.2-1.7 times as long as same segment of minor pereopod, with segments fused or distally subdivided into 5 invisible segments, proximoventrally with hooked setae; coxa robust, with epipod and setobranch. Minor second pereopod (fig. 3E) overreaching level of terminal blade of scaphocerite by lengths of distal 0.7 of carpus and chela, more slender than major pereopod; chela similar to same segment of major pereopod in length; carpus composed of 27-33 segments; merus composed of 19-23 segments.

Third pereopod (fig. 3F) overreaching level of terminal blade of scaphocerite by lengths of dactylus, propodus and distal fourth of carpus. Dactylus (fig. 3G) biunguiculate, external unguis longer than flexor unguis, with tufts of setae on posterior to terminal margin of corpus, armed with 3 small spines on flexor margin posterior to flexor unguis, decreasing in size proximally. Propodus 1.1-1.4 times as long as carpus, with distoventral spine and 4-8 ventral spines, interspaces of distal spines subequal. Carpus unarmed, with sparse long setae. Merus 1.4-2.0 times as long as carpus, distal three fifths of

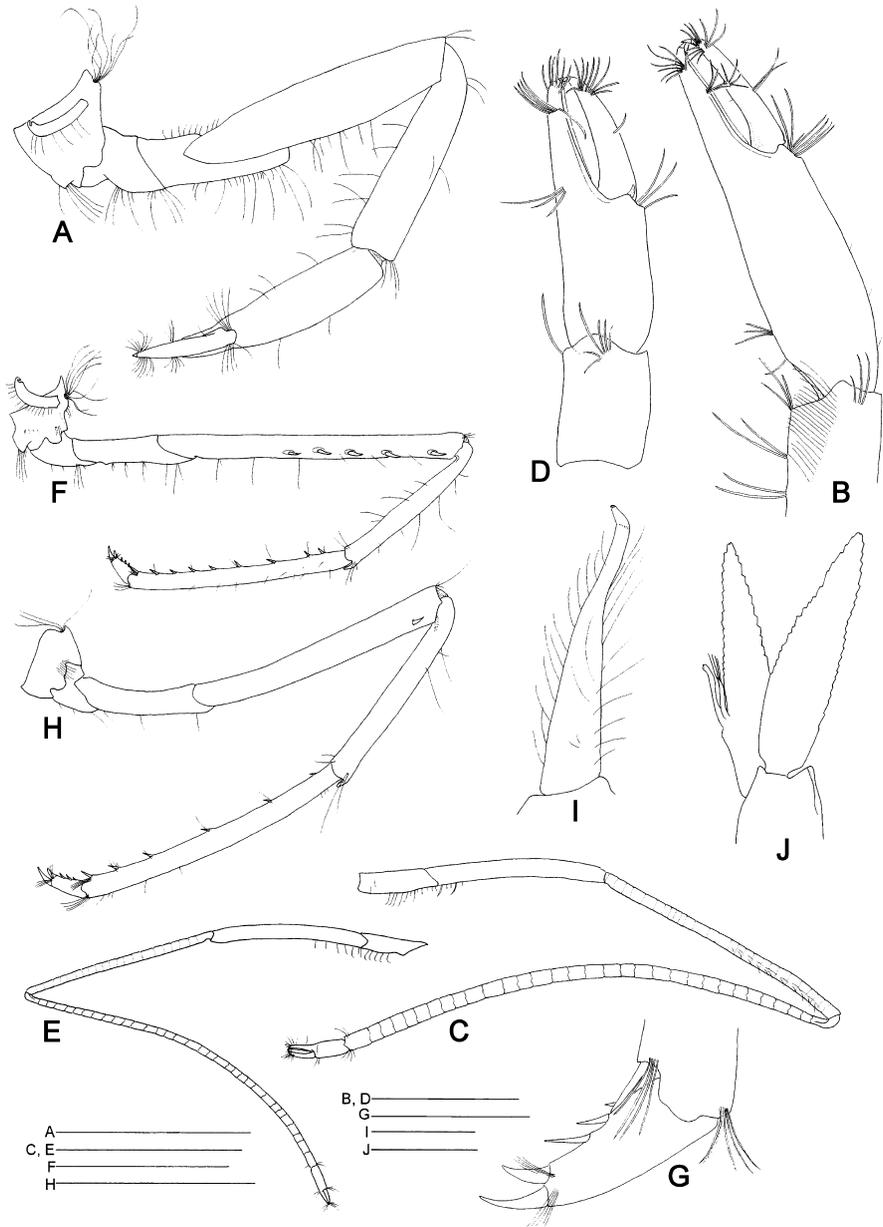


Fig. 3. *Lysmata lipkei* sp. nov. Holotype, CMNH-ZC 02380. A, right first pereiopod, lateral; B, same, chela and posterior part of carpus, mesial; C, right major second pereiopod, lateral; D, same, chela and posteriormost segment of carpus, mesial; E, left minor second pereiopod, lateral; F, right third pereiopod, lateral; G, same, dactylus, lateral; H, right fifth pereiopod, lateral; I, endopod of right first pleopod, dorsal; J, left second pleopod, dorsal (setae omitted).

Scales: A, 2.0 mm; B, J, 1.0 mm; C, E, F, H, 3.0 mm; D, G, I, 0.5 mm.

lateral surface armed with 4-7 spines, feebly widened distally. Ischium and basis unarmed, ventrally with sparse setae. Coxa robust, with epipod and seto-branch furnished with several setae. Fourth pereopod generally similar to third pereopod, overreaching level of terminal blade of scaphocerite by lengths of dactylus and distal half of propodus. Propodus with distoventral spine and 4-7 ventral spines. Merus with lateral surface armed with 2-5 spines at distal three fifths. Fifth pereopod (fig. 3H) overreaching level of terminal blade of scaphocerite by lengths of dactylus and distal fourth of propodus. Armature of dactylus similar to that of third pereopod. Propodus 1.2-1.5 times as long as carpus, with distoventral spine and 3-6 ventral spines, interspaces of spines decreasing distally. Carpus unarmed, with a few long setae. Merus 1.3-1.4 times as long as carpus, lateral surface armed with subdistal spine and 1-3 (rarely 0) lateral spines, feebly widened distally. Ischium and basis unarmed, ventrally with sparse setae. Coxa robust, with seto-branch furnished with several setae, without epipod.

Endopod of male first pleopod (fig. 3I) slender, tapering distally, distal one-eleventh sinuous, terminally with cincinnuli. Endopod of male second pleopod with both appendices interna and masculina (fig. 3J); appendix masculina shorter than appendix interna, armed with 3-4 bristle setae; appendix interna terminally with cincinnuli.

Uropod (fig. 1F) with protopodite short, posterolateral lobe acutely pointed, posterior margin furnished with long and short setae distally. Exopod reaching level of posterior end of telson, lateral margin almost straight, armed with terminal movable spine flanked both laterally and mesially by sharp tooth, diaeresis distinct. Endopod elongate, oval, slightly shorter than exopod, proximolaterally with submarginal short setae densely.

Colour in life (fig. 4). — Body and appendages generally transparent. Rostral lateral carina red. Epigastric and epicardiac regions of carapace reddish. Two red oblique bands running at hepatic and anterior branchial regions of carapace (these bands indistinct in fig. 4). Three red longitudinal bands running through posterior half of carapace to sixth abdominal somite, median band broadest, ventral most band feebly undulated. Telson and uropods marginally reddish. Antennular peduncle reddish. Third maxilliped, first and ambulatory pereopods generally reddish, dactyli of ambulatory pereopods whitish transparent. Second pereopod with scattered red small spots.

Distribution. — Known from the Boso Peninsula, Pacific coast of central Honshu and Okinawa Island and the Kerama Group, Ryukyu Islands, Japan.

Etymology. — The species epithet *lipkei* is named in honor of the late Dr. Lipke B. Holthuis (1921-2008), whose great number of contributions on

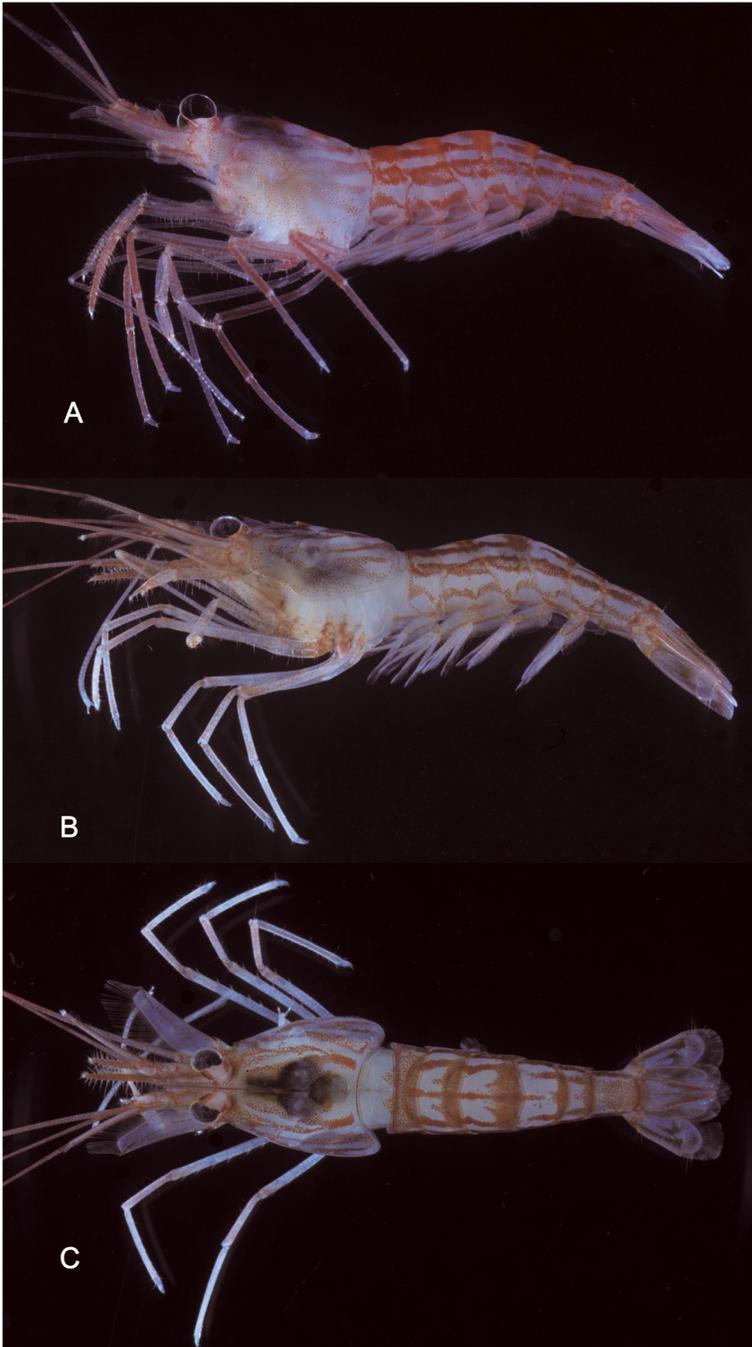


Fig. 4. *Lysmata lipkei* sp. nov. Fresh condition. Holotype, CMNH-ZC 02380 (A), male paratype, CMNH-ZC 00660 (B, C). A, B, lateral view; C, dorsal view. Photos taken by J. Okuno.

shrimp taxonomy have profoundly influenced us, as well as several generations of carcinologists. His masterful reviews of all caridean genera (Holthuis, 1955, 1993) and his landmark revisions of the Siboga material, including Hippolytidae (Holthuis, 1947), will remain as a testimony to his great skills as a taxonomist.

Common name. — Komorebi-aka-moebi (new Japanese name).

Ecological notes. — The holotype and one of the paratypes from Katsuura, Boso Peninsula occurred in small crevices at a depth of 15 m. Several specimens of the rhynchocinetid shrimp, *Rhynchocinetes uritai* Kubo, 1942 were collected together with the new species. In the Ryukyu Islands, the new species was found under large flat coral rocks at the depths of 1-5 m.

## DISCUSSION

Morphologically, *Lysmata lipkei* appears closest to *L. dispar* Hayashi, 2007, known only from the Dampier Archipelago, Western Australia. These two species share the following features: rostrum armed with more than two ventral teeth; carapace with pterygostomial angle armed with an acute tooth, and inferior orbital angle fused with antennal spine; stylocerite overreaching midlength of proximal segment of the antennular peduncle, but falling slightly short of the distal end of the segment; one-segmented and unguis-shaped accessory branch on dorsolateral flagellum of the antennule; cutting edges of closed fingers of first pereopod with proximal narrow gap; second pereopods considerably unequal in length, with carpi subdivided into more than 24 articles, and with a multi-articulated merus; meri of ambulatory pereopods armed with single row of spines; dactyli of ambulatory pereopods armed with accessory spines on flexor margin.

Although both species have several morphological features in common, *Lysmata lipkei* can be clearly distinguished from *L. dispar*, on account of the length and form of the rostrum, armature of the antennular peduncle, and articulation of the ischium of the second pereopod. The rostrum of *L. lipkei* reaches the distal margin of the intermediate segment of the antennular peduncle (fig. 1A, B), and its dorsal margin is horizontal (fig. 1C). Whereas in *L. dispar*, the rostrum reaches to the distal margin of the proximal segment of the peduncle, and its dorsal margin is slightly convex. The length of the rostrum is intraspecifically variable in some congeneric species (Rhyne & Lin, 2006). In the case of *L. lipkei*, however, it is constant within the examined individuals. Therefore, we considered this as one of the key morphological

features in distinguishing *L. lipkei* from *L. dispar*. The distal segment of the antennular peduncle is armed with a dorsolateral spinule in *L. lipkei* (fig. 1H), in contrast, *L. dispar* does not have such a spinule on the distal segment of the antennular peduncle. The ischia of the second pereopods in *L. lipkei* are distally subdivided into five hardly visible segments (fig. 3C, E), instead of the distinct ischial segments in *L. dispar*.

*Lysmata lipkei* is the seventh species of the genus from the Japanese waters. The six species previously known from Japan are: *L. amboinensis* (De Man, 1888); *L. kuekenthali* (De Man, 1902); *L. ternatensis* De Man, 1902 [as *L. dentata* (De Haan, 1844)]; *L. trisetacea* (Heller, 1861); *L. vittata* (Stimpson, 1860), and *L. zacaе* Armstrong, 1941 (see Hayashi, 1994; Okuno, 1996). Among them, *L. lipkei* is closely related to *L. kuekenthali* on account of the unguis-shaped short accessory branch of the dorsolateral antennular flagellum. The latter species was originally described by De Man (1902) from Indonesia, and is known from various localities in the Indo-West Pacific (Chace, 1997). *Lysmata lipkei* is clearly distinguishable from *L. kuekenthali*, by the distinctly unequal second pereopods and the pterygostomial angle armed with an acute tooth. In *L. kuekenthali*, the second pereopods are subequal in length, and the pterygostomial angle is unarmed or armed with a blunt tooth (Kubo, 1951). *Hippolysmata marleyi* Stebbing, 1919, from Natal, Indian Ocean coast of South Africa, is currently considered as a junior synonym of *L. kuekenthali* (see Holthuis, 1947; Chace, 1997). Stebbing (1919) described the pterygostomial angle of *H. marleyi* as “the antero-lateral angle is rounded, without denticle”. Therefore, *L. lipkei* should be regarded as a different taxon from *H. marleyi*.

#### ACKNOWLEDGEMENTS

We are grateful to Mr. Masayuki Kurihara, a skilled fisherman from Ubara, Katsuura, and colleagues of JO, Mr. Hiroyuki Tachikawa and Dr. Kensuke Yanagi, for their assistance in collecting *L. lipkei* specimens along the Boso Peninsula. Our thanks go to Dr. Tomoyuki Komai of the Natural History museum and Institute, Chiba, Dr. Masami Obuchi of the Rising Star Program, University of the Ryukyus, and Mr. Hitoshi Onaga of “Nature Works”, Yomitan, Okinawa, for providing additional specimens of the new species from Okinawa Island. Our cordial thanks are extended to Dr. J. Antonio Baeza of the Smithsonian Tropical Research Institute, and an anonymous reviewer for their valuable comments to improve the manuscript.

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