A review of the crangonid genus *Lissosabinea* Christoffersen, 1988 (Crustacea, Decapoda, Caridea), with descriptions of three new species from the western Pacific

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ABSTRACT
The crangonid genus *Lissosabinea* Christoffersen, 1988 was established to accommodate two rare deep-water species: *Sabinea indica* De Man, 1918 and *S. tridentata* Pequegnat, 1970 (type species). A study of collections made by French expeditions to the western Pacific, supplemented by material from other sources (including types of both known species), has led to a review of the genus. This study shows that the hypothesis placing *Lissosabinea* as a sister group of a clade containing three genera: *Vercoia*, *Prionocrangon* and *Paracrangon*, was derived from an insufficient character analysis. *Lissosabinea* appears most closely related to *Sabinea*, as suggested by the original generic assignment of the two known species. *Lissosabinea* maintains full generic status, as the species referred to the genus are clearly differentiated from the three species assigned to *Sabinea* by a number of morphological characters. Three new species of *Lissosabinea* are described: *L. armata* n. sp. from New Caledonia; *L. ecarina* n. sp. from the Philippines and Indonesia; and *L. unispinosa* n. sp. from New Caledonia and Tonga. The two known species are redescribed, and *L. indica* is newly recorded from New Caledonia. The bathymetric and geographic ranges of the species are briefly discussed. A key to the identification of the species of the genus is presented.

KEY WORDS
Crustacea,
Decapoda,
Caridea,
Crangonidae,
Lissosabinea,
review,
new species.

RÉSUMÉ
Révision du genre de Crangonidae Lissosabinea *Christoffersen, 1988 (Crustacea, Decapoda, Caridea) et description de trois espèces nouvelles du Pacifique occidental.*
Le genre de Crangonidae *Lissosabinea* Christoffersen, 1988 a été établi pour deux espèces rares d'eau profonde : *Sabinea indica* De Man, 1918 et *S. tridentata* Pequegnat, 1970 (espèce type). Une étude du matériel récolté par les campagnes françaises, auquel a été ajouté du matériel d'autres provenances (incluant les spécimens types des deux espèces connues), a mené à une révision du genre. Cette étude montre que l'hypothèse selon laquelle *Lissosabinea* serait le groupe-frère d'un clade contenant trois genres, *Vercoia*, *Prionocrangon* et *Paracrangon*, découlait d'une analyse de caractères insuffisante. *Lissosabinea* apparaît comme le plus proche de *Sabinea*, comme suggéré par le placement générique original des deux espèces connues. *Lissosabinea* conserve son statut générique du fait que les espèces qui lui sont attribuées sont clairement différentes des trois espèces assignées à *Sabinea* par de nombreux caractères morphologiques. Trois nouvelles espèces de *Lissosabinea* sont décrites : *L. armata* n. sp. de Nouvelle-Calédonie ; *L. ecarina* n. sp. des Philippines et d'Indonésie ; et *L. unispinosa* n. sp. de Nouvelle-Calédonie et Tonga. Les deux espèces connues sont redécrites et *L. indica* est mentionnée de Nouvelle-Calédonie pour la première fois. Les répartitions bathymétriques et géographiques des espèces sont brièvement discutées. Une clé d'identification des espèces du genre est présentée.

MOTS CLÉS
Crustacea,
Decapoda,
Caridea,
Crangonidae,
Lissosabinea,
révision,
espèces nouvelles.

INTRODUCTION

The deep-water crangonid shrimp genus *Lissosabinea* Christoffersen, 1988 was previously represented by two rare species formerly assigned to *Sabinea* Ross, 1835: *L. indica* (De Man, 1918), known from the western Pacific (De Man 1918, 1920; Chace 1984; Takeda & Hanamura 1994; Kim & Natsukari 2000), and *L. tridentata* (Pequegnat, 1970) previously recorded from the Gulf of Mexico and the southwestern Atlantic off Uruguay (Pequegnat 1970; Dardeau & Heard 1983; Christoffersen 1988; Spivak 1997). These shrimps inhabit soft bottoms of the upper bathyal zone. Major diagnostic characters of the genus include the possession of one pair of lateral teeth on the rostrum, lack of conspicuous lateral carinae on the carapace, a hump-backed abdomen lacking distinct middorsal carinae on first, second, fourth and fifth somites, and a short, nonchelate second pereopod (Holthuis 1993). Based on a cladistic analysis of morphological characters, Christoffersen (1988) hypothesized that *Lissosabinea* was not closely related to *Sabinea*, but showed it to be a sister group to a clade containing three genera, *Paracrangon* Dana, 1852, *Vercoia* Baker, 1904 and *Prionocrangon* Wood-Mason & Alcock, 1891.

A study of the collections made by French expeditions to the Indo-Pacific oceans and supplemental material from other sources allowed the author to review this rare genus. Two known species are redescribed, and three new species are described from the western Pacific, one of them previously confounded with *L. indica*. It has been found that the original definition of the genus proposed by Christoffersen (1988) was derived from an insufficient character analysis, and therefore an emended generic diagnosis and expanded general description of the genus are given.

MATERIAL AND METHODS

Material for this study was collected during various French expeditions in the southwestern Pacific: KARUBAR (Crosnier *et al.* 1997); MUS-

ORSTOM 4-6, BIOCAL (Richer de Forges 1990); CORAIL (Richer de Forges *et al.* 1988); BATHUS 3 and 4 (Richer de Forges & Chevillon 1996); BORDAU 2 (cruise report not published to date, but list of stations is available at http://www.tropicaldeepseabenthos.org).

For comparison, the following specimens were examined:
– *Sabinea sarsii* Smith, 1879: Davis Strait, W of Greenland, 68°25.8'N, 57°21.0'W, 361-362 m, 22.VIII.1991, otter trawl, coll. H. Endo, 2 ♀♀ cl 14.8, 16.0 mm (CBM-ZC 354);
– *Sabinea hystrix* (A. Milne-Edwards, 1881): Baffin Bay, 69°19.2'N, 55°11.2'W, 1040 m, otter trawl, coll. T. Goto, 1 ♂ cl 24.4 mm (CBM-ZC 724).

Postorbital carapace length (cl) represents specimen size, measured from the posterior margin of the orbit to the midpoint of the posterior margin of the carapace. The first middorsal tooth on the carapace, situated on the gastric region, is referred to "epigastric tooth".

ABBREVIATIONS

CBM	Natural History Museum and Institute, Chiba;
MNHN	Muséum national d'Histoire naturelle, Paris;
USNM	National Museum of Natural History, Smithsonian Institution, Washington, DC;
ZMUA	Zoological Museum, University of Amsterdam;
stn	station.

SYSTEMATICS

Family CRANGONIDAE Haworth, 1825

Genus *Lissosabinea* Christoffersen, 1988

Sabinea – Pequegnat 1970: 115 (part).

Lissosabinea Christoffersen, 1988: 46, 48. — Holthuis 1993: 290.

TYPE SPECIES. — *Sabinea tridentata* Pequegnat, 1970. Original designation.

OTHER SPECIES INCLUDED. — *Lissosabinea indica* (De Man, 1918), *L. armata* n. sp., *L. ecarina* n. sp. and *L. unispinosa* n. sp.

DIAGNOSIS. — Body moderately robust; integument not particularly firm; small scales present on carapace, telson, antennae and pereopods. Cephalothorax subcylindrical or slightly compressed laterally. Rostrum variable in shape, but always with one pair of distinct lateral teeth. Carapace with low, usually indistinct epibranchial carina, but other lateral carinae absent; epigastric tooth always present; antennal tooth sharp; branchiostegal tooth moderately small to large; tiny pterygostomian tooth usually present; hepatic tooth always present. Abdomen more or less hump-backed, as tergum of third somite slightly to strongly elevated. First and fourth to sixth abdominal somites smooth on dorsal surface; third somite with tergal surface elevated in posterior part or bearing median carina. Eye with well developed cornea; eye-stalk without dorsal tubercle. Antennal scale with conspicuous distolateral tooth distinctly overreaching distal margin of blade. First pereopod without exopod; merus with lamelliform carina on proximal half of ventral surface. Second pereopod very short, simple, not chelate, not reaching midlength of merus of first pereopod. Two arthrobranchs present above third maxilliped.

DISTRIBUTION. — Tropical to warm temperate waters in the western Pacific and western Atlantic; upper bathyal, 146-830 m.

GENERAL DESCRIPTION

Body moderately robust for crangonids. Integument of body not particularly firm; tegumental scales present on carapace, telson, antennae and pereopods.

Rostrum variable in shape, but armed with one pair of small to large lateral teeth. Carapace always longer than wide postorbitally, subcylindrical or slightly compressed laterally; surface with paired longish plumose setae particularly on dorsal side; middorsal line distinctly carinate at least in anterior half, bearing one to three teeth including epigastric tooth; orbital margin evenly concave, without cleft; anterolateral margin terraced anteriorly, armed with sharp antennal tooth, small to large branchiostegal tooth and tiny pterygostomian tooth; lateral surface of carapace always with hepatic tooth accompanied by shallow hepatic groove and occasionally with posthepatic tooth; postorbital carina absent; epibranchial carina usually low, inconspicuous; longitudinal suture absent.

Thoracic sternum widened posteriorly, fourth sternal plate with elongate median spur arising from anterior margin and reaching to midlength

of basis of first pereopod; in males and non-spawning females sternal plates on fifth to eighth thoracic somites slightly elevated in midline, each with sharp median tooth, size of median teeth decreasing in size posteriorly (Fig. 2G); in spawning females thoracic sternum nearly flat or concave, median teeth on fifth and sixth somites completely absent (*L. ecarina* n. sp., *L. indica*, *L. tridentata* and *L. unispinosa* n. sp.) or only that on sixth somite absent (*L. armata* n. sp.).

Abdomen more or less gibbous, with first, fourth, fifth and sixth somites rounded or faintly sulcate on dorsal surface; second somite without distinct middorsal carina, but occasionally with low, flat triangular plateau lined by row of longish plumose setae; third somite with weakly to strongly elevated, occasionally sharply carinated tergum. Pleura of anterior fifth somites broadly rounded. Sixth somite with posterolateral process sharply pointed; posteroventral angle blunt; ventral surface rounded in anterior part, shallowly convex in posterior part. Telson slender, tapering posteriorly, armed with two pairs of tiny dorsolateral spines on posterior half; dorsal surface shallowly sulcate medially in anterior half; posterior margin with one lateral pair of spinules and two pairs of long spines, flanking posteromedian projection.

Abdominal sternum flattened on anterior three somites, fourth and fifth somites each with low, blunt median carina.

Cornea distinctly wider than eye-stalk, well faceted.

Antennular peduncle not reaching midlength of antennal scale. First segment longer than distal two segments combined, dorsal surface excavated to receive eyes; ventral surface bluntly ridged, with distinct spine arising from midlength of first segment; stylocerite well developed, sharp. Second segment slightly longer than wide, subcylindrical. Third segment shorter than second segment. Flagella sexually dimorphic as in other crangonids, lateral flagellum much stouter and longer and bearing much more numerous aesthetascs in males than in females.

Antenna with second segment (= basicerite) stout, always with spine at ventrolateral distal angle; fifth segment (= carpocerite) subcylindrical. Antennal scale wel developed, exceeding half length of carapace, bearing distinct distolateral tooth distinctly overreaching rounded or truncate distal margin of blade; dorsal surface with short, oblique median ridge extending from base of antennal scale.

Mouthparts typical of family. Mandible (Fig. 15A) slender, divided distally in two principal teeth, margins of principal teeth each with one small accessory tooth. Maxillule (Fig. 15B) with small, narrowly subovate coxal endite bearing some long setae distally; basial endite notably curved mesially, with six to eight long spines arranged in double row on truncate mesial margin; palp directed laterally, slightly curved distally, bearing one setae terminally. Maxilla (Fig. 15C) with coxal and basial endites strongly reduced, each represented by very narrow convexity; palp relatively slender, tapering distally, weakly curved mesially; scaphognathite broad, anterior lobe rounded, posterior lobe also rounded, fringed with moderately long setae. First maxilliped (Fig. 15D) with endites poorly developed, with few unequal setae; endopod slender, not reaching distal margin of exopod, with row of sparse setae on mesial margin; exopod with narrow caridean lobe, and with well developed flagellum; epipod large, subtriangular, faintly bilobed. Second maxilliped (Fig. 15E) with endopod composed of seven segments, but basis and ischium partially fused; dactylus small, obliquely articulated to propodus, armed with two long spines and numerous setae of various length; propodus elongate, with row of bristle-like long setae on mesial margin; exopod far overreaching carpus of flexed endopod, bearing well developed flagellum; epipod rounded, lacking podobranch.

Third maxilliped apparently composed of four segments. Distal two segments narrow, but somewhat flattened dorsoventrally; ultimate segment tapering distally to blunt tip, with numerous setae on lateral and mesial margins; carpus (= penultimate segment) also with long setae on lateral and mesial margins. Antepenultimate segment (merus-ischium-basis fused segment) subequal in length to distal two segments combined, slightly sinuous in dorsal view, dorsally curved in lateral view, with two or three subdistal spinules on ventral surface. Coxa with rounded lateral process presumably originated from epipod; dorsodistal, lateral and

mesial margins of antepenultimate segment with numerous long plumose setae; exopod reaching midlength of antepenultimate segment, bearing well developed flagellum.

First pereopod overreaching antennal scale. Palm somewhat depressed dorsoventrally, distomesial spine (= thumb) always fixed, cutting edge more or less oblique, bearing submarginal row of sinuously curved setae on both dorsal and ventral surfaces. Carpus armed with two spines on distolateral margin. Merus with sharply carinate dorsal margin terminating in strong dorsodistal spine; ventral surface with sharp, occasionally lamelliform carina in proximal half, terminating distally in blunt or sharp spine. Exopod absent.

Second pereopod simple, short, reaching midlength of merus of first pereopod. Dactylus less than half of propodus length, with three or four long spiniform bristles distally; propodus shorter than carpus, with one or two long bristles on dorsal and ventral margins and two long bristles on each distal angle; carpus somewhat broadened distally. Merus slightly longer than ischium, and subequal in length to distal three segments combined. Ischium not strongly curved inward, with row of long setae on ventral margin. Basis setose on ventral margin. Coxa devoid of lateral process.

Third pereopod very slender, distinctly overreaching antennal scale. Dactylus needle-like, exceeding half-length of propodus, apparently lacking terminal tuft of setae. Propodus tapering distally. Carpus distinctly longer than distal two segments combined. Merus much shorter than carpus. Ischium distinctly longer than merus. Coxa without lateral process.

Fourth and fifth pereopods similar; propodi each with setal tuft dorsodistally; carpi shorter than propodi, each with small dorsodistal projection; meri longer than ischia.

Branchial formula summarized in Table 1. Two greatly unequal arthrobranchs above third maxilliped (dorsal gill much smaller than ventral gill, hidden by latter). One pleurobranch on each fourth to eighth thoracic somites; ventral apices of gills directed backwards.

Male first pleopod with endopod about 0.60 times as long as exopod, broad, strongly sinuous, terminating in triangular lobe bearing row of cincinnuli on distomesial margin; female first pleopod with spatuliform endopod. Male second pleopod with appendix masculina moderately stout, distinctly longer than appendix interna. Appendices internae on second to fifth pleopods well developed in both male and female, not tapering distally, each with cluster of cincinnuli at distomesial portion. Protopods of first to fifth pleopods distally widened in females, not widened in males; rami broad, foliaceus in females, moderately narrow in males. Uropod (Fig. 2H) with endopod narrower than exopod; endopod with shallow depression bearing setae on dorsal surface proximally; exopod not reaching endopod, lateral margin nearly straight, terminating in small tooth; terminal margin of exopod rounded or subtruncate; no diaeresis on exopod; protopod with small posterolateral tooth.

Eggs large, measuring about 1.3-1.7 × 1.2-1.4 mm, few in number.

TABLE 1. — Branchial formula of *Lissosabinea* Christoffersen, 1988. Abbreviation: **r**, rudimentary.

Thoracic somites	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Appendages	**Maxillipeds**			**Pereopods**				
	1	**2**	**3**	**1**	**2**	**3**	**4**	**5**
Pleurobranch	–	–	–	+	+	+	+	+
Arthrobranch	–	–	2	–	–	–	–	–
Podobranch	–	+	–	–	–	–	–	–
Epipod	+	+	r	–	–	–	–	–
Exopod	+	+	+	–	–	–	–	–

REMARKS

Christoffersen (1988) investigated the phylogenetic relationships among the genera of the Crangonidae based on morphological characters using parsimony analysis. He hypothesized that the sister group of *Lissosabinea* was a clade composed of *Paracrangon* + *Vercoia* + *Prionocrangon*, and these four genera were assigned to a new subfamily Paracrangoninae Christoffersen, 1988. This hypothesis is derived from the shared apomorphies, including the trend toward reduction and loss of arthrobranchs on the third maxilliped (at a node of Philochelinae + Pontophilinae + Paracrangoninae + Crangoninae) and the simple second pereopod (at a node of

Paracrangoninae) (Christoffersen 1988). Christoffersen's (1988) cladogram indicates that *Lissosabinea* possesses only a single arthrobranch on the third maxilliped. Furthermore, he clearly mentioned that there was only a single arthrobranch on the third maxilliped in the specimens he referred to *L.* cf. *tridentata* from off Uruguay. However, it has been found that the species of *Lissosabinea* all possess two arthrobranchs on the third maxilliped, a character state shared with *Aegaeon* Agassiz, 1846, *Parapontocaris* Alcock, 1901, *Pontocaris* Bate, 1888 and *Sabinea* Ross, 1835. According to Christoffersen (1988: 54), his specimens of *L.* cf. *tridentata* were different from the descriptions of *L. tridentata* given by Pequegnat (1970) and Dardeau & Hard (1983) (as *Sabinea*) in the presence of two submedian carinae on the sixth abdominal somite, each bearing a small submarginal denticulation on the posterior third. It has been confirmed that the sixth abdominal somite of *L. tridentata* is only faintly sulcate medially, lacking submedian carinae or denticulation. Since the specimens used by Christoffersen were in poor condition (Christoffersen 1988), it is reasonable to consider that his identification was wrong. It seems that Christoffersen (1988) did not actually examine specimens of *L. indica*. Komai (1995) questioned the homology of the simple, non-chelate second pereopod found in *Lissosabinea*, *Sabinea*, *Vercoia* and *Prionocrangon*, because of the great structural differences observed among them, suggesting a different origin of the non-chelate condition. The non-chelate second pereopod accompanied by a great reduction of its size is found only in *Lissosabinea* and *Sabinea* within the Crangonidae. Furthermore, one more plesiomorphy, the lack of elongate setae on the posterior lobe of the scaphognathite, also excludes *Lissosabinea* from the clade composed of Philochelinae + Pontophilinae + Paracrangoninae + Crangoninae (Christoffersen 1988: fig. 1; Komai unpubl. data). This plesiomorphic character is also seen in *Aegaeon*, *Pontocaris*, *Parapontocaris* and *Sabinea*. The sister group of *Lissosabinea* is thus most probably *Sabinea*, as the reduced, non-chelate second pereopod links the two genera. Although the original definition of *Lissosabinea* was based on an insufficient character analysis and a possible misidentification of material, full generic status for *Lissosabinea* is maintained because of the large morphological gap between the species assigned to *Sabinea* s.s. and those assigned to *Lissosabinea*, as discussed below.

One of the features that distinguish *Lissosabinea* from *Sabinea* is the absence of strongly denticulate lateral carinae on the carapace. All three species of *Sabinea* have three pairs of strongly denticulate carinae on the carapace. The abdomen of *Lissosabinea* is dorsally rounded except for a more or less gibbous third somite, while that of *Sabinea* is provided with sharp median or submedian carinae on the first to sixth somites. The posterior margin of the orbit is smooth in *Lissosabinea*, instead of having a distinct cleft as in *Sabinea*. Furthermore, the armature of the second pereopod is characteristic and constant in species of *Lissosabinea* (see above). In contrast, in the species of *Sabinea*, the propodus and dactylus of the second pereopod have only scattered setae. Other characters shared by all species of *Lissosabinea* include: rostrum is armed with a pair of conspicuous lateral teeth; lateral carinae on the carapace are poorly developed, only a rather inconspicuous epibranchial carina is recognizable; and the merus of the first pereopod is provided with a distinct, occasionally lamelliform ventral carina in the proximal half, which terminates in an acute or blunt tooth. Of the characters enumerated above, at least the more or less gibbous third abdominal somite and the distinct ventral carina are apomorphic, suggesting monophyly of *Lissosabinea*.

This study demonstrates that the species of *Lissosabinea* all have tegumental scales on their carapace, telson, antennae and/or pereopods. The presence of tegumental scales is well known in species of the Oplophoridae and Pandalidae within the Caridea (Mauchline *et al.* 1977; Chace 1985). In Crangonidae, however, the possession of the tegumental scales has only been recently documented for two species of *Aegaeon*, *A. lacazei* (Gourret, 1887) and *A. rathbuni* (De Man, 1918) (see Komai 2000), and *Pseudopontophilus serratus* Komai, 2004. Komai (2000) suggested a possibility that the presence or absence of the tegumental scales is indicative of presumed phylogenetic relationships among the crangonid genera, but later Komai (2004) sug-

gested that the presence of the tegumental scales was homoplastic because of the character incongruence observed among the genera. As noted above, a sister relation between *Lissosabinea* and *Sabinea* is suggested in this study, but species of *Sabinea* do not have tegumental scales. Further *Aegaeon* shares only plesiomorphic characters with *Lissosabinea* but not the possession of the tegumental scales (Christoffersen 1988; Chan 1996; pers. obs.).

No information on larval development is available for the species of *Lissosabinea*. Nevertheless, because of the large and few eggs, it can be assumed that the larval development of *Lissosabinea* species is highly abbreviated.

KEY TO SPECIES OF *LISSOSABINEA* CHRISTOFFERSEN, 1988

1. Carapace with only one tooth (epigastric tooth) on dorsal midline ... *L. unispinosa* n. sp.
— Carapace with two or three teeth on dorsal midline 2

2. Carapace with two teeth on dorsal midline and one or two posthepatic teeth 3
— Carapace with three teeth on dorsal midline, but without posthepatic tooth 4

3. Third abdominal somite with distinct median carina; dactylus of fourth pereopod less than half of propodus in length ..... *L. indica*
— Third abdominal somite weakly elevated medially, but without distinctly delineated median carina; dactylus of fourth pereopod more than half of propodus in length .... *L. ecarina* n. sp.

4. Carapace with small median teeth, epigastric tooth not reaching base of rostrum; epibranchial tooth present; median carina on third abdominal somite not extremely high; fourth and fifth pereopods slender ..... *L. tridentata*
— Carapace with large median spines, epigastric tooth overreaching base of rostrum; epibranchial tooth absent; median carina on third abdominal somite extremely high; fourth and fifth pereopods very stout ..... *L. armata* n. sp.

Lissosabinea indica (De Man, 1918) (Figs 1-4)

Sabinea indica De Man, 1918: 304 (type locality: N of Tanah Djampeah Island, Indonesia); 1920: 303, pl. 25, fig. 75, 75a-l. — Chace 1984: 59 (in part). — Takeda & Hanamura 1994: 30.

Lissosabinea indica – Christoffersen 1988: 48. — Kim & Natsukari 2000: 35, fig. 1a, b.

HOLOTYPE. — *Siboga*, stn 65a, N of Tanah Djampeah Island, Indonesia, 07°00'S, 120°34.5'E, 400 m, 6.V.1899, ♀ cl 8.9 mm (ZMUA).

OTHER MATERIAL EXAMINED. — **Japan.** RV *Seiyo-maru*, 1994 cruise, stn S2, off Izu-Oshima Island, Izu Islands, 34°34.6'N, 139°19.9'E, 280 m, sledge net, 15.X.1994, 1 ♂ cl 6.3 mm (CBM-ZC 7801).
Indonesia. *Albatross*, stn 5621, W of Halmahera, 00°15.00'N, 127°24.35'E, 545 m, 28.XI.1909, 1 ovigerous ♀ 9.1 mm (USNM 205087).
KARUBAR, stn CP 17, Banda Sea, 05°15'S, 133°01'E, 459-439 m, 24.X.1991, 1 ♀ 9.0 mm (MNHN-Na 15152).
Chesterfield Islands. CORAIL 2, stn DE 15, 20°50.69'S, 160°55.25'E, 21.VII.1988, 1 ♀ cl 7.0 mm (MNHN-Na 15153).
New Caledonia. MUSORSTOM 5, stn DW 306, 22°07.66'S, 159°21.40'E, 375-415 m, 12.X.1986, 1 ♀ cl 5.0 mm (MNHN-Na 15154); stn CP 363, 19°47.90'S, 158°44.30'E, 700-685 m, 19.X.1986, 1 ♂ cl 7.0 mm (MNHN-Na 15155).

DISTRIBUTION. — Japan, Indonesia, Coral Sea and New Caledonia; 146-700 m.

SIZE. — Females cl 5.0-9.1 mm; ovigerous females cl 9.1 mm; males cl 6.3-7.0 mm.

DESCRIPTION

Rostrum (Figs 1; 2A, B) strongly laterally compressed in distal half, styliform with relatively shallow ventral blade, nearly straight or somewhat upturned, overreaching distal margin of second segment of antennular peduncle, but not reaching distal margin of third segment; dorsal surface

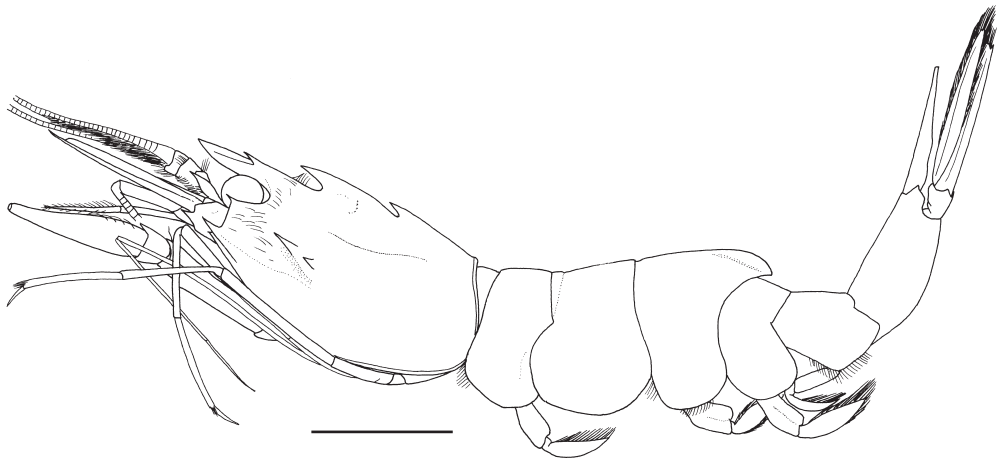

FIG. 1. — *Lissosabinea indica* (De Man, 1918), entire animal in lateral view, New Caledonia, MUSORSTOM 5, stn CP 363, ♂ cl 7.0 mm (MNHN-Na 15155). Scale bar: 5 mm.

weakly ridged on midline, with scattered short to long setae in proximal 0.70, extending onto anterior part of carapace; lateral tooth strong, arising from 0.40-0.50 of rostrum; lateral face slightly concave at base, with sharp lateral carina extending to distal 0.20 of rostral length; ventral margin convex, unarmed but bearing two rows of short setae.

Carapace (Figs 1; 2A, B) 1.20-1.25 times as long as wide. Middorsal carina sharp, extending to 0.80-0.90 of carapace length, armed with two relatively large teeth; epigastric tooth not reaching base of rostrum, arising at 0.20 of carapace length; second tooth smaller than epigastric tooth, arising at 0.60 of carapace length. Antennal tooth moderately small, not reaching anterior margin of cornea of eye. Branchiostegal tooth directed forward, slightly falling short of or reaching anterior margin of antennal basicerite. Pterygostomian tooth tiny. Lateral face of carapace with relatively large hepatic and small post-hepatic teeth, but epibranchial tooth absent; post-hepatic tooth aligned with hepatic tooth; epibranchial carina obsolete.

Sternal tooth on fifth thoracic somite absent in spawning females.

Second abdominal somite with low, triangular plateau on posterior half of tergum delimited by row of long setae in females (Fig. 2C), smooth in males (Fig. 1). Third somite (Figs 1; 2C) with distinct middorsal carina extending anteriorly to midlength, remainder rounded; posterodorsal margin of somite somewhat produced posteriorly. Sixth somite (Figs 1; 2C) about 1.8 times as long as high; dorsal surface flattened on midline. Telson (Fig. 2D, E) with two pairs of minute dorsolateral spines; two mesial spines at posterolateral angle long, very slender; terminal process acutely pointed.

Cornea of eye (Fig. 2A, B) spherical, maximum diameter 0.20-0.22 of carapace length.

Antennular peduncle (Figs 2A, B; 4A) reaching 0.30-0.35 of antennal scale; stylocerite slightly overreaching distal margin of first segment, strongly compressed laterally; lateral flagellum composed of about 15 articles in females; mesial flagellum composed of about 13 articles in females; flagella of males not intact, but both composed at least of more than 20 articles. Antennal scale (Fig. 2A, F) about 0.70-0.75 of carapace length and 2.8 times as long as wide, lateral margin faintly sinuous, distal blade obliquely truncate; basicerite (Fig. 2A, B) with relatively large ventrolateral spine; carpocerite reaching midlength of antennal scale.

Third maxilliped (Fig. 3A) overreaching antennal scale by 0.20-0.30 length of ultimate segment; ultimate segment subequal in length to penultimate

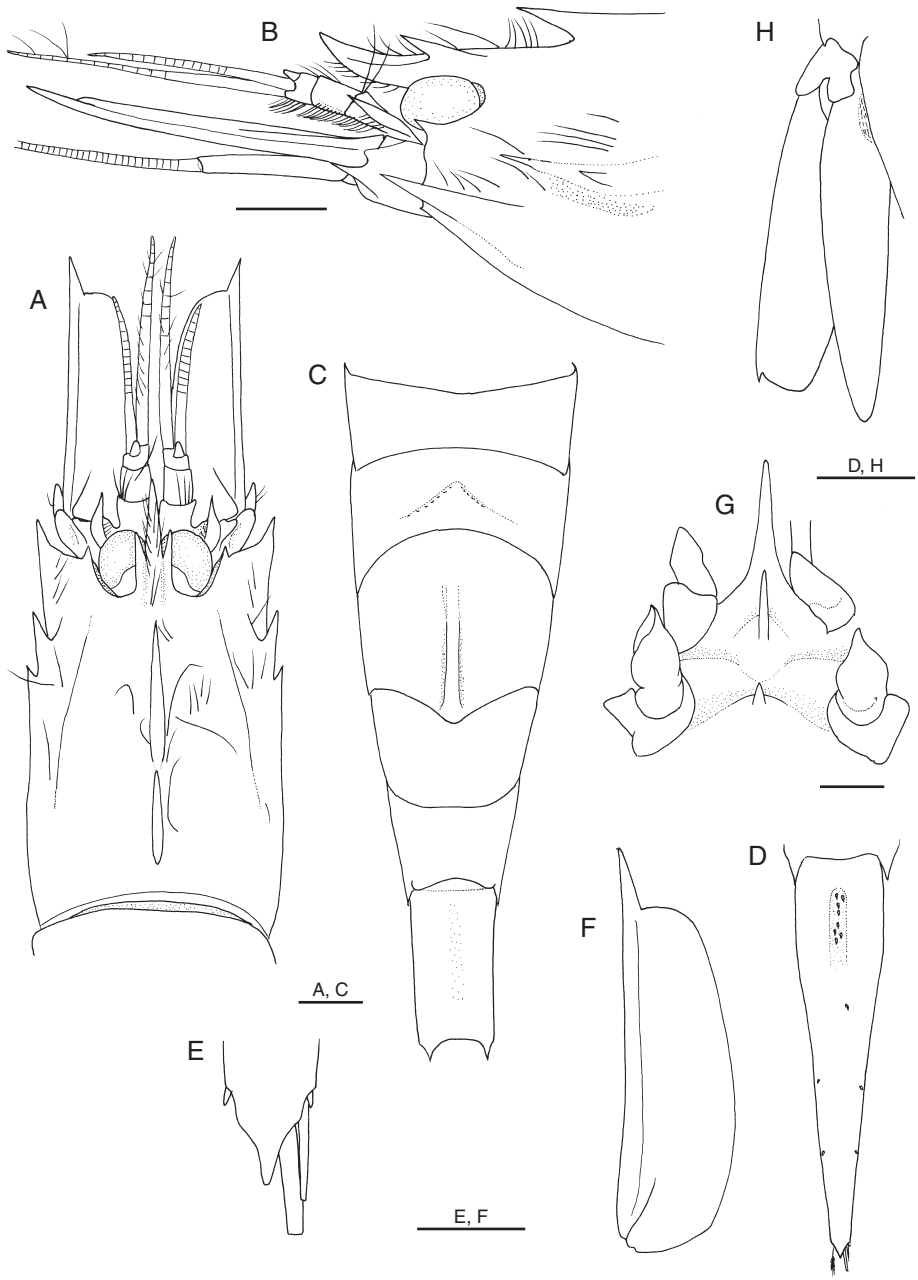

FIG. 2. — *Lissosabinea indica* (De Man, 1918), Banda Sea, Indonesia, KARUBAR, stn CP 17, ♀ cl 9.0 mm (MNHN-Na 15152): **A**, carapace and cephalic appendages, dorsal view (tegumental scales omitted); **B**, anterior part of carapace and cephalic appendages, lateral view; **C**, abdomen, dorsal view; **D**, telson, dorsal view; **E**, posterior part of telson, dorsal view; **F**, left antennal scale, dorsal view; **G**, thoracic sternum, ventral view; **H**, left uropod, dorsal view. Scale bars: A-D, F, H, 2 mm; E, 0.5 mm; G, 1 mm.

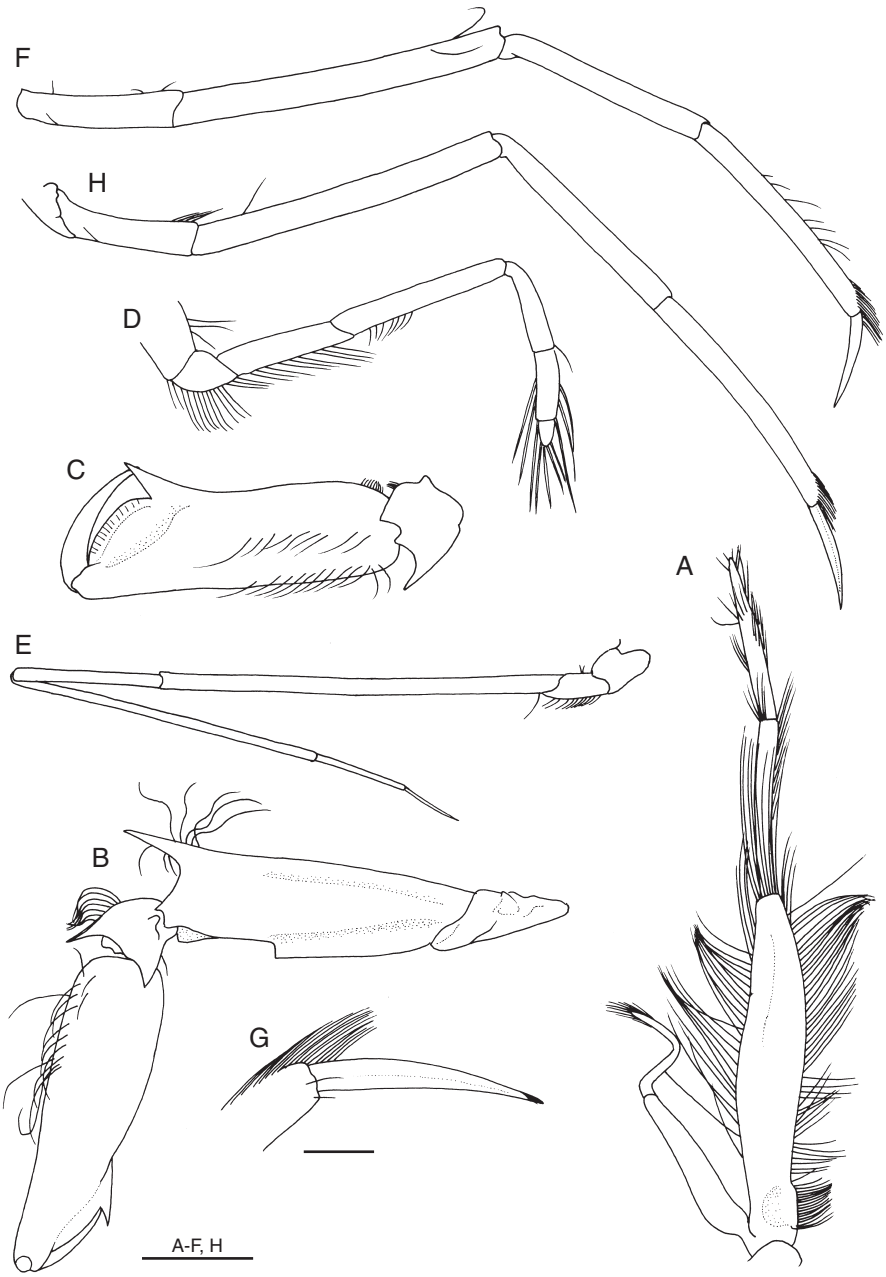

FIG. 3. — *Lissosabinea indica* (De Man, 1918), Banda Sea, Indonesia, KARUBAR, stn CP 17, ♀ cl 9.0 mm (MNHN-Na 15152): **A**, third maxilliped, dorsal view; **B**, first pereopod, lateral view; **C**, same, chela, dorsal view; **D**, second pereopod, lateral view; **E**, third pereopod, lateral view; **F**, fourth pereopod, lateral view; **G**, same, dactylus, lateral view; **H**, fifth pereopod, lateral view. Scale bars: A-E, G, 2 mm; F, H, 0.5 mm.

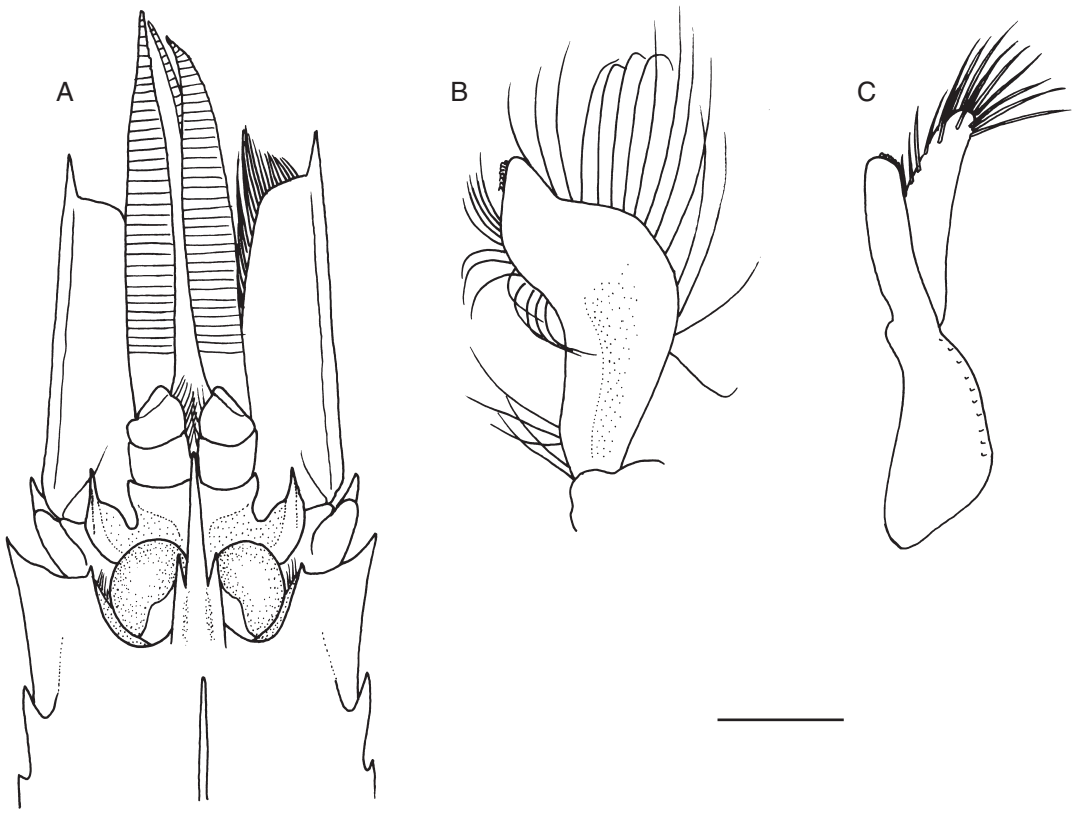

FIG. 4. — *Lissosabinea indica* (De Man, 1918), New Caledonia, MUSORSTOM 5, stn CP 363, ♂ cl 7.0 mm (MNHN-Na 15155): **A**, anterior part of carapace and cephalic appendages, dorsal view; **B**, endopod of left first pleopod, ventral view; **C**, appendix interna and masculina of left second pleopod, dorsomesial view. Scale bar: A, 2 mm; B, C, 0.5 mm.

segment; antepenultimate segment strongly flattened dorsoventrally, somewhat foliaceus.

First pereopod (Fig. 3B, C) with palm about 3.3 times as long as wide; cutting edge of palm oblique; pollex relatively large, not recurved; carpus armed with two moderately large teeth on lateral margin; merus with strong dorsodistal tooth overreaching distal margin of anteriorly extended carpus, distolateral margin unarmed; ventral lamina of merus terminating distally in subacute tooth. Second pereopod (Fig. 3D) far falling short of midlength of merus of first pereopod; dactylus about half length of propodus; propodus not widened distally. Third pereopod (Fig. 3E) very slender; ischium 2.7 times as long as merus. Fourth pereopod (Fig. 3F) moderately slender, overreaching antennal scale by length of dactylus and 0.40-0.50 of propodus; dactylus (Fig. 3G) slender, about 0.35-0.45 times as long as propodus, slightly flattened dorsoventrally, terminating in acute unguis exceeded by tuft of setae arising from lateral of base of unguis; propodus with distal tuft of setae (Fig. 3G); carpus 0.85-0.90 as long as propodus; merus about 10.0-10.1 times as long as wide, occasionally with small dorsodistal tooth mesially; ischium about 0.50 times as long as merus. Fifth pereopod (Fig. 3H) similar to fourth, overreaching antennal scale by length of dactylus and 0.20 of propodus; merus unarmed on dorsodistal margin.

Endopod of male first pleopod as illustrated (Fig. 4B). Appendix masculina (Fig. 4C) bearing numerous long bristles dorsally and distally.

Coloration

In life (based on color slides). Carapace, antennae and anterior five abdominal somites mottled reddish brown; rostrum and first middorsal tooth whitish; sixth abdominal somite and telson generally white, reddish brown broad band across posterior half of tail fan (telson + uropods). Eye opaque. Meri of fourth and fifth pereopods banded with reddish brown and white.

REMARKS

This species resembles *L. ecarina* n. sp., which is also found in Indonesian waters. Differences between the two species are discussed under the account of the new species.

The present specimens, including those from Japan and New Caledonia, are very similar. De Man (1918, 1920) did not mention the presence of small tegumental scales on the carapace and various appendages. However, reexamination of the holotype has shown that there are many minute pits on the tegumental surfaces, clearly suggesting the presence of tegumental scales. Perhaps, the scales had been detached when De Man examined the holotype. Kim & Natsukari (2000) pointed out that the Japanese specimen they reported upon was different from the extensive description by De Man (1920) in the possession of scattered setae on the dorsal surface of the rostrum and the presence of two pairs of subterminal spines on the telson. It has been found that there are several small pits, representing setal pockets, on the dorsal surface of the rostrum in the holotype, although, indeed, no setae are present there. The terminal process of the telson has two pairs of pits laterally, representing pockets of subterminal spines. Therefore, the discrepancies pointed by Kim & Natsukari (2000) can be attributed to damage of the holotype.

The present material indicates that this species is rather widely distributed in the western Pacific northward to central Japan and southward to New Caledonia, with the previous records include Indonesia (De Man 1918, 1920), Philippines (Chace 1984) and southern Japan (Kim & Natsukari 2000). As mentioned below, the specimens from the Philippines, referred to *L. indica* (as *Sabinea*) by Chace (1984), actually represent *L. ecarina* n. sp.

Lissosabinea tridentata (Pequegnat, 1970) (Figs 5; 6)

Sabinea tridentata Pequegnat, 1970: 115, figs 4-16, 4-17 (type locality: southeastern Gulf of Mexico, 391 m). — Pequegnat *et al.* 1971: 10. — Dardeau & Heard 1983: 5, 30, figs 2b, 15.

Not *Lissosabinea tridentata* – Spivak 1997: 73, table 1.

HOLOTYPE. — Gulf of Mexico, *Alaminos*, stn 65-A-9-21, off Florida, 24°58'N, 84°17'W, 391 m, 14.VII.1965, ♂ 4.0 mm (USNM 120088).

ALLOTYPE. — Same data as holotype, ♀ cl 4.3 mm (USNM 120089).

DISTRIBUTION. — Known with certainty only from the Gulf of Mexico; 391 m.

SIZE. — Female cl 4.3 mm; male cl 4.0 mm.

DESCRIPTION

Rostrum (Fig. 6A, B) straight, directed forward, relatively broad, reaching distal margin of first segment of antennular peduncle; dorsal surface with low, blunt median carina and shallow sulcus on either side of median carina extending to level of base of epigastric tooth; dorsolateral margin slightly elevated, armed with large, slender lateral tooth arising at midlength of rostrum; lateral face excavate at base, with short lateral carina extending to distal 0.30 of rostral length; ventral surface compressed laterally, forming sharp blade with convex ventral margin.

Carapace (Figs 5A, C; 6A) 1.10-1.20 times as long as wide. Middorsal carina sharp, extending to 0.80-0.90 of carapace length, armed with three relatively small teeth; epigastric tooth not reaching base of rostrum, arising at 0.15 of carapace length; second tooth smallest, arising at 0.30 of carapace length; third (= cardiac) tooth arising at 0.60 of carapace length. Antennal tooth small, not reaching anterior margin of cornea of eye. Branchiostegal tooth directed forward or somewhat ascending, reaching or slightly overreaching anterior margin of antennal basicerite. Pterygostomial angle rounded. Lateral face of carapace with relatively small hepatic and epibranchial teeth; epibranchial carina short, rather inconspicuous.

Sternal tooth on fifth thoracic somite absent in spawning female.

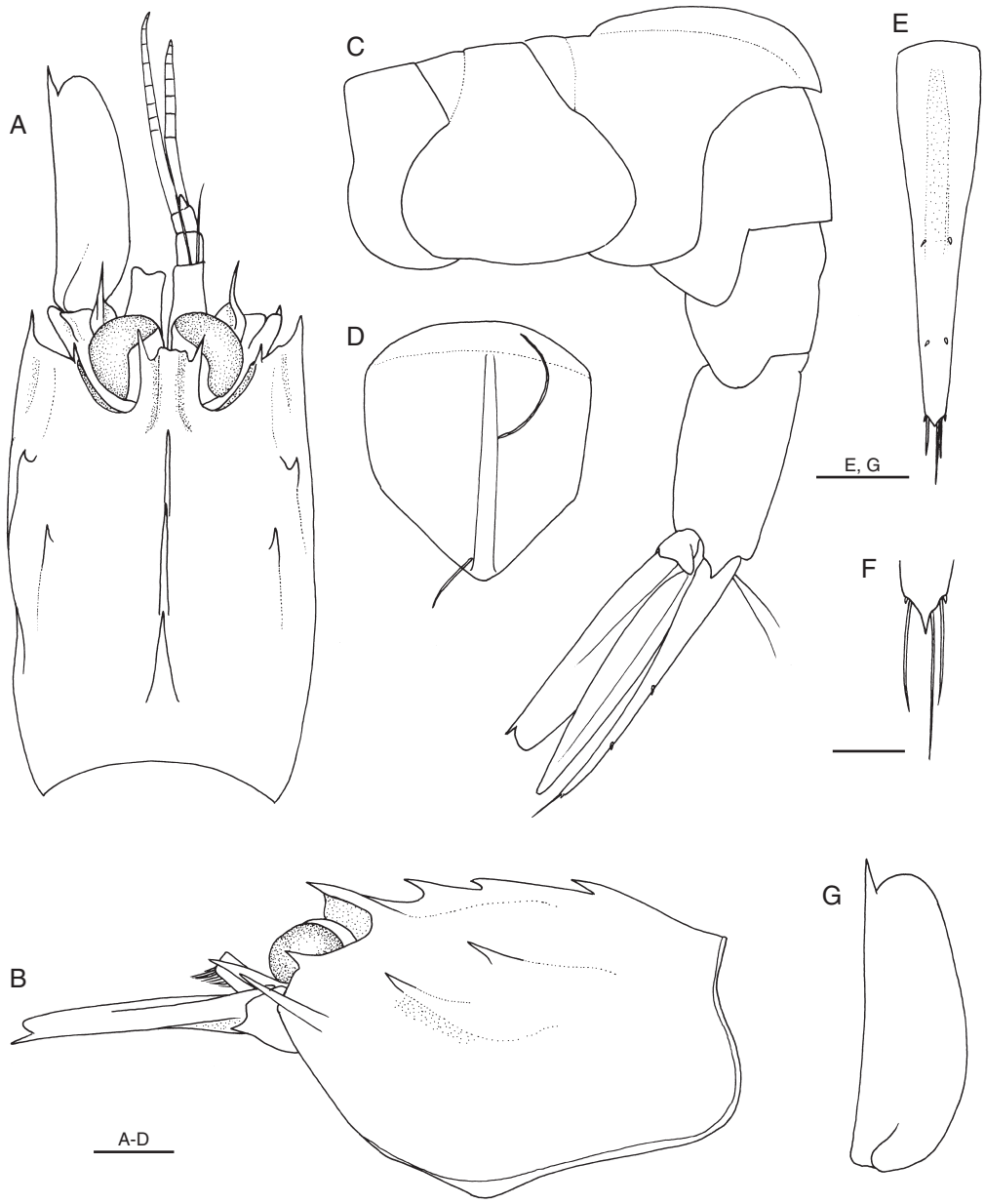

FIG. 5. — *Lissosabinea tridentata* (Pequegnat, 1970), off Florida, Gulf of Mexico, *Alaminos*, stn 65-A-9-21, allotype ♀ cl 4.3 mm (USNM 120089): **A**, carapace and cephalic appendages, dorsal view; **B**, same, lateral view; **C**, abdomen, lateral view; **D**, third abdominal somite, dorsal view; **E**, telson, dorsal view; **F**, posterior part of telson, dorsal view; **G**, left antennal scale, dorsal view. Scale bars: A-E, G, 1 mm; F, 0.5 mm.

Second abdominal somite (Fig. 5C) smooth on dorsal surface. Third somite (Fig. 5C, D) with distinct middorsal carina running almost over entire length, strongly arched in lateral view; posterodorsal margin of somite strongly produced posteriorly. Sixth somite about 1.8 times as long as high; dorsal

surface shallowly sulcate on midline. Telson (Fig. 5E, F) with two pairs of tiny dorsolateral spines; two mesial spines at posterolateral angle elongate, very slender; terminal process acutely pointed.

Cornea of eye (Fig. 5A, B) spherical, maximum diameter 0.24-0.25 of carapace length.

Antennular peduncle (Fig. 5A) reaching 0.35 of antennal scale; stylocerite reaching distal margin of first segment, strongly compressed laterally in distal half; lateral flagellum composed of seven articles in female; mesial flagellum composed of 10 articles in female. Antennal scale (Fig. 5A, G) about 0.70 of carapace length and 2.30 times as long as wide, lateral margin slightly concave, distal blade rounded; basicerite (Fig. 5A, B) with small ventrolateral tooth; carpocerite slightly overreaching midlength of antennal scale.

Third maxilliped overreaching antennal scale by half length of ultimate segment; ultimate segment longer than penultimate segment; antepenultimate segment moderately slender, not foliaceus.

First pereopod (Fig. 6C, D) with palm about 3.80 times as long as wide; cutting edge of palm strongly oblique; pollex relatively small, not recurved; carpus armed with two moderately large spines on lateral margin; merus with strong dorsodistal spine overreaching distal margin of anteriorly extended carpus, distolateral margin unarmed; ventral lamina terminating distally in acute tooth. Second pereopod not reaching midlength of merus of first pereopod; dactylus about half length of propodus; propodus not widened distally. Third pereopod very slender. Fourth pereopod (Fig. 6E) moderately slender, overreaching antennal scale by length of dactylus and 0.30-0.50 of propodus; dactylus slender, about 0.50 times as long as propodus, slightly flattened dorsoventrally, terminating in acute unguis exceeded by tuft of setae arising from lateral of base; propodus with distal tuft of setae; carpus 0.55-0.60 as long as propodus; merus about 9.0 times as long as wide, unarmed on dorsodistal margin; ischium about 0.70 times as long as merus. Fifth pereopod similar to fourth, overreaching antennal scale by length of dactylus and 0.20 of propodus.

Coloration

Unknown.

REMARKS

The possession of three median teeth on the carapace links *L. tridentata* to *L. armata* n. sp., although the two species are different in many characters. Differences between the two species are discussed under the account of *L. armata* n. sp.

Dardeau & Heard (1983), who also reexamined the type material, commented that minor details of Pequegnat's (1970) figures were inaccurate in that both the stylocerite and antennule were narrower than depicted and in that the distal blade of the antennal scale is actually broadly rounded, rather than obliquely truncate. Here it is confirmed that Dardeau & Heard's (1983) observation was correct. The antennular stylocerite is strongly compressed laterally and weakly twisted. In addition, the eye is somewhat smaller than depicted by Pequegnat (1970: fig. 4-17).

Christoffersen (1988) assigned two specimens from off Uruguay, one exuvia and a damaged second, to *L.* cf. *tridentata*. As noted above, his specimens were different from *L. tridentata* in having two submedian carinae on the sixth abdominal somite, each is provided with a denticulation at the posterior third and the possession of only a single arthrobranch on the third maxilliped. In all species of *Lissosabinea* the sixth abdominal somite is rounded dorsally, and the third maxilliped is provided with two arthrobranchs. Therefore, it is suggested that Christoffersen (1988) was actually reporting a species other than *L. tridentata*, although it remains unknown what species was represented. Spivak (1997) listed *L. tridentata* from the southwestern Atlantic, but his enumeration was based on the record of Christoffersen (1988).

Lissosabinea armata n. sp.
(Figs 7-9)

HOLOTYPE. — New Caledonia, BATHUS 3, stn DW 776, 24°44.24'S, 170°08.01'E, 770-830 m, 24.XI.1993, ♀ cl 6.6 mm (MNHN-Na 15156).

PARATYPE. — Same data as holotype, 1 badly damaged female cephalothorax cl 7.5 mm (MNHN-Na 15157).

DISTRIBUTION. — Known only from southern New Caledonia; at depths of 770-830 m.

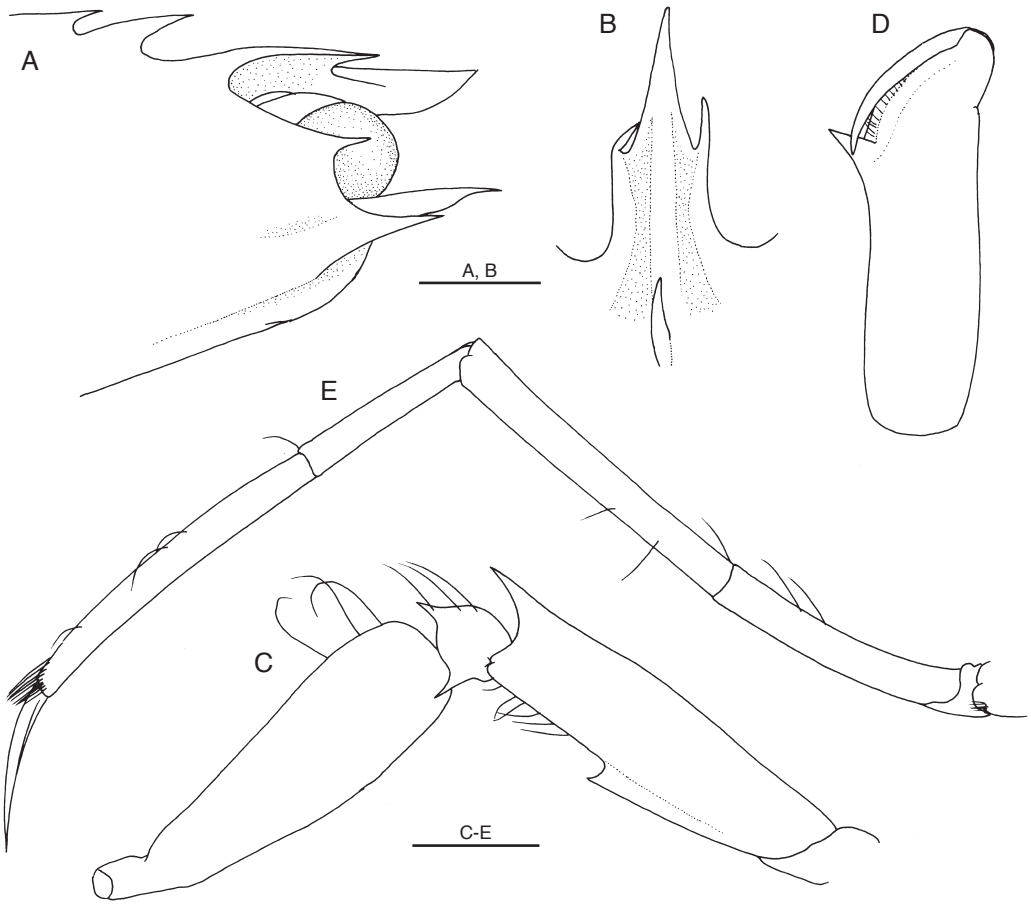

FIG. 6. — *Lissosabinea tridentata* (Pequegnat, 1970), off Florida, Gulf of Mexico, *Alaminos*, stn 65-A-9-21, holotype ♂ cl 4.0 mm (USNM 120088): **A**, anterior part of carapace (eye and antennular stylocerite depicted), right side, lateral view; **B**, rostrum, dorsal view; **C**, first pereopod, lateral view; **D**, same, chela, dorsal view; **E**, fourth pereopod, lateral view. Scale bars: 1 mm.

SIZE. — Non-ovigerous, but spawning female cl 6.6-7.5 mm.

ETYMOLOGY. — From the Latin *armatus* (= armed), in reference to the strong armature on the carapace.

DESCRIPTION

Rostrum (Fig. 8A, B) straight, directed forward, relatively broad, slightly overreaching distal margin of first segment of antennular peduncle; distal part spiniform, lacking ventral blade; dorsal surface with low, blunt median ridge and shallow sulcus on either side of median ridge extending to level of base of epigastric tooth, and with few setae; dorsolateral margin slightly elevated, armed with large tooth arising from midlength of rostrum and reaching anterior 0.30 of rostrum; lateral face excavate at base, with sharp lateral carina extending to tip of rostrum.

Carapace (Figs 7; 8A, B) 1.50 times as long as wide. Middorsal carina sharp, extending nearly to posterodorsal margin of carapace, armed with three large teeth; epigastric tooth overreaching base of rostrum, arising at 0.11 of carapace length; second tooth slightly smaller than first, arising from 0.33 of carapace length; third (= cardiac) tooth smallest, arising at 0.61 of carapace length. Dorsal surface of carapace with two pairs of long plumose setae at level of midlength (either side of second median tooth). Antennal tooth long, slightly ascending,

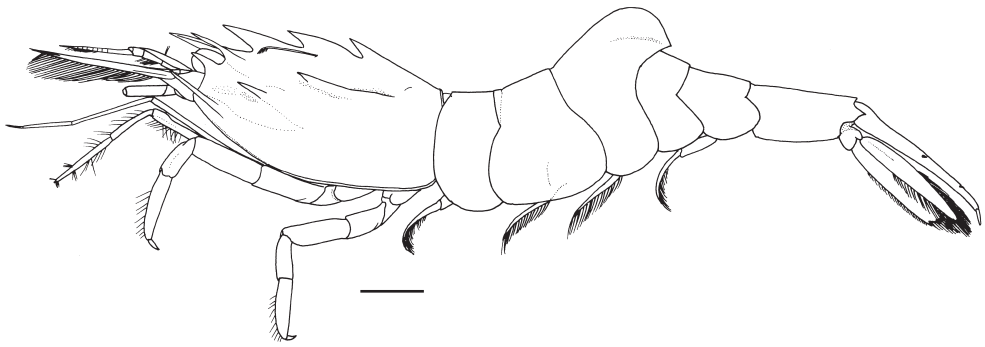

FIG. 7. — *Lissosabinea armata* n. sp., entire animal in lateral view, New Caledonia, BATHUS 3, stn DW 776, holotype ♀ cl 6.6 mm (MNHN-Na 15156). Scale bar: 2 mm.

reaching anterior margin of cornea of eye. Branchiostegal tooth directed somewhat dorsally, overreaching anterior margin of antennal basicerite. Pterygostomian angle with tiny tooth. Lateral face of carapace with relatively large hepatic and epibranchial teeth; epibranchial carina relatively long, conspicuous.

Sternal tooth on fifth thoracic somite (Fig. 8C) well developed even in spawning female, extending beyond base of spur on fourth somite.

Second abdominal somite (Fig. 7) smooth on dorsal surface. Third somite (Figs 7; 8D) with very high, thick middorsal carina in posterior 0.75, very strongly arched in lateral view; posterodorsal margin of somite strongly produced posteriorly, partially covering fourth somite. Sixth somite about 2 times as long as high; dorsal surface flat on midline. Telson (Fig. 8E, F) with two pairs of small, blunt dorsolateral spines; posterolateral angle with three spines, lateralmost spine short, blunt, second spine slender, third, mesialmost spine stout, longest; terminal process rounded.

Cornea of eye (Fig. 8A, B) spherical, lightly pigmented with opaque, maximum diameter 0.16 of carapace length.

Antennular peduncle (Fig. 8A, B) reaching 0.35 of antennal scale; stylocerite elongate, reaching nearly distal margin of third segment, spiniform; lateral flagellum composed of eight or nine articles in female; mesial flagellum composed of nine or 10 articles in female. Antennal scale (Fig. 8A) about 0.64 of carapace length and 2.10 times as long as wide, lateral margin straight, distal blade truncate; basicerite with long ventrolateral spine reaching level of distal margin of first segment of antennular peduncle; carpocerite reaching 0.35 of antennal scale.

Third maxilliped (Fig. 9A) reaching distal margin of antennal scale by tip of ultimate segment; ultimate segment longer than carpus (= penultimate segment); antepenultimate segment moderately slender, not foliaceus.

First pereopod (Fig. 9B, C) with palm about three times as long as wide; cutting edge of palm weakly oblique; pollex relatively long, slender, not recurved; carpus armed with two moderately large spines on lateral margin; merus with very strong dorsodistal spine overreaching distal margin of anteriorly extended carpus, distolateral margin with tiny blunt tooth; ventral lamina terminating distally in small acute tooth. Second pereopod (Fig. 9D) not reaching midlength of merus of first pereopod; dactylus about 0.25 length of propodus; propodus weakly widened distally. Third pereopod (Fig. 9E) slender; ischium 1.76 times as long as merus. Fourth pereopod (Fig. 9F) stout, not reaching antennal scale; dactylus (Fig. 9G) strongly compressed laterally, about 0.29 times as long as propodus, terminating in acute unguis; dorsal margin of dactylus somewhat laminate, convex in lateral view; propodus notably tapering distally, lacking distal tuft of setae, with large articulating knobs against dactylus; carpus 0.56 times as long as propodus; merus about three times as long as wide, unarmed on dorsodistal margin; ischium 0.74 times as long as merus. Fifth

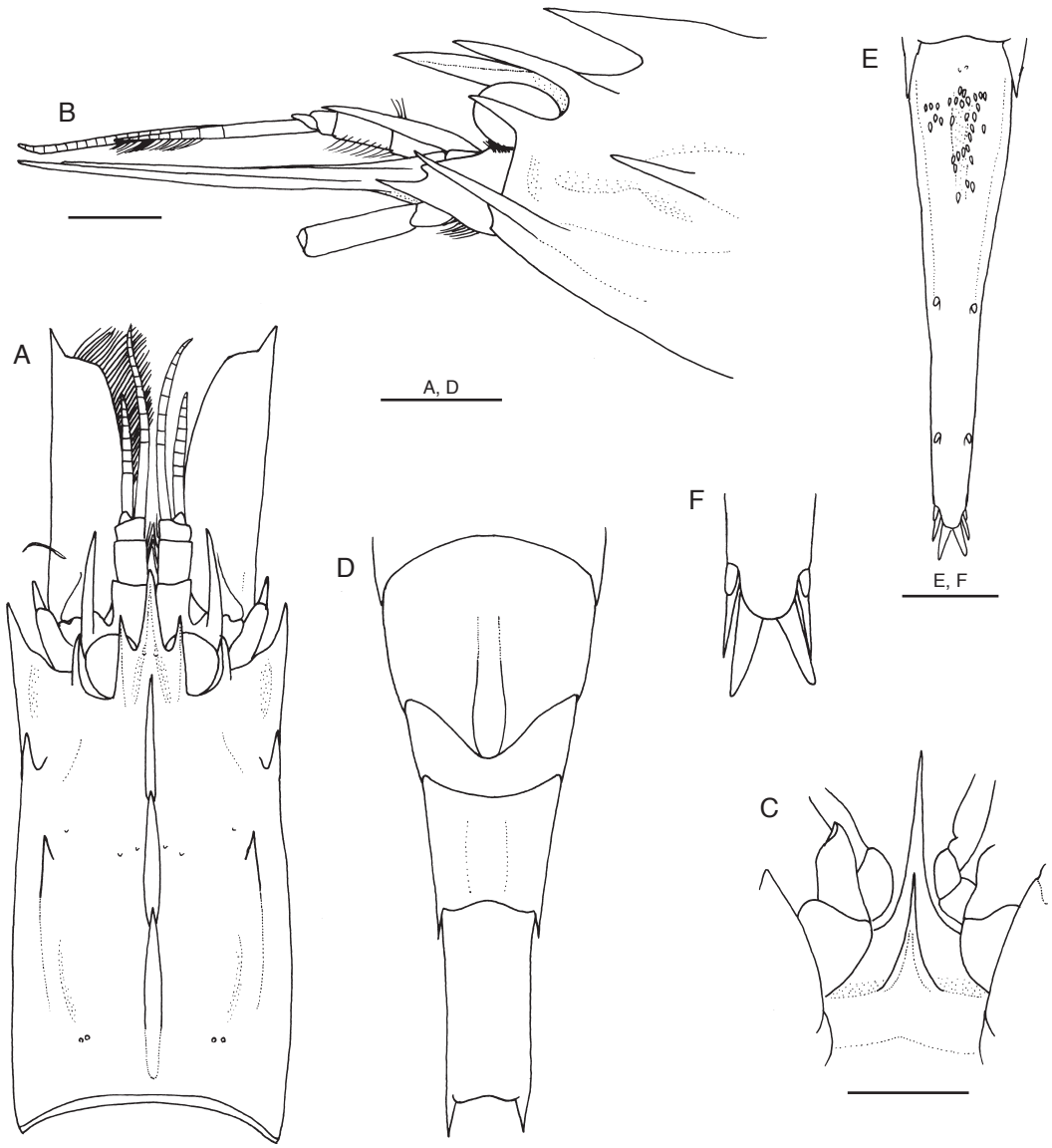

FIG. 8. — *Lissosabinea armata* n. sp., New Caledonia, BATHUS 3, stn DW 776, holotype ♀ cl 6.6 mm (MNHN-Na 15156): **A**, carapace and cephalic appendages, dorsal view (tegumental scales omitted); **B**, anterior part of carapace and cephalic appendages, lateral view; **C**, thoracic sternum, ventral view; **D**, third to sixth abdominal somites, dorsal view; **E**, telson, dorsal view; **F**, posterior part of telson, dorsal view. Scale bars: A, D, 2 mm; B, C, E, 1 mm; F, 0.5 mm.

pereopod (Fig. 9H) similar to fourth, not reaching midlength of antennal scale.

Coloration

Unknown.

REMARKS

As mentioned before, the presence of three median teeth on the carapace links this new species to *L. tridentata*. However, *L. armata* n. sp. differs from its congeners in many characters, making it unique within

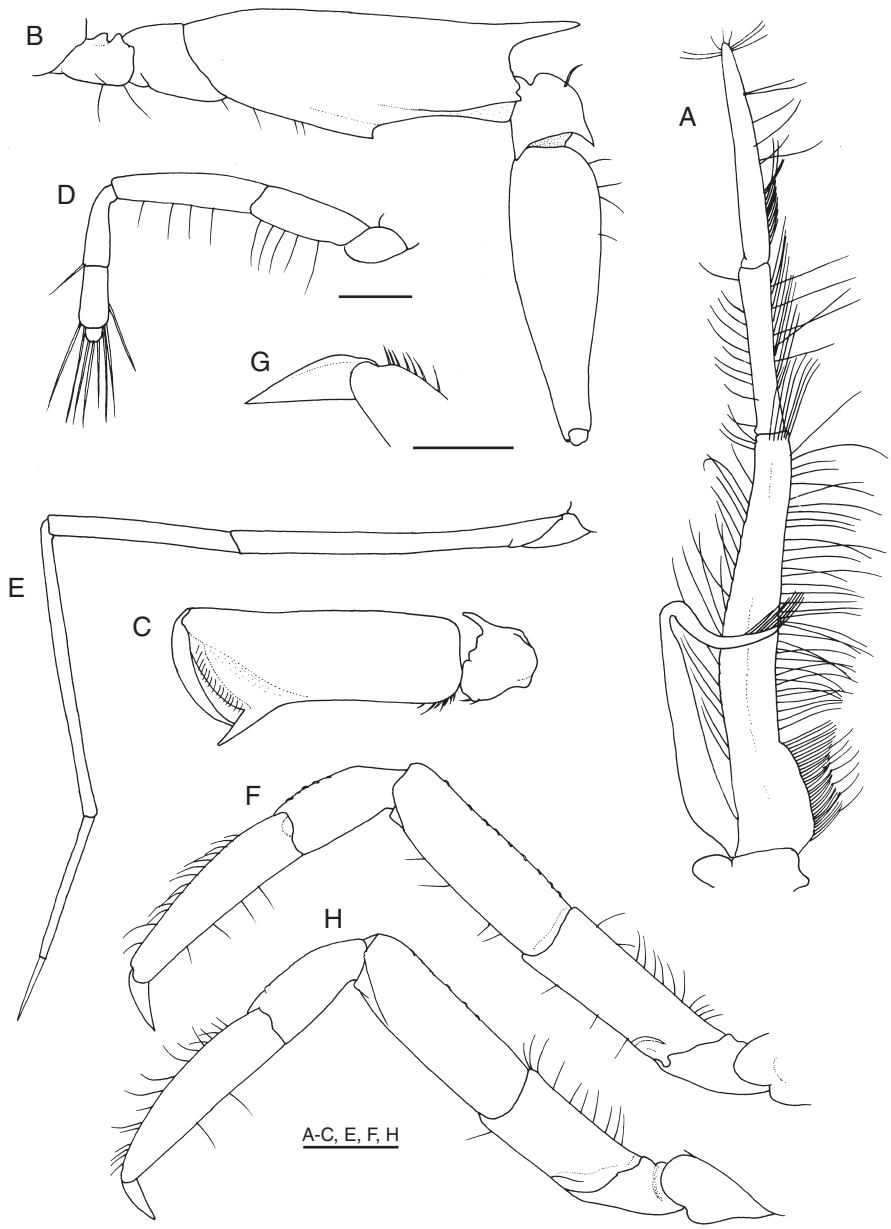

FIG. 9. — *Lissosabinea armata* n. sp.: **A**-**C**, New Caledonia, BATHUS 3, stn DW 776, paratype badly damaged female cephalothorax cl 7.5 mm (MNHN-Na 15157); **A**, third maxilliped, dorsal view; **B**, left first pereopod, lateral view; **C**, same, chela, dorsal view; **D**-**H**, same station, holotype ♀ cl 6.6 mm (MNHN-Na 15156); **D**, second pereopod, lateral view; **E**, left third pereopod, lateral view; **F**, left fourth pereopod, lateral view; **G**, same, dactylus and distal part of propodus, lateral view; **H**, left fifth pereopod, lateral view. Scale bars: A-C, E, F, H, 1 mm; D, G, 0.5 mm.

the genus: the median teeth on the carapace are larger than in any other congeneric species, particularly the first tooth overhanging the base of the rostrum; the antennal tooth on the carapace is elongate, slightly overreaching the anterior margin of the eye; the third abdominal somite is provided with an unusually high,

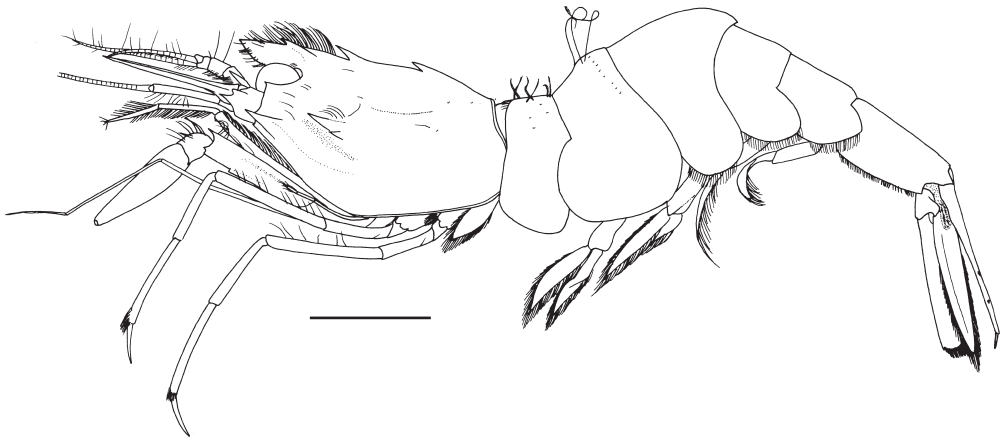

FIG. 10. — *Lissosabinea ecarina* n. sp., entire animal in lateral view, Banda Sea, Indonesia, KARUBAR, stn CP 25, holotype ♀ cl 7.7 mm (MNHN-Na 15158). Scale bar: 5 mm.

broad median carina; the posteromedian process of the telson is rounded; the antennular stylocerite is elongate, reaching the distal margin of the third segment of the antennular peduncle; the ventrolateral tooth on the antennal basicerite is elongate, reaching the level of the distal margin of the first segment of antennular peduncle; the cutting edge of the subchela is less oblique than in other congeners; the propodi of the second pereopod are somewhat broadened distally; the fourth and fifth pereopods are very stout, with short, laterally compressed dactyli and propodi notably tapering distally; the distal tufts of setae on the propodi of the fourth and fifth pereopods are rudimentary. Other characters differentiating between *L. armata* n. sp. and *L. tridentata* include: the epibranchial carina on the carapace is more clearly defined in *L. armata* n. sp. than in *L. tridentata*; the distal margin of the blade of the antennal scale is obliquely truncate in *L. armata* n. sp., rather than broadly rounded in *L. tridentata*.

Lissosabinea ecarina n. sp.
(Figs 10-12)

Sabinea indica – Chace 1984: 59 (in part).

HOLOTYPE. — Indonesia, KARUBAR, stn CP 25, Kai Islands, 05°30'N, 132°52'E, 336-346 m, 26.X.1991, ovigerous ♀ cl 7.7 mm (MNHN-Na 15158).

PARATYPES. — **Philippines.** *Albatross*, stn 5550, W of Jolo Island, Sulu Archipelago, 06°02.00'N, 120°44.40'E, 472 m, 17.IX.1909, 1 ovigerous ♀ cl 8.0 mm (USNM 205085); stn 5565, SW of Jolo Island, 05°51.42'N, 120°30.30'E, 444 m, 21.IX.1909, 1 ♀ cl 6.0 mm (USNM 205086).
Indonesia. Same data as holotype, cl 6.3 mm (MNHN-Na 15159); KARUBAR, stn CP 84, Tanimbar Islands, 09°23'N, 131°09'E, 275-246 m, 4.XI.1991, 2 ovigerous ♀♀ cl 6.2, 7.3 mm (MNHN-Na 15160).

DISTRIBUTION. — Western Pacific: Philippines and Indonesia; 246-472 m.

SIZE. — Females cl 6.0-7.7 mm, ovigerous females cl 6.2-7.7 mm; males unknown.

ETYMOLOGY. — From the Latin prefix *e-* (non) and *carina* (ridge), and referring to the absence of a distinct median carina on the third abdominal somite.

DESCRIPTION

Rostrum (Fig. 11A, B) strongly compressed laterally, styliform with relatively deep ventral blade, nearly straight or slightly upturned, overreaching distal margin of first segment of antennular peduncle, but not reaching distal margin of second segment; dorsal surface weakly ridged in midline, bearing numerous short to long setae in proximal 0.70 and extending onto anterior part of carapace; lateral tooth strong, arising from 0.40-0.50 of rostrum; lateral face slightly concave at base, with sharp

lateral carina extending to distal 0.20 of rostral length; ventral margin strongly convex, unarmed, but with two rows of short setae.

Carapace (Figs 10; 11A, B) 1.10-1.20 times as long as wide. Middorsal carina not sharp except for two median teeth, extending to 0.70 of carapace length; two middorsal teeth relatively small, epigastric tooth falling far short of base of rostrum, arising at 0.20 of carapace length; second tooth slightly smaller than first, arising at about 0.60 of carapace length. Antennal tooth small, not reaching anterior margin of cornea of eye. Branchiostegal tooth directed forward, falling short of anterior margin of antennal basicerite. Pterygostomian tooth tiny. Lateral surface of carapace with relatively large hepatic and one or two small post-hepatic teeth, but epibranchial tooth absent; post-hepatic tooth arising inferior to level of hepatic tooth; epibranchial carina obsolete.

Sternal tooth on fifth thoracic somite absent in spawning female.

Second abdominal somite (Figs 10; 11C) with low, triangular plateau on posterior half of tergum, delimited by row of long setae. Third somite weakly elevated posteriorly on tergum, but without distinct middorsal carina; posterodorsal margin of somite weakly produced posteriorly. Sixth somite about two times as long as high; dorsal surface flattened on midline. Telson (Fig. 11D, E) with two pairs of minute dorsolateral spines; lateral margin with low, but distinct lobe subproximally; two mesial spines at posterolateral angle long, very slender; terminal process acutely or subacutely pointed.

Cornea of eye (Fig. 11A, B) spherical, maximum diameter 0.20-0.22 of carapace length.

Antennular peduncle (Fig. 11A, B) reaching 0.30-0.35 of antennal scale; stylocerite not reaching distal margin of first segment, somewhat compressed laterally; lateral flagellum composed of about 11-13 articles in females; mesial flagellum composed of about 11-12 articles in females. Antennal scale (Fig. 11A) about 0.70-0.75 of carapace length and about 2.8 times as long as wide, lateral margin nearly straight, distal blade obliquely, roundly truncate; basicerite with relatively large ventrolateral spine; carpocerite slightly overreaching midlength of antennal scale.

Third maxilliped (Fig. 12A) reaching antennal scale by tip of ultimate segment; ultimate segment subequal in length to penultimate segment; antepenultimate segment strongly flattened dorsoventrally, somewhat foliaceus.

First pereopod (Fig. 12B, C) with palm about 3.20-3.30 times as long as wide; cutting edge of palm oblique; pollex relatively large, not recurved; carpus armed with two small teeth on distolateral margin; merus with strong dorsodistal tooth not reaching distal margin of anteriorly extended carpus, distolateral tooth small, blunt; ventral carina of merus terminating in sharp tooth (occasionally tooth absent). Second pereopod (Fig. 12D) far falling short of midlength of merus of first pereopod; dactylus about half length of propodus; propodus not widened distally. Third pereopod (Fig. 12E) very slender; ischium 3.0-3.1 times as long as merus. Fourth pereopod (Fig. 12F) moderately slender, overreaching antennal scale by length of dactylus and 0.30 of propodus; dactylus (Fig. 12G, H) slender, 0.50-0.55 times as long as propodus, slightly flattened dorsoventrally, terminating in acute unguis exceeded by tuft of setae arising from lateral of base of unguis; propodus with distal tuft of setae (Fig. 12G); carpus 0.80-0.85 as long as propodus; merus about 10.0-10.1 times as long as wide, unarmed on dorsodistal margin; ischium about 0.55-0.60 times as long as merus. Fifth pereopod (Fig. 12I) similar to fourth, overreaching antennal scale by length of dactylus and 0.20 of propodus; ischium 0.45-0.50 times as long as merus.

Coloration

Unknown.

REMARKS

Lissosabinea ecarina n. sp. is most similar to *L. indica*, both occurring in Indonesian waters. These two species differ from other congeners in the presence of two median, post-hepatic and epibranchial teeth on the carapace, the possession of a low, triangular plateau on the second abdominal somite in females and the somewhat broadened, foliaceous antepenultimate segment of the third maxilliped. The lack of a conspicuous median carina on the third abdominal somite distinguishes *L. ecarina*

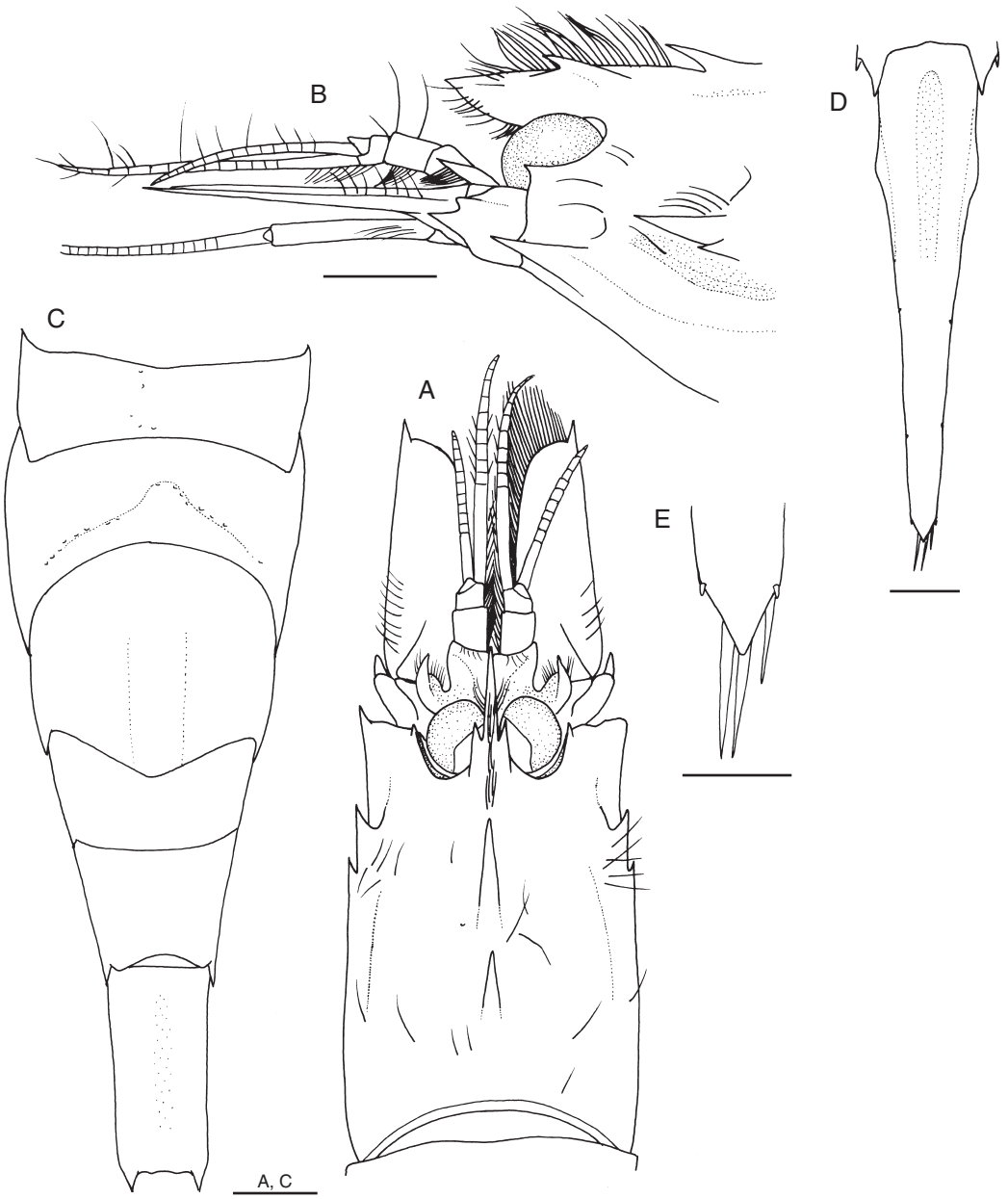

FIG. 11. — *Lissosabinea ecarina* n. sp., Banda Sea, Indonesia, KARUBAR, stn CP 25, holotype ♀ cl 7.7 mm (MNHN-Na 15158): **A**, carapace and cephalic appendages, dorsal view (tegumental scales omitted); **B**, anterior part of carapace and cephalic appendages, lateral view; **C**, abdomen, dorsal view; **D**, telson, dorsal view (tegumental scales omitted); **E**, posterior part of telson, dorsal view. Scale bars: A-C, 2 mm; D, 1 mm; E, 0.5 mm.

n. sp. from *L. indica*. In *L. indica*, the tergum of the third abdominal somite is somewhat compressed laterally in the midline, forming a distinct carina. Also, in comparison with *L. indica*, the ventral blade of the rostrum of *L. ecarina* n. sp. is deeper and the dactylus of the fourth pereopod is longer

FIG. 12. — *Lissosabinea ecarina* n. sp., left appendages, Banda Sea, Indonesia, KARUBAR, stn CP 25, holotype ♀ cl 7.7 mm (MNHN-Na 15158): **A**, third maxilliped, dorsal view; **B**, first pereopod, lateral view; **C**, same, chela, dorsal view; **D**, second pereopod, lateral view; **E**, third pereopod, lateral view; **F**, fourth pereopod, lateral view; **G**, same, dactylus and distal part of propodus, lateral view; **H**, same, detail of distal part of dactylus; **I**, fifth pereopod, lateral view. Scale bars: A-C, E, F, I, 2 mm; D, G, 1 mm; H, 0.5 mm.

(more than half length of the propodus versus less than half of it). The posthepatic tooth is aligned with the hepatic tooth in *L. indica*, while it arises somewhat inferior to the level of the hepatic tooth in *L. ecarina* n. sp.

Chace (1984) reported *L. indica* (as *Sabinea*) on the basis of one specimen from Indonesia and two specimens from the Philippines. Reexamination of these specimens has revealed that only the specimen from Indonesia represents the true *L. indica*. The two specimens from the Philippines are here referred to *L. ecarina* n. sp.

Lissosabinea unispinosa n. sp.
(Figs 13-16)

HOLOTYPE. — MUSORSTOM 4, stn 195, 18°54.8'S, 163°22.2'E, 465 m, 19.IX.1985, ovigerous ♀ cl 4.5 mm (MNHN-Na 15161).

PARATYPES. — **New Caledonia.** MUSORSTOM 4, stn DW 162, 18°35.0'S, 163°10.3'E, 525 m, 16.IX.1985, 1 ovigerous ♀ cl 4.8 mm (MNHN-Na 15162). — Stn CP 170, 18°57.0'S, 163°12.6'E, 480 m, 17.IX.1985, 1 ovigerous ♀ cl 4.6 mm (MNHN-Na 15163). — Stn CP 180, 18°56.8'S, 163°17.7'E, 440 m, 18.IX.1985, 1 ♂ cl 4.3 mm (MNHN-Na 15164). — Stn 195, 18°54.8'S, 163°22.2'E, 465 m, 19.IX.1985, 2 ovigerous ♀♀ cl 4.6, 5.0 mm, 1 cephalothorax cl 5.1 mm (sex could not be determined) (MNHN-Na 15165). — Stn DW 196, 18°55.0'S, 163°23.7'E, 450 m, 20.IX.1985, 1 ovigerous ♀ cl 4.4 mm (MNHN-Na 15166). — Stn DW 222, 22°57.6'S, 167°33.0'E, 410-440 m, 30.IX.1985, 1 ovigerous ♀ cl 4.1 mm (MNHN-Na 15167).
BIOCAL, stn DW 44, 22°47'S, 167°14'E, 440-450 m, 30.VIII.1985, 1 ♀ cl 5.0 mm (MNHN-Na 15168). — Stn CP 45, 22°47'S, 167°15'E, 430-465 m, 30.VIII.1985, 1 ♂ cl 4.1 mm, 2 ovigerous ♀♀ cl 4.3, 4.5 mm (CBM-ZC 8341). — Stn CP 78, 22°16'S, 167°15'E, 445-450 m, 5.IX.1985, 1 ♀ cl 4.3 mm, 2 ovigerous ♀♀ cl 4.7 mm, crushed (MNHN-Na 15169). — Stn DW 81, 20°29'S, 166°47'E, 430-470 m, 5.IX.1985, 1 ♀ cl 2.9 mm (MNHN-Na 15170).
MUSORSTOM 5, stn DW 301, 22°06.90'S, 159°24.60'E, 487-610 m, 12.X.1986, 1 ♂ cl 3.8 mm, 1 ♀ cl 4.0 mm (MNHN-Na 15171). — Stn DW 305, 22°09.27'S, 159°24.42'E, 430-440 m, 12.X.1986, 1 ovigerous ♀ cl 4.0 mm (MNHN-Na 15172).
MUSORSTOM 6, stn DW 478, 21°08.96'S, 167°54.28'E, 400 m, 22.II.1989, 1 ovigerous ♀ cl 3.7 mm (MNHN-Na 15173).
BATHUS 4, stn DW 929, 18°51.55'S, 163°23.27'E, 502-516 m, 7.VIII.1994, 1 ♂ cl 3.8 mm (MNHN-Na 15174).
Tonga. BORDAU 2, stn CP 1527, Eua, 21°16'S, 174°59'W, 483-509 m, 3.VI.2000, 1 ovigerous ♀ cl 4.5 mm (MNHN-Na 15175).

DISTRIBUTION. — So far known only from New Caledonia and Tonga, 410-610 m.

SIZE. — Females cl 3.7-5.0 mm, ovigerous females cl 3.7-5.0 mm; males cl 3.8-4.3 mm.

ETYMOLOGY. — From the Latin *uni-* (one) and *spinosa* (spined), and indicating the presence of only one median tooth on the carapace.

DESCRIPTION

Rostrum (Fig. 14A, B) slightly ascending, straight, narrow, distal part slightly compressed laterally, falling slightly short of or slightly overreaching distal margin of first segment of antennular peduncle; dorsal surface rounded in anterior part and flattened in posterior part, bearing few short setae in proximal 0.40; lateral tooth weak, arising from 0.40-0.50 of rostrum; lateral face slightly concave at base, without lateral carina; ventral margin devoid of blade, but occasionally with one small tooth or trace of tooth subdistally.

Carapace (Figs 13; 14A, B) 1.10-1.20 times as long as wide. Middorsal carina low, extending to midlength of carapace, terminating anteriorly in small epigastric tooth at anterior 0.10-0.11 of carapace, otherwise unarmed on midline of carapace. Dorsal surface with transverse row of long plumose setae across midlength, interrupted medially. Antennal tooth small, reaching midlength of cornea of eye. Branchiostegal tooth directed forward, falling short of anterior margin of antennal basicerite. Pterygostomial tooth tiny. Lateral surface of carapace with relatively small hepatic tooth, but epibranchial tooth absent; epibranchial carina absent.

Sternal tooth on fifth thoracic somite absent in spawning female (Fig. 14C).

Second abdominal somite (Fig. 13) dorsally rounded. Third somite (Figs 13; 14D, E) with tergum weakly elevated posteriorly, forming broad, rather inconspicuous middorsal carina; posterodorsal margin of somite produced posteriorly. Sixth somite about two times as long as height; dorsal surface rounded.

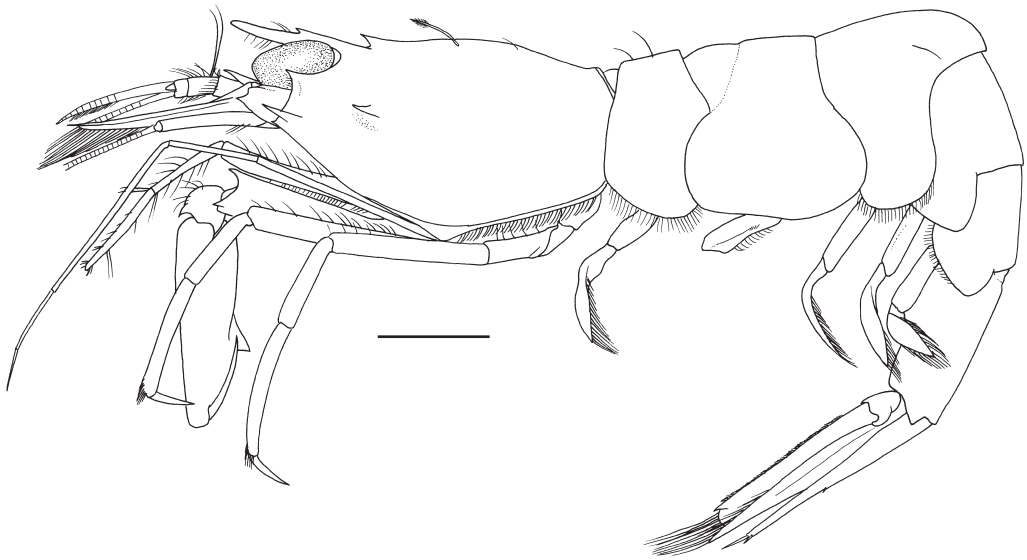

FIG. 13. — *Lissosabinea unispinosa* n. sp., entire animal, lateral view, New Caledonia, MUSORSTOM 4, stn 195, holotype ♀ cl 4.5 mm (MNHN-Na 15161). Scale bar: 2 mm.

Telson (Fig. 14F) with two pairs of small dorsolateral spines; lateral margin with trace of lobe subproximally; three pairs of spines present on posterolateral corner, of them two mesial pairs very slender, subequal in length; terminal process acutely pointed.

Cornea of eye (Fig. 14A, B) very large, somewhat flattened dorsoventrally, maximum diameter 0.30-0.35 of carapace length.

Antennular peduncle (Fig. 14A, B) reaching 0.45-0.50 of antennal scale; stylocerite reaching distal margin of first segment, slightly compressed laterally; lateral flagellum composed of about eight to 10 articles in females, 20-25 articles in males; mesial flagellum composed of about 11-15 articles in females, 20-25 articles in males. Antennal scale (Fig. 14A, H) 0.65-0.70 of carapace length and 3.30-3.50 times longer than wide, lateral margin slightly concave, distal blade slightly rounded; basicerite (Fig. 14A, B) with small ventrolateral spine; carpocerite slightly overreaching midlength of antennal scale.

Third maxilliped (Fig. 16A) overreaching antennal scale by distal 0.15-0.20 of ultimate segment; ultimate segment slightly longer than carpus (= penultimate segment); antepenultimate segment moderately slender, not foliaceus.

First pereopod (Fig. 16B, C) with palm about 3.40-3.50 times longer than wide; cutting edge of palm strongly oblique; pollex relatively large, broadly triangular, slightly recurved; carpus armed with two moderately large spines on distolateral margin; merus with strong dorsodistal spine not reaching distal margin of anteriorly extended carpus, distolateral spine long, slender; ventral carina of merus distinct but not lamelliform, terminating distally in sharp tooth. Second pereopod (Fig. 16D) far falling short of midlength of merus of first pereopod; dactylus 0.25-0.30 of propodus length; propodus not widened distally. Third pereopod (Fig. 16E) very slender; ischium 2.50-2.60 of merus length. Fourth pereopod (Fig. 16F) relatively stout, overreaching antennal scale by length of dactylus; dactylus (Fig. 16G) 0.35-0.40 of propodus length, subconical, slightly curved, terminating in acute unguis; propodus with distal tuft of setae (Fig. 16G); carpus 0.60-0.70 of propodus length; merus about 8.0-8.5 longer than wide, unarmed on dorsodistal margin; ischium 0.45-0.50 times of merus length. Fifth pereopod (Fig. 16H) similar to fourth, reaching antennal scale by tip of dactylus; ischium 0.44-0.47 of merus length.

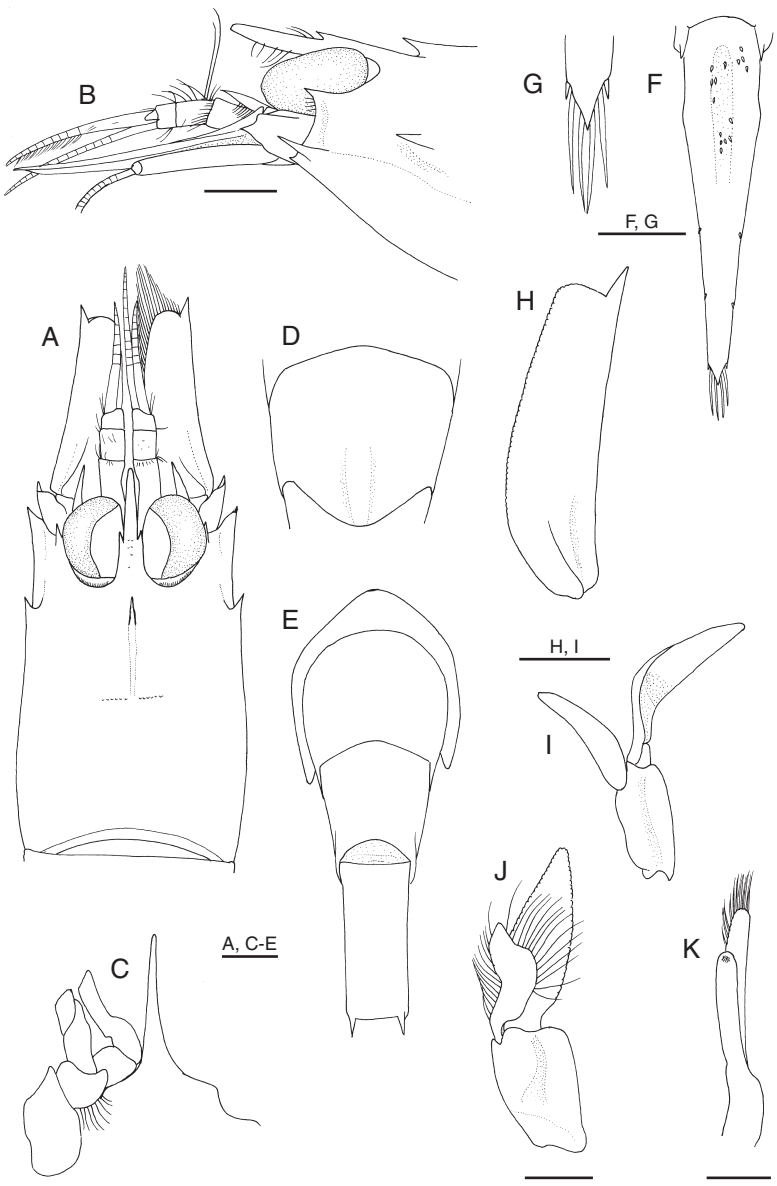

FIG. 14. — *Lissosabinea unispinosa* n. sp.: **A-I**, New Caledonia, MUSORSTOM 4, stn 195, holotype ♀ cl 4.5 mm (MNHN-Na 15161); **A**, carapace and cephalic appendages, dorsal view (tegumental scales omitted); **B**, anterior part of carapace and cephalic appendages, lateral view; **C**, thoracic sternum, ventral view; **D**, third abdominal somite, dorsal view; **E**, fourth to sixth abdominal somites, dorsal view; **F**, telson, dorsal view; **G**, posterior part of telson, dorsal view; **H**, right antennal scale, dorsal view; **I**, left first pleopod, ventral view; **J**, **K**, New Caledonia, BIOCAL, stn CP 45, paratype ♂ cl 4.1 mm (CBM-ZC 8431); **J**, left first pleopod, ventral view; **K**, appendix interna and masculina, ventromesial view. Scale bars: A, B, D-F, H, I, 1 mm; C, G, J, 0.5 mm; K, 0.25 mm.

Endopod of first pleopod of male (Fig. 14J) sinuous, spatulate; female endopod (Fig. 14I) slender tapering distally. Appendix masculina on second pleopod distinctly longer than appendix internae (Fig. 14K), bearing moderately long bristles on dorsal surface to terminal to subterminal parts.

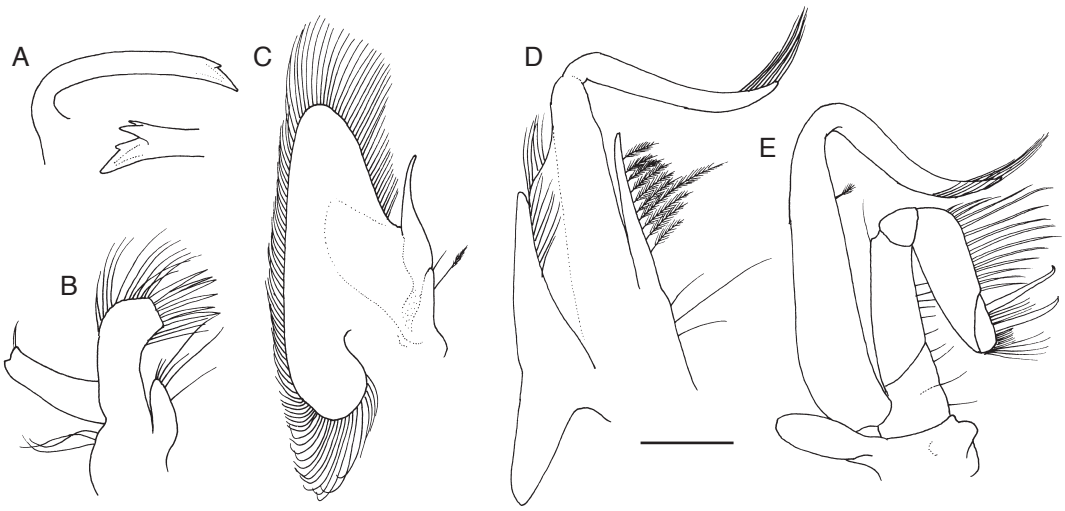

FIG. 15. — *Lissosabinea unispinosa* n. sp., left mouthparts, New Caledonia, BIOCAL, stn CP 45, paratype ovigerous ♀ cl 4.3 mm (CBM-ZC 8341): **A**, mandible, ventral view, inset, distal part, inner view; **B**, maxillule; **C**, maxilla; **D**, first maxilliped; **E**, second maxilliped. Scale bar: 0.5 mm.

Coloration
Unknown.

REMARKS
This new species is unique within the genus in having only one small middorsal tooth (= epigastric tooth) on the carapace. Other characteristics of *L. unispinosa* n. sp. include: the eye is somewhat depressed dorsoventrally and its size is very large, maximum diameter is 0.30-0.35 of the carapace length; the subchela has a strongly oblique cutting edge and relatively large, recurved pollex; and the dactyli of the fourth and fifth pereopods are subconical, neither dorsoventrally nor laterally compressed. In comparison with *L. ecarina* n. sp., *L. indica* and *L. tridentata*, the fourth and fifth pereopods are relatively stout, but being less stout than in *L. armata* n. sp.

DISCUSSION

Despite the present study, species of *Lissosabinea* still remain very rare except for *L. unispinosa* n. sp., of which 23 specimens were available for study. Four specimens of *L. indica* are newly added to the previous records; *L. ecarina* n. sp. is described based on five specimens; and *L. armata* n. sp. is represented only by two specimens, one of them is badly damaged. The available data suggests that most specimens were collected from soft bottoms, where trawl or dredge operations were possible. Therefore, the scarcity of specimens may reflect natural rarity of the animals.

Species of *Lissosabinea* are so far known from the northwestern and southwestern Pacific, Gulf of Mexico, and the southwestern Atlantic. Information on the geographical range of each species is still limited because of the scarcity of the specimens. Although the supposed highly abbreviated larval development seems to suggest that the geographical ranges of species are limited, *L. indica* shows a rather broad longitudinal range from Japan to New Caledonia. Other species seem to show limited range of distribution: *L. tridentata* ranges from the Gulf of Mexico possibly to Uruguay; *L. armata* n. sp. is known only from south of New Caledonia; *L. ecarina* n. sp. occurs only in the Philippines and Indonesia; and *L. unispinosa* n. sp. is distributed in New Caledonia and Tonga in the southwestern Pacific. It is difficult to comment further on the biogeography of the genus, as future surveys may

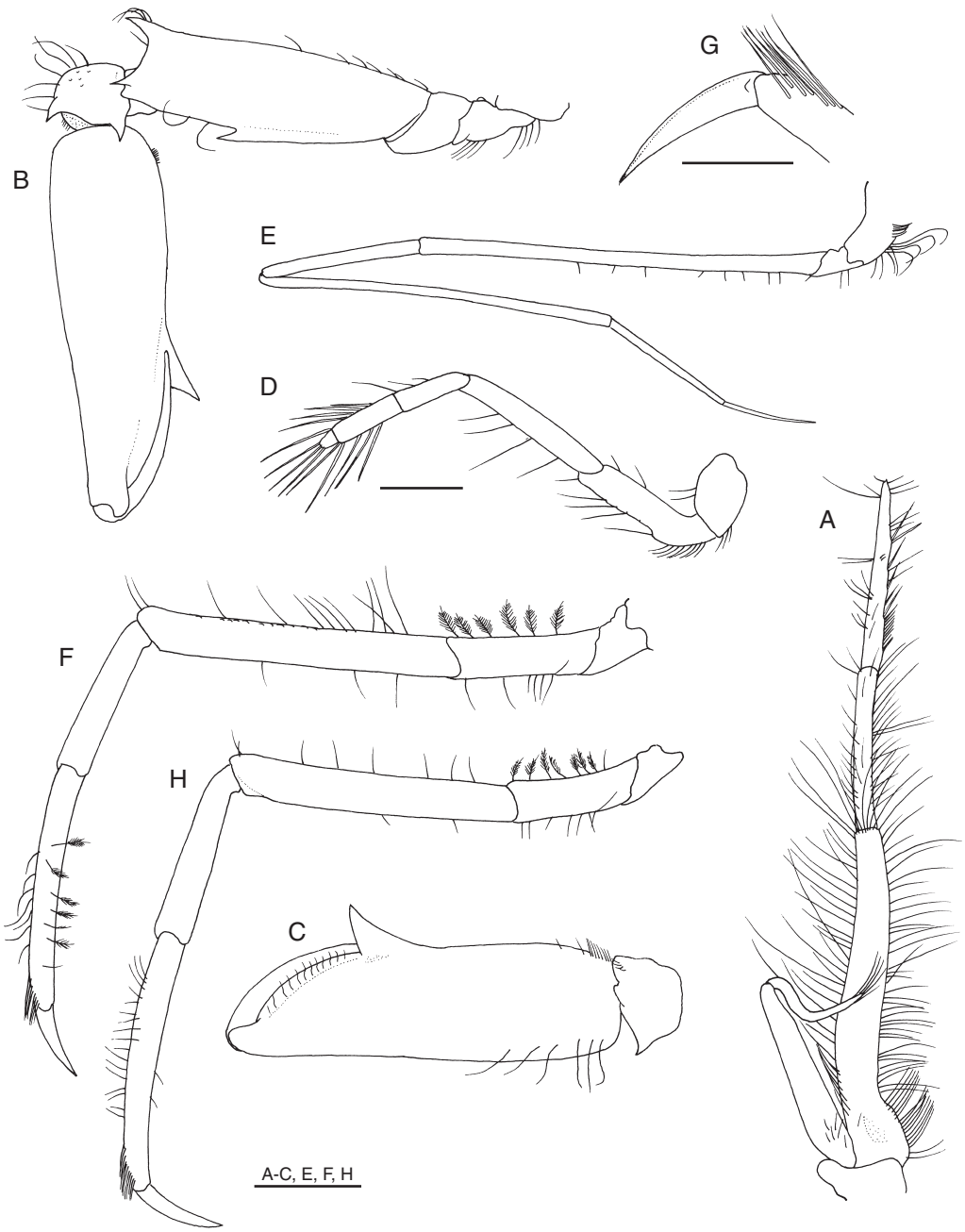

FIG. 16. — *Lissosabinea unispinosa* n. sp., left appendages, New Caledonia, MUSORSTOM 4, stn 195, holotype ovigerous ♀ cl 4.5 mm (MNHN-Na 15161): **A**, third maxilliped, dorsal view; **B**, first pereopod, lateral view; **C**, same, chela, dorsal view; **D**, second pereopod, lateral view; **E**, third pereopod, lateral view; **F**, fourth pereopod, lateral view; **G**, same, dactylus and distal part of propodus, lateral view; **H**, fifth pereopod, lateral view. Scale bars: A-C, E, F, H, 1 mm; D, G, 0.5 mm.

TABLE 2. — Summary of bathymetric ranges of species of *Lissosabinea* Christoffersen, 1988.

Species	Bathymetric range
Lissosabinea indica	146-700 m
Lissosabinea tridentata	166-391 m
Lissosabinea armata n. sp.	770-830 m
Lissosabinea ecarina n. sp.	246-472 m
Lissosabinea unispinosa n. sp.	410-610 m

eventually reveal the wider distributions of the described species and the existence of more species in the Indo-Pacific region, as has been documented for other crustacean taxa.

Species of *Lissosabinea* are exclusively inhabitants of upper bathyal zone. The bathymetrical ranges of the species greatly overlap for each other, as summarized in Table 2.

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