

Decapod Crustaceans Collected from the Southern Part of the Sea of Japan in 2000–2001 using TRV Toyoshio-maru

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Abstract During biological expeditions to the southern part of the Sea of Japan in 2000–2001 conducted on the TRV *Toyoshio-maru* of Hiroshima University, a small collection of decapod Crustacea was obtained in depths ranging from 43 to 133 m. The material is represented by five infraorders, 20 families and 41 species. It includes some little known species, such as the thalassinideans *Axiopsis tsushimaensis* Sakai, 1992, *Calaxius mimasensis* (Sakai, 1967a), and *Cheramus spinophthalmus* (Sakai, 1970), the pagurid *Catapaguroides japonicus* de Saint Laurent, 1968, and the pilumnids *Typhlocarcinops takedai* Ng, 1987 and *Xenophthalmodes morsei* Rathbun, 1932. These species are fully described and illustrated, enabling better comparisons between those species and their close relatives. Brief accounts are given for the pagurids *Anapagurus japonicus* Ortmann, 1892 and *Turleania similis* Komai, 1999b, and the galatheids *Munida japonica* Stimpson, 1858 and *M. pherusa* Macpherson and Baba, 1993, in order to supplement previous taxonomic accounts of these species.

Key words: Crustacea, Decapoda, Sea of Japan, taxonomy.

Introduction

A small, but diverse collection of decapod crustaceans from the southern part of the Sea of Japan, obtained during biological expeditions in 2000–2001 conducted on TRV *Toyoshio-maru* of the Faculty of Applied Biological Science, Hiroshima University, provides the foundation of this report. The decapod crustacean fauna of this region has been well documented (cf. Yokoya, 1933; Miyake *et al.*, 1962; Fujino and Miyake, 1970; Sakai, 1970; Takeda and Miyake, 1972; Takeda, 1973). The collection includes a total of 73 specimens (apart from those not identifiable to species level) representing five infraorders, 20 families and 41 species (Table 1). It contains some poorly or little known taxa. Among the interesting species are the axiid shrimp *Calaxius mimasensis* (Sakai, 1967a), and the pilumnid crab *Typhlocarcinops takedai* Ng, 1987, both represented only by type material. Specimens of the rare axiid

Axiopsis tsushimaensis Sakai, 1992 and the callianassid mud shrimp *Cheramus spinophthalmus* (Sakai, 1970), both of which were originally described from the surveyed area, are also included. The rare pagurid hermit crab *Catapaguroides japonicus* de Saint Laurent, 1968, known only from Sagami Bay and Suruga Bay (de Saint Laurent, 1968; Miyake, 1978), is represented by a single male specimen in the present collection. These five species are fully described and illustrated, as the original descriptions of them are based on incomplete specimens or omit several important details. Although the pilumnid *Xenophthalmodes morsei* Rathbun, 1932 has been well represented in previous literature, morphology of this species remains poorly known. Therefore, a detailed description of this species is also presented, making it possible to better assess its relationships with congeneric species. Brief accounts are given for the following species in order to supplement

Table 1. List of decapod species collected during TRV *Toyoshio-maru* cruises to southern Sea of Japan. Stations are given in the combination of the year (00=2000; 01=2001) and station number (see Table 2).

Family Species	Stations	Number of specimens	CBM-ZC reg. no.
Solenoceridae			
<i>Solenocera comata</i> Stebbing, 1915	00-07; 00-12	1; 1	5618; 5622
Sicyonidae			
<i>Sicyonia cristata</i> (De Haan, 1849)	00-05	1	5610
<i>Sicyonia curvirostris</i> Balss, 1913	00-12	1	5623
Pasiphaeidae			
<i>Leptocheila sydniensis</i> Dakin and Colefax, 1940	01-07	1	6149
Alpheidae			
<i>Alpheus collumianus</i> Stimpson, 1860	00-14	1	5634
<i>Synalpheus neomeris</i> (De Man, 1897)	01-09	1	6151
Processidae			
<i>Hayashidonus japonicus</i> (De Haan, 1849)	00-05	1	5611
Crangonidae			
<i>Philocheras incisus</i> (Kemp, 1916)	01-09	2	6152
Axiidae			
<i>Axiopsis tsushimaensis</i> Sakai, 1992	01-06	1	6146
<i>Calaxius mimasensis</i> (Sakai, 1967)	00-12	2	5624
Callianassidae			
<i>Cheramus spinophthalmus</i> (Sakai, 1970)	01-10; 01-12	7; 8	6166; 6170
Diogenidae			
<i>Diogenes penicillatus</i> (Stimpson, 1858)	01-12	1	6171
Paguridae			
<i>Anapagurus japonicus</i> Ortmann, 1892	01-09	1	6153
<i>Catapaguroides japonicus</i> de Saint Laurent, 1968	01-09	1	6154
<i>Nematopagurus vallatus</i> (Melin, 1939)	00-05	1	5614
<i>Pagurus megalops</i> (Stimpson, 1858)	00-05	1	5612
<i>Turleania similis</i> Komai, 1999	00-12	1	5625
Galatheidae			
<i>Bathymunida brevisrostris</i> (Yokoya, 1933)	01-09	1	6156
<i>Munida japonica</i> Stimpson, 1858	00-12	2	5626
<i>Munida pherusa</i> Macpherson and Baba, 1993	01-09; 01-12	2; 1	6157; 6172
<i>Paramunida scabra</i> (Henderson, 1888)	00-06	3	5615
Latreillidae			
<i>Eplumula phalangium</i> (De Haan, 1839)	01-09	1	6158
Dorippidae			
<i>Ethusa quadrata</i> Sakai, 1937	00-10	1	5639
Leucosiidae			
<i>Cryptocnemus obolus</i> Ortmann, 1892	00-12	4	5629
<i>Ebalia longimana</i> Ortmann, 1892	00-12	1	5627
<i>Ebalia tuberculosa</i> (A. Milne Edwards, 1873)	01-09	1	6160
<i>Leucosia unidentata</i> De Haan, 1841	00-06	1	5616
<i>Nursia japonica</i> Sakai, 1935	01-10	1	6165
<i>Praebebalia longidactyla</i> Yokoya, 1933	01-09	1	6161
Calappidae			
<i>Mursia trispinosa</i> Parisi, 1914	01-12	1	6173
Majidae			
<i>Cyrtomaia oustoni</i> Terazaki, 1903	00-12	1	5630
<i>Sunipea indicus</i> (Alcock, 1892)	00-10	1	5640

Table 1. (continued)

Family Species	Stations	Number of specimens	CBM-ZC reg. no.
Portunidae			
<i>Liocarcinus corrugatus</i> (Pennant, 1777)	00-10; 01-12	1; 1	5642; 6175
<i>Charybdis bimaculata</i> (Miers, 1886)	00-14	1	5635
<i>Portunus haani</i> (Stimpson, 1857)	00-05	1	5613
Canceridae			
<i>Cancer gibbosulus</i> (De Haan, 1833)	00-12; 01-12	2; 1	5617; 6174
Pilumnidae			
<i>Typhlocarcinops takedai</i> Ng, 1987	01-11; 01-12	6; 1	6168; 6176
<i>Xenopthalmodes morsei</i> Rathbun, 1932	01-11	1	6169
Goneplacidae			
<i>Carcinoplax longimanus</i> (De Haan, 1844)	01-06; 01-07	1; 1	6147; 6150
<i>Carcinoplax surugensis</i> Rathbun, 1932	01-06	1	6148
<i>Singhaplax nipponensis</i> (Yokoya, 1933)	00-07	1	5621

previous descriptions: *Anapagurus japonicus* Ortmann, 1892, *Turleania similis* Komai, 1999b, *Munida japonica* Stimpson, 1858, and *M. pherusa* Macpherson and Baba, 1993. Complete synonymies are given for *Axiopsis tsushimaensis*, *Calaxius mimasensis*, *Catagurooides japonicus*, *Typhlocarcinops takedai*, and *Xenopthalmodes morsei*, and restricted synonymies, listing significant references accompanied by illustrations, are given for the other species.

Materials and Methods

Collecting sites of the expeditions were located in depths ranging from 43 to 163 m (but one station at a depth of 721 m) in the southern part of the Sea of Japan (Table 2). Collections were made with an ORI dredge. Duration of tows was 5–10 minutes. Stations where decapods were recovered are shown in Table 2. Samples were fixed in 3% formalin sea water solution, and later preserved in 70% ethanol. They are deposited in the collection of the Natural History Museum and Institute, Chiba. Supplemental specimens from other sources have been also examined, when necessary. For thalassinideans and galatheids, postorbital carapace length (cl), measured from the posterior margin of the orbit to the midpoint of the posterodorsal margin of the carapace, is used as a standard measurement. For pagurids, shield length (sl), measured from the tip of the rostrum to the midpoint of the posterior margin of the shield, is used. For brachyurans, meas-

urements are given in this sequence: carapace length measured from the midpoint of the frontal margin to the midpoint of the posterior margin of the carapace (cl) by greatest carapace width (cw). The following abbreviations are used: CBM=Natural History Museum and Institute, Chiba; KMNH=Kitakyushu Museum of Natural History; USNM=National Museum of Natural History, Smithsonian Institution; ZLKU=Zoological Laboratory, Faculty of Agriculture, Kyushu University; ovig=ovigerous female (s); stn=station.

Taxonomic Account

Infraorder Thalassinidea

Family Axiidae

Axiopsis tsushimaensis Sakai, 1992

(Figs. 1–3)

Axiopsis consobrina De Man, 1905: 595 (part).

Axiopsis (Axiopsis) consobrina-De Man, 1925: 80 (part).

Axiopsis (Axiopsis) aff. *serratifrons*-Sakai, 1970: 37; 1987: 303 (list), 304 (list).

Axiopsis tsushimaensis Sakai, 1992: 173, figs 14, 15 [type locality: off Fukuoka, Tsushima Strait]; Sakai, 1994: 198; Komai, 2000: 228 (list).

Material examined. TRV *Toyoshio-maru*, 2001–11 cruise: stn 6, off Hagi, Yamaguchi Prefecture, 115 m, 1 female (cl 5.0 mm) (CBM-ZC 6146).

Description. Integument of body not firm.

Table 2. List of sampling data.

Station	Locality	Position	Depth	Date	Local time
00-05	N of Karatsu, Fukuoka	33°45.00' N, 130°01.18' E	43 m	14 July 2000	10:07-10:30
00-06	NE of Iki Island	33°57.23' N, 129°54.24' E	86 m	14 July 2000	08:23-08:50
00-07	N of Iki Island	34°09.27' N, 129°46.24' E	105 m	13 July 2000	16:27-17:04
00-10	S of Iki Island	34°04.26' N, 129°06.31' E	122 m	13 July 2000	09:00-09:37
00-12	S of Izuhara, Tsushima Island	33°56.21' N, 129°25.36' E	133 m	13 July 2000	11:27-12:05
00-14	NW of Iki Island	33°58.14' N, 129°31.36' E	101 m	13 July 2000	13:45-14:17
01-06	off Hagi, Yamaguchi	35°20.00' N, 131°10.00' E	115 m	05 July 2001	13:08-13:37
01-07	off Hagi, Yamaguchi	35°10.00' N, 131°10.00' E	129 m	05 July 2001	14:38-15:10
01-09	off Hagi, Yamaguchi	34°55.00' N, 131°10.00' E	79-83 m	06 July 2001	10:16-10:45
01-10	off Hagi, Yamaguchi	34°40.00' N, 131°10.00' E	99 m	05 July 2001	12:25-13:06
01-11	off Kawajiri-misaki, Yamaguchi	34°29.00' N, 131°04.20' E	86-88 m	07 July 2001	09:45-10:00
01-12	off Kawajiri-misaki, Yamaguchi	34°28.40' N, 130°52.10' E	84 m	07 July 2001	10:55-11:10

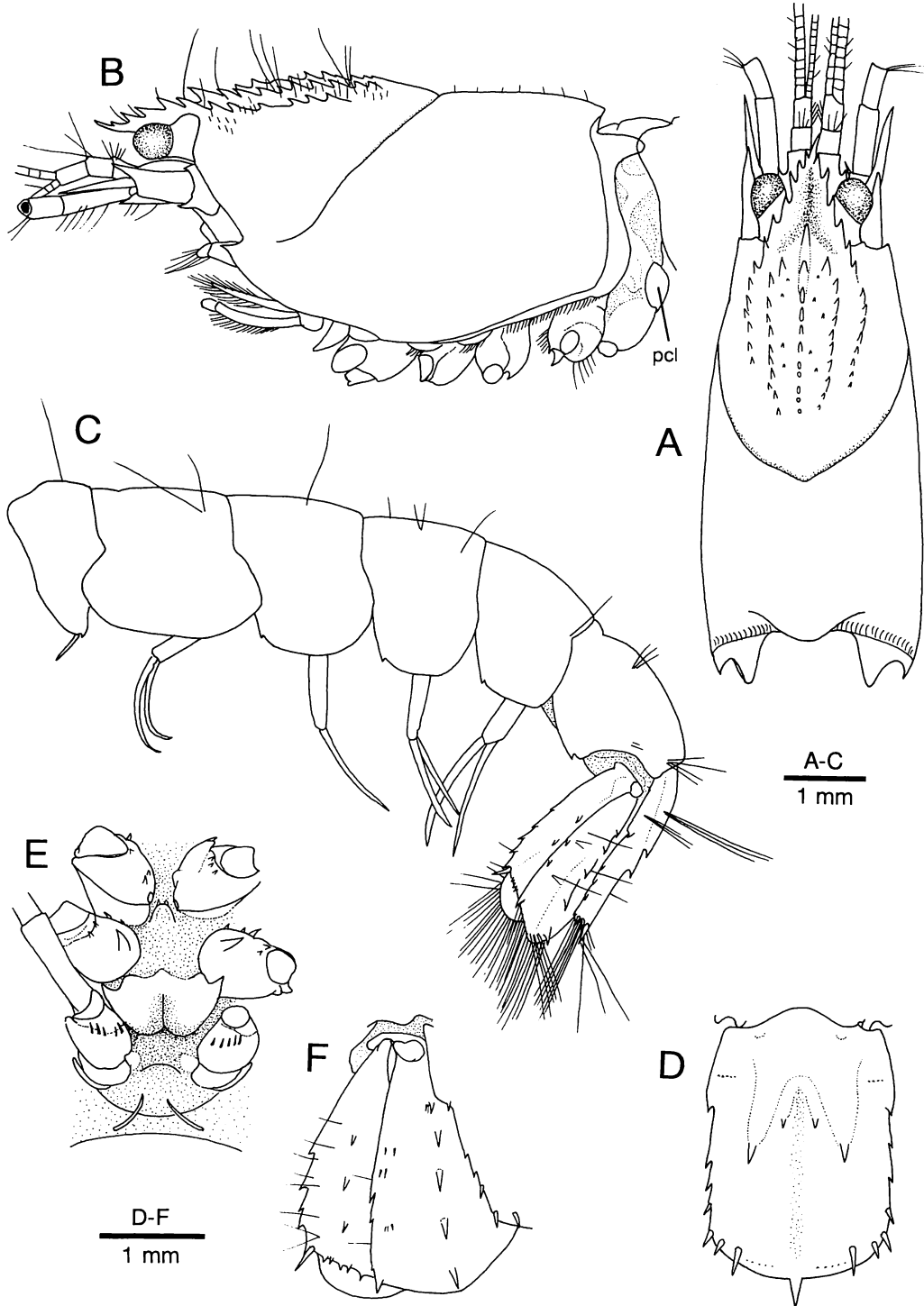


Fig. 1. *Axiopsis tsushimaensis* Sakai, 1992. Female (cl 5.0 mm, CBM-ZC 6146) from off Hagi, Yamaguchi Prefecture (stn 01-16). A, carapace and cephalic appendages, dorsal; B, same, lateral; C, abdomen, telson and abdominal appendages, lateral; D, telson, dorsal (setae omitted); E, posterior thoracic sternum, first abdominal sternite, and coxae of third to fifth pereopods, ventral (setae omitted); F, left uropod, dorsal (setae partially omitted). pcl, precoxal lobe.

Rostrum (Fig. 1A, B) directed forward, relatively broadly triangular in dorsal view, 0.29 times as long as carapace, reaching anterior margin of intermediate segment of antennular peduncle, gradually tapering, acutely pointed, slightly upturned apex; dorsal surface concave, lacking median carina; lateral margins with 5 moderately large spines becoming smaller distally on left, 4 on right, and few short setae; ventral surface rounded.

Carapace (Fig. 1A, B) smooth, with scattered short setae and row of few tufts of long setae on either side of median carina on gastric region. Gastric region slightly convex; median carina with row of 11 spines becoming larger anteriorly, extending from base of rostrum to about midlength of carapace; submedian carinae extending from level of second spine on median carina to posterior end of median carina, slightly convex against midline of carapace, armed with 10 (right) or 11 (left) small spines; lateral rostral carinae extending to level of 0.40 carapace length, parallel to submedian carinae, armed with 8 (left) or 10 (right) small spines posterior to level of orbital margin; intercarinal space between median and submedian carinae with 4 or 5 spinules. Anterolateral margin weakly convex just inferior to base of ocular peduncle, armed with strong, acute tooth at pterygostomial position. Cervical groove deep, extending nearly to base of pterygostomial tooth. Postcervical region rounded dorsally, with row of sparse, short setae. Ventrolateral and posterolateral margins broadly carinate; posterodorsal margin produced posteriorly as large, rounded lobe; cardiac notch distinct.

Abdomen (Fig. 1C) with paired long setae or tuft(s) of setae on dorsal surface of each somite. Pleuron of first somite produced ventrally in subtriangular lobe, with tiny projection on apex; that of second somite broadly rounded; those of third to fifth somites broadly rounded, but each with tiny acute tooth anteroventrally; that of sixth somite convex on ventral margin, with tiny tooth at posteroventral corner. Posterolateral projection of sixth somite rounded. Telson (Fig. 1D) subrectangular, not narrowed posteriorly, 1.40 times longer than

greatest breadth; dorsal surface with shallow median sulcus beginning from anterior 0.30 length, with 2 pairs of submedian spines and median tuft of long setae at anterior end of median sulcus; lateral margins each with 3 fixed spines; 4 pairs of movable spines present posterolaterally, mesial 2 pairs submarginal, mesialmost pair longest; posterior margin generally weakly convex, with prominent median spine.

Ocular peduncle (Fig. 1A, B) reaching beyond midlength of rostrum, somewhat constricted at base of cornea with noticeably dilated basal part. Corneal region subglobose, weakly dilated, darkly pigmented.

Antennular peduncle (Fig. 1A, B) reaching distal margin of fourth segment of antennal peduncle. Basal segment longer than distal two segments combined, with small subdistal spine arising from distolateral surface of statocyst lobe. Penultimate segment unarmed. Ultimate segment longer than penultimate segment, unarmed. Flagella somewhat shorter than carapace, each with short and long setae alternating every 2 or 3 articles; dorsal flagellum with aesthetascs on subdistal 8 or 9 articles.

Antennal peduncle (Fig. 1A, B) moderately slender. First segment with row of 5 spinules on ventrodorsal margin; antennal gland opening situated ventrolaterally. Second segment with dorsolateral distal angle produced in strong spine reaching to midlength of fourth segment. Third segment with prominent spine at ventromesial distal angle. Fourth segment subcylindrical, unarmed. Fifth segment about 0.40 times as long as fourth segment, unarmed. Scaphocerite slender, terminating in acute tip, reaching distal margin of fourth segment. Antennal flagellum missing.

Mandible (Fig. 2A) large, clearly visible in lateral view; incisor process obtusely dentate on cutting edge anteriorly; palp consisting of 3 articles, ultimate article longest, curved, with numerous setae of various length. Maxillule (Fig. 2B) with coxal endite with anteromesial margin weakly produced, bearing row of stiff setae, remaining mesial margin with row of fine setae; basal endite with row of spines on distomesial margin; palp (Fig. 2C) consisting of 2 articles, basal

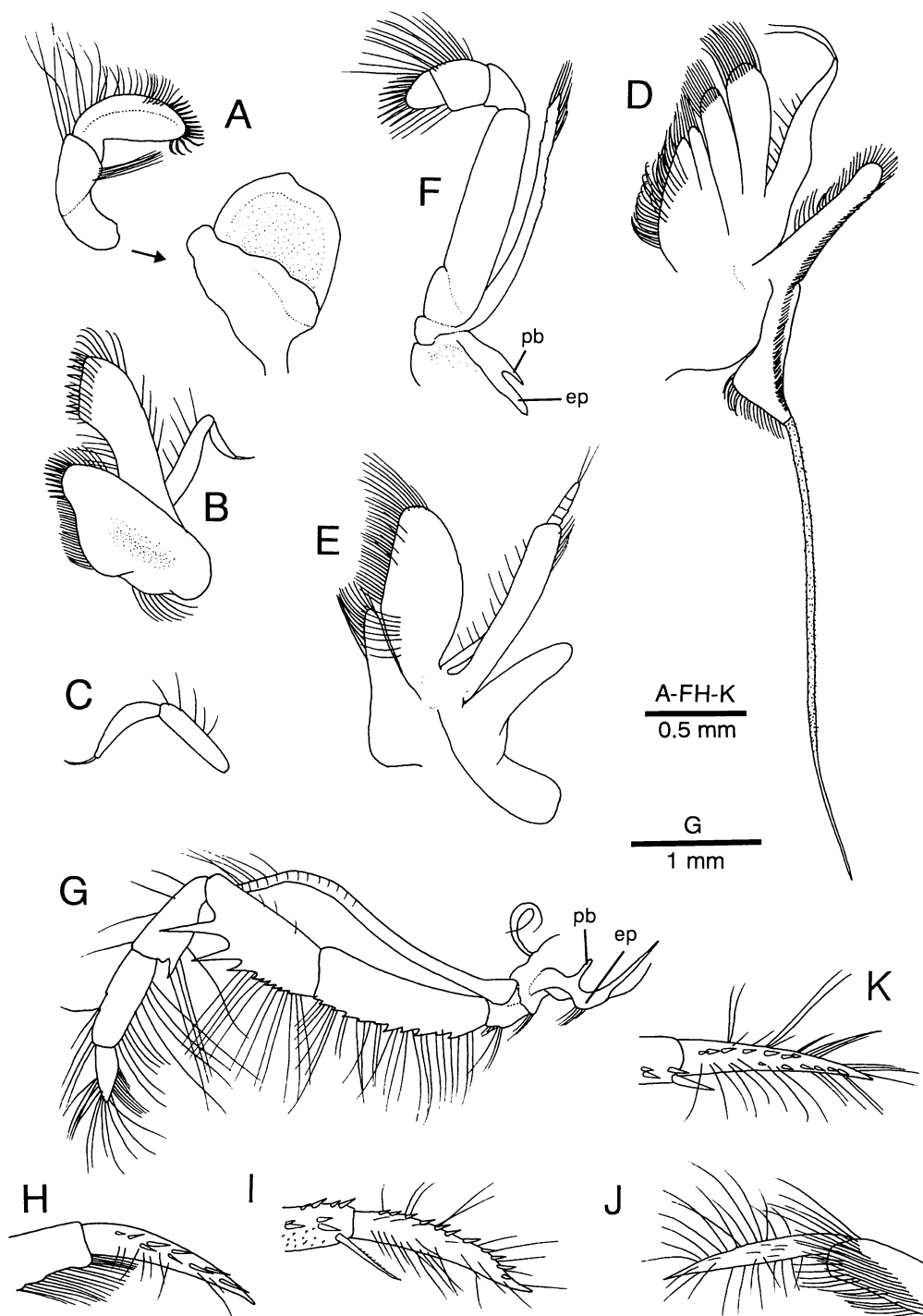


Fig. 2. *Axiopsis tsushimaensis* Sakai, 1992. Female (cl 5.0 mm, CBM-ZC 6146) from off Hagi, Yamaguchi Prefecture (stn 01-06). All appendages but fifth pereopod dissected from left. A, mandible, inner; inset, detached palp; B, maxillule, outer; C, palp of maxillule, lateral; D, maxilla, outer; E, first maxilliped, outer; F, second maxilliped, outer; G, third maxilliped, lateral; H, dactylus of third pereopod, lateral; I, dactylus of fourth pereopod, lateral; J, dactylus of right fifth pereopod, lateral; K, same, mesial. ep, epipod; pb, podobranch.

article with 5 simple setae on inner surface, distal article curved, directed posteriorly, tapering distally, with 1 apical bristle. Maxilla (Fig. 2D) with coxal endite bilobed, distal lobe much narrower than proximal lobe; basal endite bilobed, deeply notched, distal lobe somewhat broader than proximal lobe; palp elongate, overreaching anterior lobe of scaphognathite, with 2 apical setae; scaphognathite narrow, posterior lobe subtriangular, with elongate, spinulose whip. First maxilliped (Fig. 2E) with coxal endite produced anteromesially; basal endite ovate; endopod digitiform, simple; exopod nearly straight, overreaching anterior margin of basal endite, with short, 4-articulated flagellum bearing 2 apical setae. Second maxilliped (Fig. 2F) with endopod apparently 7-articulated, but merus and ischium partially fused; merus elongate; dactylus semi-circular, with row of long spines on distal margin; exopod overreaching distal margin of merus; epipod small, bearing rudimentary podobranch represented by simple bud.

Third maxilliped (Fig. 2G) overreaching distal margin of antennal peduncle by length of dactylus. Basis with 1 minute spinule on mesiodorsal margin. Ischium with denticulate ventral margin; crista dentata (not illustrated) composed of row of acute teeth noticeably becoming larger distally. Merus with 9 spines becoming larger distally (particularly distal 3 prominent). Carpus with small ventrodistal spine. Propodus subequal in length to carpus, slightly narrowed distally. Dactylus distinctly shorter than propodus, tapering distally. Exopod slender, distinctly overreaching distal margin of merus. Epipod elongate, tapering to acute apex, without minute setules on distal portion; podobranch much shorter than epipod, showing as non-lamellate, slender bud.

First pereopods (Fig. 3A, C) not massive, noticeably unequal, both strongly compressed laterally. Right first pereopod (Fig. 3A, B) with coxa bearing 2 spinules at ventromesial distal angle. Basis unarmed. Ischium short, with row of small spines becoming larger distally on ventral margin mesially. Merus becoming narrower proximally; dorsal surface slightly convex, rather sharply ridged, with prominent spine arising

distal 0.25; lateral surface weakly convex; mesial surface slightly concave; ventral margin with 1 small spine at distal corner and row of 11 spines generally becoming larger distally in proximal 0.75, distalmost spine largest, arising slightly proximal to level of dorsal subdistal spine. Carpus short, 0.59 times as long as palm, 1.38 times as long as greatest height, unarmed. Chela 3.18 times as long as deep. Palm 1.75 times as long as deep, not becoming deeper distally; dorsal margin distinctly carinate, slightly denticulate on distal half, flanked by row of sparse short setae; lateral and mesial faces weakly convex, smooth; ventral margin including fixed finger slightly sinuous, distinctly ridged, with row of minute denticles, flanked by rows of long setae. Fixed finger terminating in noticeably curved, acute, calcareous claw, with row of subacute, calcareous teeth on cutting edge and 1 corneous subdistal spine ventrally. Dactylus 0.83 times as long as palm, terminating in noticeably curved, acute calcareous claw, with tufts of long setae; dorsal margin not distinctly carinate, subdistally with small corneous spine; lateral and mesial faces convex, but devoid of distinct longitudinal carina; cutting edge subproximally with 1 prominent, rounded tooth and with row of spaced, small corneous spinules in distal 0.75.

Left first pereopod (Fig. 3C, D) slightly shorter, much more slender than right, but in armature and setation generally similar to right. Merus strongly compressed laterally, becoming narrower proximally; dorsal surface slightly convex, rather sharply ridged, with 1 prominent subdistal spine; lateral surface weakly convex; mesial surface slightly concave; ventral margin with small spine at distal corner and row of 8 spines in proximal 0.70, distalmost spine largest, proximal 5 spines small, not visible in lateral view. Carpus 0.89 times as long as palm, 2.43 times as long as greatest height. Chela 4.65 times as long as deep. Palm 2.52 times as long as deep, not becoming deeper distally; dorsal margin distinctly carinate, not denticulate; ventral margin including fixed finger nearly straight, distinctly carinate, not denticulate. Fixed finger with row of small, acute calcareous teeth over entire length on

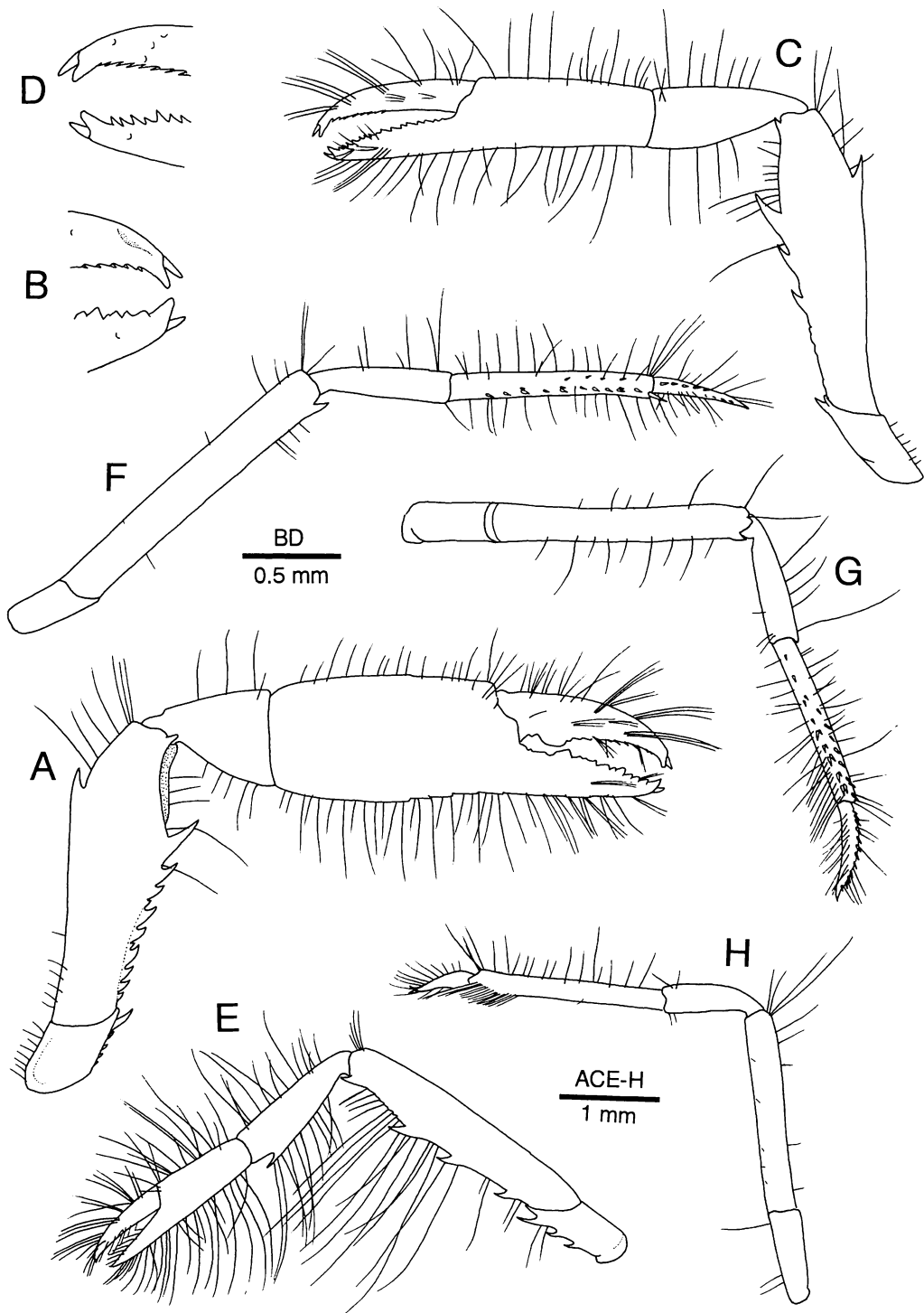


Fig. 3. *Axiopsis tsushimaensis* Sakai, 1992. Female (cl 5.0 mm, CBM-ZC 6146) from off Hagi, Yamaguchi Prefecture (stn 01-06). A, right (major) first pereopod, lateral; B, tips of fingers of right first pereopod, lateral; C, left (minor) first pereopod, lateral; D, tips of fingers of left first pereopod, lateral; E, left second pereopod, lateral; F, right third pereopod, lateral; G, right fourth pereopod, lateral; H, left fifth pereopod, lateral.

Table 3. *Axiopsis tsushimaensis* Sakai, 1992. Gill formula. r, rudimentary.

Thoracic somites	1	2	3	4	5	6	7	8
Appendages	Maxillipeds			Pereopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	—	—	—	—	—
Arthrobranchs	—	—	2	2	2	2	2	—
Podobranchs	—	r	r	r	r	r	—	—
Epipods	+	+	+	+	+	+	+	—
Exopods	+	+	+	—	—	—	—	—
Setobranchs	—	—	+	+	+	+	+	—

cutting edge. Dactylus 0.92 times as long as palm, with row of sparse corneous spinules on cutting edge.

Second pereopod (Fig. 3E) chelate, overreaching distal margin of antennal peduncle by length of dactylus. Coxa with 1 minute spinule at ventromesial distal angle. Basis unarmed. Ischium with 3 spines on straight ventral margin. Merus with 4 prominent, spaced spines on slightly convex ventral margin, distalmost spine subterminal. Carpus 0.78 times as long as chela, becoming slightly deeper distally, with 1 small subdistal spine on ventral margin. Chela 4.00 times longer than deep; palm becoming slightly deeper distally, 2.10 times as long as deep; dorsal surface rounded; ventral surface weakly carinate. Fixed finger terminating in slender corneous claw, unarmed on cutting edge. Dactylus as long as palm, terminating in slender corneous claw, with row of minute corneous spinules on distal 0.60 of cutting edge.

Third pereopod (Fig. 3F) slender, overreaching anterolateral margin of carapace by length of distal 3 segments. Coxa with 1 spine at ventromesial distal angle and 1 spine on ventral surface centrally; gonopore on mesial face. Basis and ischium unarmed. Merus 6.90 times as long as deep, with small subdistal tooth ventrodistally. Carpus 0.68 times as long as propodus. Propodus with 2 rows of corneous spinules on lateral face (dorsal row confined to distal half); 1 short ventrodistal spine present. Dactylus (Fig. 2H) 0.51 times as long as propodus, nearly straight, terminating in small corneous claw; dorsal margin with few tufts of long setae; lateral face with 2 rows of corneous spinules

(dorsal row on proximal 0.60, ventral row on distal half); mesial face without corneous spinules.

Fourth pereopod (Fig. 3G) overreaching anterolateral margin of carapace by length of dactylus and 0.60 of propodus. Coxa with tiny spinules on anteroventral margin and 1 small spine on ventral surface anteriorly. Basis and ischium unarmed. Merus 7.00 times as long as deep, with 1 ventrodistal spine. Carpus 0.69 times as long as propodus. Propodus with 2 rows of corneous spinules on lateral surface (dorsal row on distal 0.60, ventral row over entire length, spines composing ventral row sometimes paired); ventral surface with cluster of setae in distal 0.40; ventrodistal spine elongate, reaching proximal 0.35 of dactylus. Dactylus (Fig. 2I) 0.58 times as long as propodus, somewhat twisted, terminating in corneous claw; dorsal margin with row of 11 corneous spinules over entire length; lateral face with several setae ventrally; mesial face with dense cluster of setae ventrally on proximal half.

Fifth pereopod (Fig. 3H) shortest among pereopods, overreaching anterolateral margin of carapace by length of dactylus. Coxa without spines. Basis, ischium and merus unarmed. Carpus 0.52 times as long as propodus. Propodus without corneous spinules on lateral face, but with numerous grooming setae ventrodistally; ventrodistal margin with 1 slender spine. Dactylus (Fig. 2J, K) 0.36 times as long as propodus, setose, slightly curved, terminating in slender corneous claw; mesial face with 2 rows of slender corneous spinules.

Branchial formula summarized in Table 3. Gills trichobranchiate. Two arthrobranchs

on each third maxilliped through fourth pereopod. Podobranchs on third maxilliped to third pereopods rudimentary, showing as simple buds; no podobranch on fourth pereopod. Epipods on third maxilliped to fourth pereopods slender, strongly curved dorsally, without marginal denticles.

Sixth thoracic sternite (Fig. 1E) with distinct median projection bearing 2 minute submedian spinules on anterior margin. Sternal plate of seventh somite (Fig. 1E) with deep median groove; anterior margin 5-lobed, lateralmost lobes each terminating in slender spine. Eighth thoracic sternite (Fig. 1E) depressed medially, with pair of spines just mesial to coxae of fifth pereopods; precoxal lobe generally ovate, with small acute spine ventrally.

First pleopod (Fig. 1E) very small, uniramous. Second to fifth pleopods (Fig. 1C) each with long, slender appendix interna bearing cincinnuri.

Uropod (Fig. 1F) with protopodite unarmed. Endopod with lateral margin slightly convex, terminating in spine not reaching convex posterior margin, bearing 3 minutes to small spines in addition to posterolateral spine in posterior 0.40; dorsal surface with median carina bearing row of 5 small spines. Exopod with lateral margin slightly convex, bearing 5 small spines on posterior half; 1 long movable spine arising from just mesial to distolateral spine; posterior margin rounded, reaching distolateral movable spine; dorsal surface with lateral carina bearing 3 small spines, submedian carina unarmed; uropodal diaeresis distinct, dorsally with row of 5 spinules.

Coloration. In formalin. Generally yellowish white. Tips of chelae of first pereopods with tinge of orange.

Distribution. Tsushima Strait and southern Sea of Japan, at depths of 70–115 m (Sakai, 1992; present study); north of Sulu Island, the Philippines, at depth of 275 m (Sakai, 1994).

Remarks. *Axiopsis tsushimaensis* was a single juvenile specimen from off Fukuoka, Korea Strait. Subsequently, Sakai (1994) identified one of the three syntypic specimens of *Axiopsis consobrina* (De Man, 1905) from the Philippines as this species (see below). The

present specimen is referred with little hesitation to *A. tsushimaensis* as it agrees well with the original description. In addition, the collecting location of our specimen is approximate to the type locality. Minor difference between the original description and the present specimen is found in the length of the antennal scaphocerite. In the holotype, the scaphocerite falls short of the distal margin of the fourth segment of the antennal peduncle, but it reaches the margin in the present specimen. The holotype was not intact, missing the left first, fourth and fifth pereopods (Sakai, 1992). Several details, such as morphology of the mouthparts, thoracic sternum and pleopods, and gill formula, were not mentioned in the original description. Therefore, a detailed description is given here in order to supplement morphological information of this rare species. Sakai (1992) attributed the right first pereopod to being the "smaller", although the left first pereopod was missing from the holotype. It has been found that the major right first pereopod of the present specimen is similar to the right first pereopod of the holotype illustrated by Sakai in proportion of each segment and armature. It is reasonable to consider that the right cheliped of the holotype actually represents major cheliped.

Sakai and de Saint Laurent (1989) restricted the genus *Axiopsis* Borradaile, 1903 to the following four species: *A. serratifrons* (A. Milne Edwards, 1873) known from Pan-tropical waters, *A. consobrina* (De Man, 1905) from Indonesia, *A. irregularis* (Edmondson, 1930) from Hawaii, and *A. baronai* Squires, 1977 from Colombia. The remaining species previously assigned to *Axiopsis* were reassigned to other genera, including five new genera. Subsequent to Sakai and de Saint Laurent (1989), the following four species have been also assigned to the genus (Sakai, 1992; 1994; Kensley, 1996): *A. australiensis* (De Man, 1925) from southeastern Australia, *A. bythos* Kensley, 1996 from the Philippines, *A. tsushimaensis*, and *A. werribee* Poore and Griffin, 1979 from Victoria, Australia. It has been shown that diagnoses given by Sakai and de Saint Laurent (1989) for several axiid genera were not very accurate or adequate (Poore, 1994). Practically, *Axiopsis* can be

recognized by the following set of characters (Poore, 1994): rostrum broadly triangular in dorsal view; carapace not covered by scale-like tubercles, lacking prominent supraocular spine; gastric region of carapace with longitudinal carinae; ocular peduncle not particularly elongate, with cornea usually darkly pigmented; antennal scaphocerite well developed; pleurobranchs absent on fifth to seventh thoracic somites; epipods present on first to fourth pereopods; first pleopod absent in male; second to fifth pleopods each with appendix interna; exopod of uropod with distinct diaeresis.

As Sakai (1992) indicated, *A. tsushimaensis* appears most similar to *A. consobrina* in having the spinose gastric carinae on the carapace. In other congeners, the gastric carinae are smooth or at most tuberculate. He distinguished the two species by the structure of the scaphocerite and the thickness of the ocular peduncle; the scaphocerite is simple and overreaches the midlength of the fourth segment of the antennal peduncle in *A. tsushimaensis*, while it possesses one subproximal spine on the mesial margin and reaches only to the proximal one-third of the fourth segment of the antennal peduncle in *A. consobrina*; the eye is more thicker in *A. tsushimaensis* than in *A. consobrina*. Subsequently, Sakai (1994) found that two species were confounded in the syntypes of *A. consobrina*, and thus selected the male specimen from Indonesia, which was described in detail by De Man (1925), as the lectotype of *A. consobrina*. Sakai (1994) referred the young specimen from the Philippines to *A. tsushimaensis*, mentioning the simple scaphocerite lacking a subproximal spine on the mesial margin and the presence of some spines in the intercarinal spaces on the gastric region. Comparison of the present specimen with the extensive description of *A. consobrina* by De Man (1925) reveals further substantial differences between the two species. In *A. tsushimaensis*, the median gastric carina on the carapace does not extend onto the rostrum, rather than extending onto the rostrum in *A. consobrina*. The ischium of the third maxilliped is serrated with row of small spines on the ventral margin in *A. tsushimaensis*, but it is armed

only with two or three spines in the proximal half in *A. consobrina*. The ventral margin of the merus of the right major first pereopod is armed with eight to ten spines (see also Sakai, 1992) increasing in size distally in *A. tsushimaensis*, but it bears five similar spines in *A. consobrina*. The palm of the right first pereopod is smooth in *A. tsushimaensis*, instead of being tuberculate near the base of the fixed finger in *A. consobrina*.

Sakai (1992) suggested that a damaged specimen from Tsushima Island referred to *Axiopsis* (*Axiopsis*) aff. *serratifrons* by Sakai (1970) actually represented *A. tsushimaensis* because of the proximity of the sampling location to the type locality and the morphological similarity in the third maxilliped. Although Sakai's (1970) specimen was not reexamined, we agree with Sakai (1992) in identifying the specimen as *A. tsushimaensis*. Sakai (1970) presented a branchial formula of that specimen, but it appears incorrect; according to Sakai, one arthrobranch is present on the second thoracic somite and no podobranch is present on the second maxilliped to fourth pereopods. However, in our specimen, there is no actually arthrobranch, but a rudimentary podobranch is present on the second maxilliped; the podobranchs on the third maxilliped to fourth pereopods are devoid of gill lamellae, but clearly discernible as simple lobes.

***Calaxius mimasensis* (Sakai, 1967)**

(Figs. 4–6)

- Calocaris* (*Calastacus*) *mimasensis* Sakai, 1967
a: 41, pl. 3, fig. 1 [type locality: Tosa Bay];
Miyake, 1982: 192 (list); 1991a: 192 (list);
1998b: 192 (list).
Calocaris mimasensis-Sakai, 1987: 303 (list),
305 (list).
Calaxius mimasensis-Sakai and de Saint Laurent,
1989: 86; Komai, 2000: 229 (list).

Material examined. TRV *Toyoshio-maru*, 2000–10 cruise: stn 12, off Tsushima Island, 133 m, 1 male (cl 5.6 mm), 1 female (cl 6.6 mm) (CBM-ZC 5624).

Description. Integument of body firm.

Rostrum (Fig. 4A–C) directed forward, narrowly triangular in dorsal view, 0.23 times as long as carapace, reaching mid-

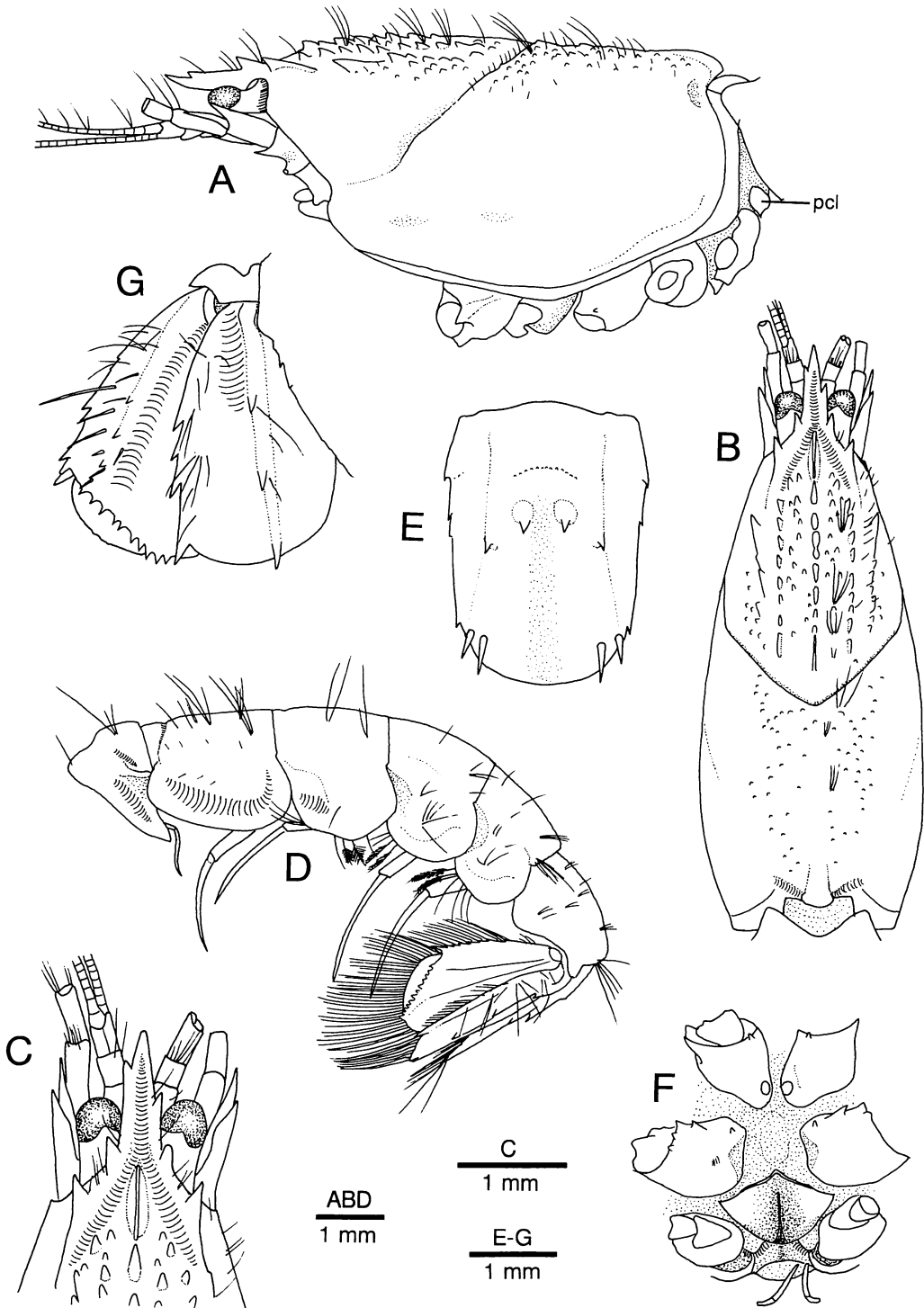


Fig. 4. *Calaxius mimasensis* (Sakai, 1967). Female (cl 6.6 mm, CBM-ZC 5624) from Tsushima Strait (atn 00-10). A, carapace and cephalic appendages, lateral; B, same, dorsal; C, anterior part of carapace and cephalic appendages, dorsal; D, abdomen, telson and abdominal appendages, lateral; E, telson, dorsal (setae omitted); F, posterior thoracic sternites and coxae of third to fifth pereopods, ventral (setae omitted); G, left uropod, dorsal (setae partially omitted). pcl, precoxal lobe.

length of distal segment of antennular peduncle, tapering to acutely pointed, slightly upturned apex; dorsal surface concave, lacking median carina in anterior 0.50–0.70; lateral margins each with 2 large spines (asymmetrically arranged from right to left; anterior spine smaller than posterior); ventral surface rounded, unarmed.

Carapace (Fig. 4A–C) with gastric region weakly convex, bearing scattered, minute simple setae and 3 pairs of tufts of longer plumose setae; median carina extending from proximal 0.30–0.50 of rostrum to adjacent to cervical groove, with 7–10 small denticles becoming sharper and larger anteriorly, anterior 0.20 unarmed, somewhat crested; submedian carinae extending from level of anteriormost denticle on median carina to somewhat anterior to cervical groove, mostly parallel to midline of carapace, armed with 9–11 acute or subacute spines; lateral rostral carinae interrupted posterior to supraocular spine; supraocular spine about same size of posterior spine on lateral rostral carina; posterior division of lateral rostral carinae low, subparallel to midline of carapace, bearing 4 tiny spinules, terminating anteriorly in prominent spine at level of anterior 0.20 of carapace length; intercarinal space between median and submedian carina with irregular single row of 8–13 acute or subacute spinules increasing in size anteriorly. Anterolateral margin weakly convex just ventral to base of ocular peduncle, pterygostomial margin broadly rounded. Cervical groove deep, extending to pterygostomial region. Post-cervical region with numerous, scattered minute tubercles, minute simple setae and 3 pairs of tufts of long plumose setae; posteromedian lobe supported by short, broad median carina. Sharp submarginal ridge along ventrolateral and posterolateral margins; cardiac notch distinct.

Abdominal somites (Fig. 4D) with paired short to long setae or tuft(s) of setae on dorsal surface. Terga of all somites rounded dorsally, that of first somite anteriorly with conspicuous transverse groove interrupted medially. Pleuron of first somite forming narrowly triangular lobe with blunt or acute ventral apex, lateral face shallowly grooved medially; those of second to fifth somites

broadly rounded, that of second somite with shallow submarginal groove; that of sixth somite obtusely triangular. Posterolateral projection of sixth somite well produced, rounded. Telson (Fig. 4E) subrectangular, slightly narrowed posteriorly, 1.37 times longer than greatest breadth at level of anterior 0.25 length; dorsal surface with shallow median sulcus beginning from anterior 0.40 length, with 2 pairs of submedian spines (anterior pair arising from slightly anterior to midlength, posterior pair at midlength); lateral margins each with 2 or 3 small fixed spines; 2 or 3 pairs of movable spines present posterolaterally (mesial pair longer, submarginal); posterior margin generally broadly convex, without median spine.

Ocular peduncle (Fig. 4A, C) reaching beyond midlength of rostrum, somewhat inflated basally. Corneal region subglobose, weakly dilated, darkly pigmented.

Antennular peduncle (Fig. 4A, C) reaching midlength of fifth segment of antennal peduncle. Basal segment longer than distal 2 segments combined, lateral and dorsomesial margins of statocyst lobe somewhat expanded; no spine on statocyst lobe. Penultimate segment unarmed. Ultimate segment longer than penultimate segment, unarmed. Flagella somewhat longer than carapace, dorsal flagellum with long setae every 2 or 3 articles, ventral flagellum with shorter setae every 2 or 3 articles on proximal half.

Antennal peduncle (Fig. 4A, C) moderately slender. First segment with 2 spines on ventrodistal margin; antennal gland opening situated ventrolaterally. Second segment with dorsolateral distal angle produced in strong spine reaching to midlength of second segment. Third segment with prominent spine at ventromesial distal angle. Fourth segment subcylindrical, unarmed. Fifth segment about 0.40 times as long as fourth segment, unarmed. Antennal acicle (=scaphocerite) slender, terminating in acute tip, slightly falling short of or reaching distal margin of fourth segment. Antennal flagellum missing.

Mouthparts generally similar to those of *Axiopsis tsushimaensis* described above. First maxilliped with endopod digitiform, simple, but abruptly narrowed at midlength;

exopod with rudimentary flagellum consisting of 1 article and apical setae. Second maxilliped with rudimentary podobranch represented by simple bud; epipod elongate, minutely denticulate marginally.

Third maxilliped (Fig. 6A) overreaching distal margin of antennal peduncle by length of dactylus. Basis with 1 small spine on ventral margin mesially. Ischium with 2 small spines on ventral margin; crista dentata (not illustrated) composed of row of acute teeth noticeably becoming larger distally. Merus with 2 or 3 prominent spines in distal 0.75 of ventral margin (posterior-most spine sometimes rudimentary), distal-most spine largest. Carpus with tiny ventrodistal spine. Propodus subequal in length to carpus, slightly narrowed distally. Dactylus distinctly shorter than propodus, slightly tapering distally. Exopod slender, slightly overreaching distal margin of merus. Epipod foliaceous, with elongate, minutely denticulate distal part; podobranch much shorter than epipod, distinctly lamellate.

First pereopods (Fig. 5) massive, noticeably unequal with left larger in female (in male specimen, right cheliped missing). Left major first pereopod (Fig. 5A–C) with coxa bearing 1 spinule on ventrodistal margin, posteromesial part somewhat produced, bearing 1 or 2 minute spinules. Basis unarmed. Ischium short, with 4 spines becoming larger distally on ventral margin. Merus strongly compressed laterally, becoming narrower proximally; dorsal margin convex in distal 0.25, sharply carinate, with 2 prominent subdistal spines; lateral surface weakly convex; mesial surface concave; ventral margin with row of 7 spines (2 proximal spines small and directed mesially, thus not visible in lateral view) becoming larger distally, distal-most spine somewhat proximal to level of first spine on dorsal margin. Carpus articulated obliquely to merus (angle 15–20° degree from perpendicular plane of merus), 0.53 times as long as palm, 0.85 times as long as deep; dorsal surface faintly ridged mesially, with 3 spines becoming larger distally. Chela 0.86 times as long as carapace in male, 0.94 times as long in female, 2.22–2.30 times as long as deep. Palm 1.20–1.28 times as long as deep, not becoming deeper distally; dorsal

surface not carinate, with 3 large spines and numerous small protuberances accompanied with tufts of short to long plumose setae, general outline in lateral view slightly convex; lateral face weakly convex, with few prominent tubercles and scattered small tubercles, and with numerous tufts of long setae obscuring surface, ventrolateral margin sharply carinate; mesial faces weakly convex, with few tiny tubercles and tufts of short, stiff setae. Fixed finger terminating in slightly curved, blunt or subacute calcareous claw, with 2 rows of tufts of short plumose setae on lateral face and 1 row of simple stiff setae on mesial face; ventrolateral carina extending to distal 0.25 of fixed finger proper; cutting edge with 4 low, rounded calcareous teeth in proximal 0.60. Dactylus 0.88–0.90 times as long as palm, terminating in noticeably curved, blunt or subacute calcareous claw crossing tip of fixed finger; dorsal surface rounded, with double or triple row of tufts of setae; lateral face bluntly carinate in midline on proximal half, with several tufts of setae; mesial face rounded, with 1 row of tufts of setae adjacent to cutting edge; cutting edge devoid of conspicuous teeth, but with broad notch leaving narrow hiatus proximally.

Right minor first pereopod (Fig. 5D, E) somewhat smaller than right (left chela about 0.80 times as long as right chela) slightly more slender than right, but in structure and setation generally similar to right. Ischium with 4 spines on ventral margin (distal most tooth much larger than others). Merus with 6 spines becoming larger distally on ventral margin; dorsal margin with 4 spines becoming larger distally. Carpus 0.75 times as long as palm, 1.09 times as long as greatest height; dorsal surface faintly ridged, with 3 spinules. Chela 2.28 times as long as deep. Palm 1.14 times as long as deep, not becoming deeper distally; dorsal margin rounded, with 3 prominent spines becoming larger distally; lateral face 1 prominent spine near base of fixed finger and scattered low, small tubercles each bearing tufts of long setae, ventrolateral margin sharply carinate. Fixed finger broken off distally, cutting edge weakly concave in proximal 0.40, bearing 1 prominent, subacute tooth at midlength.

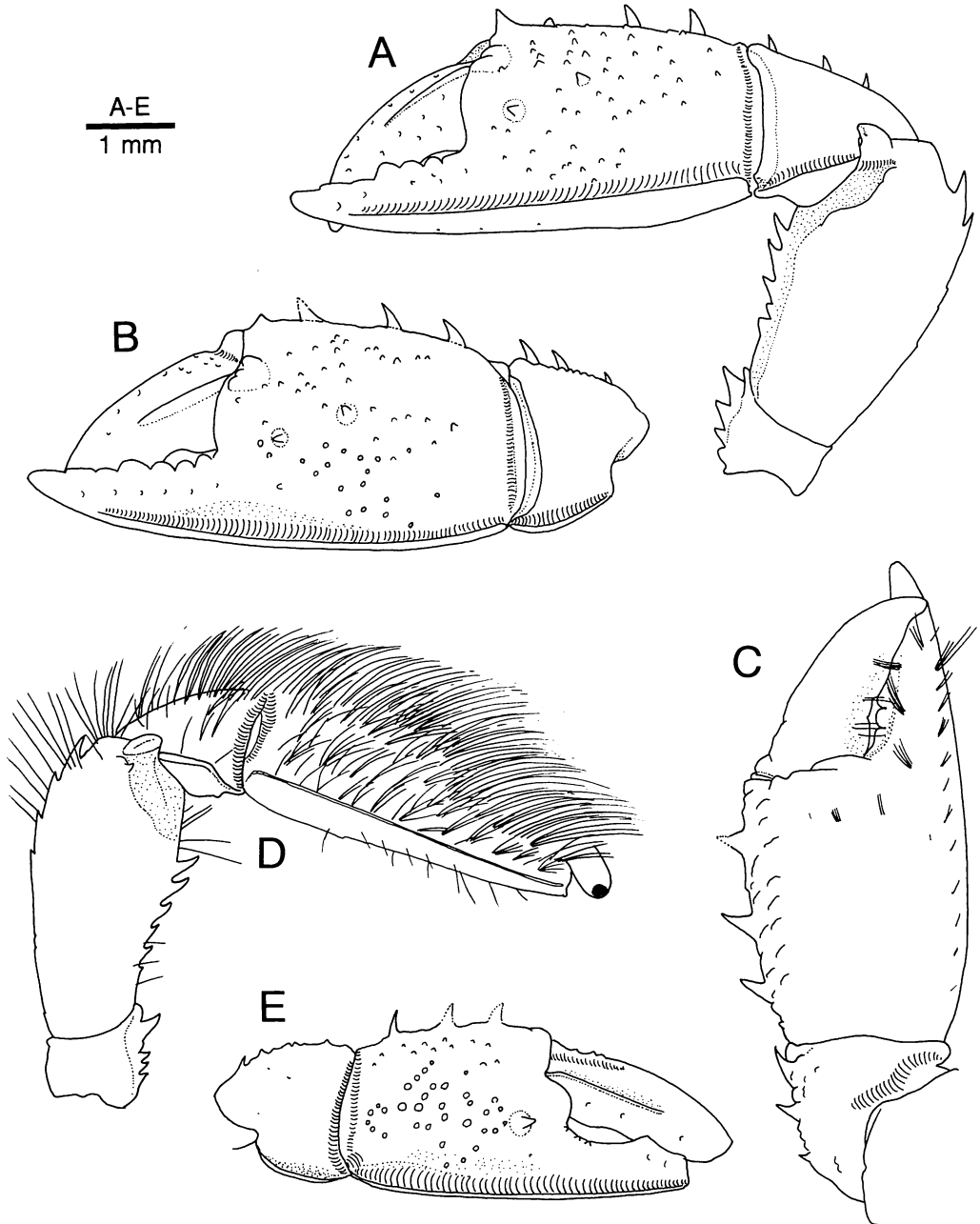


Fig. 5. *Calaxius mimasensis* (Sakai, 1967). Female (cl 6.6 mm, CBM-ZC 5624) from Tsushima Strait (stn 00-10). A, left (major) cheliped, lateral (setae omitted); B, same, chela and carpus, obliquely lateral view perpendicular to horizontal plane; C, same, obliquely mesial view perpendicular to horizontal plane (setae omitted); D, right (minor) cheliped, lateral; E, same, chela and carpus, obliquely lateral view perpendicular to horizontal plane (setae omitted).

Dactylus broken off distally, remainder 1.15 times as long as palm, cutting edge with obsolete tooth at slightly proximal to midlength.

Second pereopod (Fig. 6B) chelate, over-reaching distal margin of antennal peduncle by length of dactylus. Coxa with 1 minute tubercle at ventrolateral distal angle; poster-

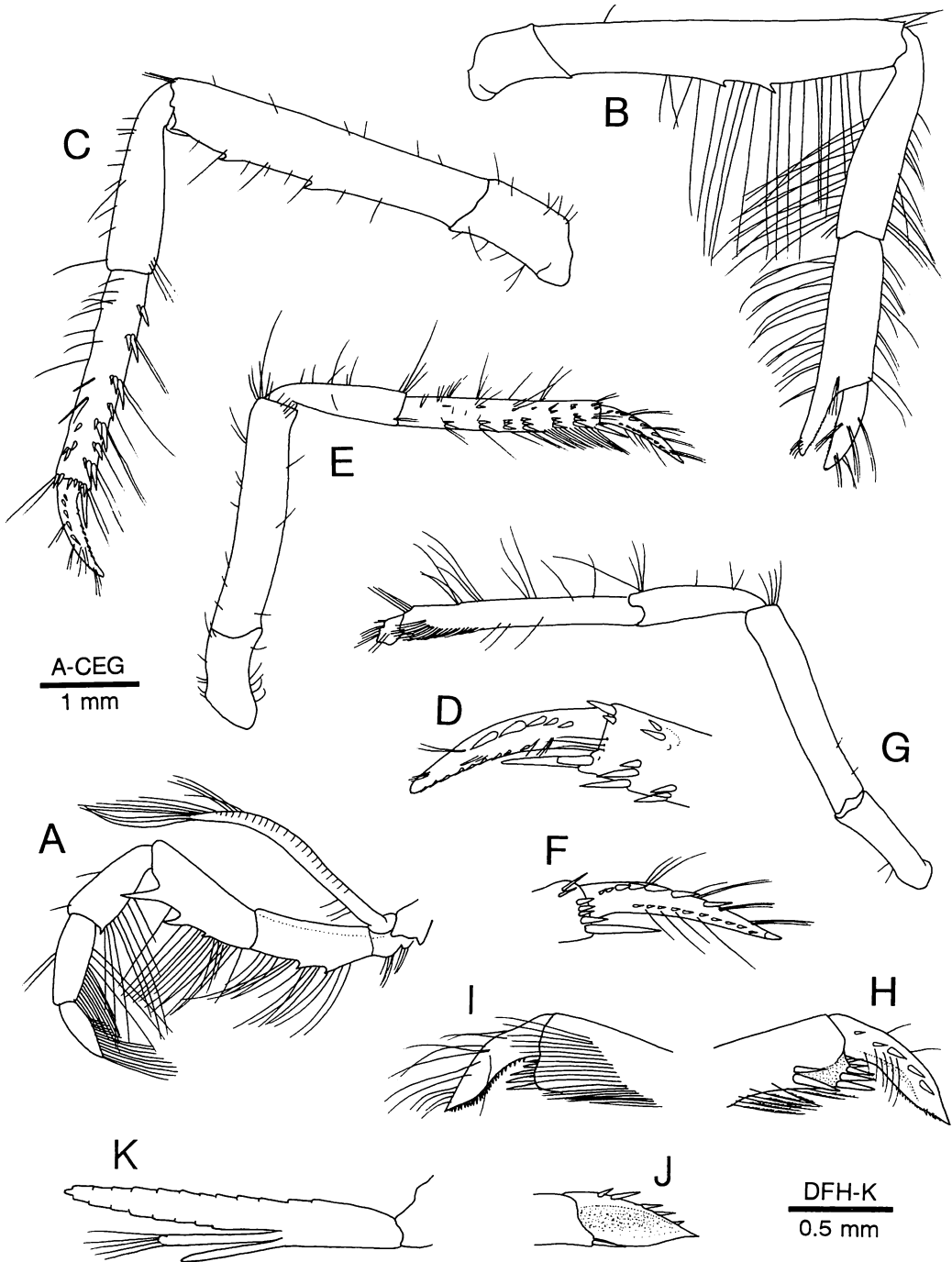


Fig. 6. *Calaxius mimasensis* (Sakai, 1967). A-D, G-J, female (cl 6.6 mm, CBM-ZC 5624) from Tsushima Strait (stn 00-10); E, F, K, male (cl 5.6 mm, same lot). A, left third maxilliped, lateral; B, right second pereopod, lateral; C, left third pereopod, lateral; D, same, distal part of propodus and dactylus, lateral (setae partially omitted); E, right fourth pereopod, lateral; F, same, distal part of propodus and dactylus, lateral (setae partially omitted); G, left fifth pereopod, lateral; H, same, distal part of propodus and dactylus, flexor (setae partially omitted); I, same, extensor (setae partially omitted); J, same, mesial (setae omitted); K, endopod of left second pleopod, ventral (setae on endopod proper omitted).

omesial part produced posteriorly, terminating in minute spine. Basis with 1 spinule at distolateral angle. Ischium with concave ventral margin terminating distally in tiny tubercle. Merus with 2 small spines on ventral margin adjacent to midlength. Carpus 0.94 times as long as chela, becoming slightly deeper distally, without spine on ventral margin. Chela 4.57 times longer than deep; palm not becoming deeper distally, 2.81 times as long as deep; dorsal and ventral surfaces not distinctly carinate. Fixed finger terminating in small corneous claw, cutting edge with row of minute corneous spinules becoming more widely spaced proximally. Dactylus 0.70 times as long as palm, terminating in small corneous claw, cutting edge with row of minute, closely set corneous spinules in distal 0.60.

Third pereopod (Fig. 6C, D) moderately slender, overreaching anterolateral margin of carapace by length of distal three segments. Coxa with 1 minute blunt spine on ventromesial distal margin; no gonopore-like structure in male; gonopore in female situated at posteromesial part of coxa. Basis with 1 spinule at distolateral margin. Ischium with concave ventral margin devoid of spines. Merus 5.56 times as long as deep, with 2 or 3 widely spaced spines on ventral margin. Carpus 0.85 times as long as propodus. Propodus with lateral face bearing row of couplet or triplet of small corneous spines ventrally and short row of small corneous spines dorsally in distal 0.30; mesial face without corneous spines; ventrodistal margin with 2 long spines (mesial spine longer, reaching midlength of dactylus). Dactylus 0.49 times as long as propodus, slightly curved, terminating in small acute unguis; dorsal surface with few tufts of long setae; lateral face with row of 5 or 6 small corneous spines dorsally and row of minute corneous spinules ventrally; mesial face without corneous spines or spinules.

Fourth pereopod (Fig. 6E, F) overreaching anterolateral margin of carapace by length of dactylus and half of propodus. Coxa with minute tubercle on ventromesial distal margin. Basis unarmed. Ischium with concave ventral margin devoid of spines. Merus 5.0 times as long as deep, without spines on

ventral margin. Carpus 0.66 times as long as propodus. Propodus with longitudinal row of simple to triplet corneous spinules dorsally and short transverse rows of 2-4 small corneous spines ventrally (spines becoming longer ventrally), and with numerous setae on ventral surface in distal 0.40; ventrodistal margin with 1 long spine reaching 0.40 of dactylus. Dactylus 0.49 times as long as propodus, slightly twisted, terminating in acute unguis, with row of small corneous spines dorsally and row of minute corneous spinules ventrally; mesial face unarmed.

Fifth pereopod (Fig. 6G-J) shortest and most slender among pereopods, overreaching anterolateral margin of carapace by length of dactylus. Coxa without spines. Basis, ischium and merus unarmed. Carpus 0.59 times as long as propodus. Propodus becoming somewhat broader distally, with mesiodistal portion somewhat produced bearing bundle of corneous spines, showing semichelate condition; ventrolateral face with obliquely longitudinal band of grooming setae extending distally from distal 0.40; mesial face with subterminal couplet of corneous spines. Dactylus foliaceous in shape, 0.30 times as long as propodus, somewhat twisted, directed mesially, terminating in slender corneous unguis; lateral (extensor) surface with several setae; mesial (flexor) surface concave, with row of 5 small corneous spines dorsally; ventral margin sinuous, with row of minute corneous spinules.

Branchial formula summarized in Table 4. Gills trichobranchiate. Pleurobranchs on fifth to seventh thoracic somites distinctly shorter than arthrobranchs on corresponding somites, but distinctly lamellate. Two well-developed, lamellate arthrobranchs on each third maxilliped to fourth pereopod. Podobranchs on third maxilliped to third pereopods each shorter than distal part of epipod, distinctly lamellate. Distal parts of epipods on third maxilliped to fourth pereopods directed dorsally, foliaceous, marginally denticulate.

Epistome generally triangular, surface flattened. Sixth thoracic sternite (Fig. 4F) without median projection. Seventh thoracic sternite (Fig. 4F) with anterior section separated from sternal plate by distinct

Table 4. *Calaxiopsis mimasensis* (Sakai, 1967). Gill formula.

Thoracic somites	1	2	3	4	5	6	7	8
Appendages	Maxillipeds			Pereopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	—	+	+	+	—
Arthrobranchs	—	—	2	2	2	2	2	—
Podobranchs	—	—	+	+	+	+	—	—
Epipods	+	+	+	+	+	+	+	—
Exopods	+	+	+	—	—	—	—	—
Setobranchs	—	—	—	+	+	+	+	—

transverse ridge, its ventral surface weakly concave; sternal plate with deep median groove, anterolateral margins produced ventrally, each terminating in acute tooth. Eighth thoracic sternite (Fig. 4F) consisting of low transverse ridge divided medially by deep longitudinal groove; depressed medially, with pair of spines just mesial to coxae of fifth pereopods; precoxal lobe generally ovate, with small acute spine ventrally.

First pleopod absent in male; first pleopod in female (Fig. 4F) very short, uniramous. Second to fifth pleopods each with long, slender appendix interna bearing cincinnuri; appendix masculina of male second pleopod (Fig. 6K) slightly longer than appendix interna, bearing 5 simple stiff setae distally.

Uropod (Fig. 4G) with protopodite unarmed. Endopod with lateral margin slightly convex, bearing 3 spinules, terminating posteriorly in prominent spine; dorsal surface with median carina bearing row of 3 spines (posteriormost spine submarginal, reaching beyond posterior margin of endopod). Exopod with lateral margin slightly convex, bearing 2-4 spinules, terminating posteriorly in small spine; 1 slender movable spine arising from just mesial to distolateral spine, not reaching posterior margin of exopod; posterior margin broadly rounded; dorsal surface with lateral carina bearing 1-4 minute spinules, submedian carina low, unarmed; uropodal diaeresis distinct, dorsally with row of 9-10 spinules.

Coloration. In formalin. Carapace generally ivory, with broad longitudinal stripe of orangish brown narrowed posteriorly on lateral face. Abdomen white on tergum, reddish brown in pleura. Ocular peduncle

with tinge of orange laterally. Antennal peduncles with tinge of dark orange basally. Chelae of first pereopods generally ivory, fingers light orange; palms each with tinge of dark orange at base of dactylus; carpi ivory, with blotch of light orange laterally; meri ivory in distal 0.20, remainder light orange. Second pereopods generally light orangish brown. Third to fifth pereopods generally light orangish brown, distal parts of carpi and meri with tinge of white.

Distribution. Previously known only from Tosa Bay, Shikoku, Japan, at a depth of 200 m (Sakai, 1967a).

Remarks. Sakai and de Saint Laurent (1989) established a new genus *Calaxius* to accommodate a new species, *C. acutirostris* (type species of the genus) and seven other species previously assigned to various axiid genera: *C. inaequalis* (Rathbun, 1901) known from Puerto Rico, *C. pailoloensis* (Rathbun, 1906) from Hawaii and Indonesia, *C. euphthalmus* (De Man, 1905) from Indonesia, *C. sibogae* (De Man, 1925) from Indonesia, *C. mimasensis* (Sakai, 1967a) from Japan, *C. jeneri* (Williams, 1974) from North Carolina, and *C. oxypleura* (Williams, 1974) from the Straits of Florida. Subsequently, two new species, *C. manningi* Kensley, Lin and Yu, 2000 and *C. galapagensis* Kensley and Hickman, 2001, have been described from Taiwan and Galapagos Islands, respectively. So far, ten species are known in the genus. The genus *Calaxius* is recognized by the following features (cf. Poore, 1994): supraocular spine prominent; antennal scaphocerite simple; uropodal exopod with distinct diaeresis; epipods present on first to fourth pereopods; pleurobranchs present on fifth to

seventh thoracic somites; first pleopod absent in male; second to fifth pleopods each with well-developed appendix interna.

Calaxius mimasensis was originally described based on a single female specimen collected in Tosa Bay, Japan by Sakai (1967a) [as *Calocaris (Calastacus)*]. There has been no subsequent record of this rare species. Our specimens generally fit the original description by Sakai (1967a) particularly in conformation of the gastric carinae, development of the antennal scaphocerite, armature of the third maxilliped and uropod, shape of the telson and longitudinally striped color of the body. However, some differences between our specimens and the original description are apparent: the first pereopods are more strongly unequal in the present female specimen than in the holotype (in the male specimen, the right first pereopod is missing); the teeth on the cutting edge of the fixed finger of the smaller first pereopod are fewer in the present female specimen than in the holotype; there is an irregular single row of small tubercles in the intercarinal space between the median and submedian carinae on the gastric region in the present specimens, but no tubercles are mentioned or illustrated in the original description; two movable spines at the posterolateral corner of the telson appear much longer in the present specimens than in the holotype. The holotype was deposited in the collection of ZLKU under registration number 12086 (Sakai, 1967a). The ZLKU collection is now housed in the Kitakyushu Museum of Natural History. At our request, Dr. Y. Yabumoto checked the data base of the type material registered in the KMNH collection, but the holotype of *C. mimasensis* has not been registered nor located. Therefore, it is impossible to assess whether those discrepancies are due to intraspecific variation or inaccuracy in the original description. Concerning the possibility that the general variability observed in *C. mimasensis* may extend to the first pereopods and armature of the carapace and telson as in other axiid species, it is best at present to refer our specimens to *C. mimasensis*.

Sakai and de Saint Laurent's (1989) reassignment of this species to *Calaxius* was

based only on the female holotype. However, morphology of the first to fifth pleopods, which provide generic diagnosis (see above), remains unknown in this species. During this study, the absence of the first pleopod in male and the presence of the well-developed appendix internae on the second to fifth pleopods have been confirmed in the present specimens, and the generic assignment of this species is now fully supported. Kensley and Hickman (2001) indicated that the species of *Calaxius* fall into two groups, those with strongly triangular and ventrally acute abdominal pleura, and those with ventrally rounded pleura. However, the abdominal pleura of *C. mimasensis* has remained unknown (Kensley and Hickman, 2001). The present study has shown that *C. mimasensis* is referable to the latter group. *C. mimasensis* appears most similar to *C. galapagensis*. In these two species, the median and submedian gastric carinae are distinctly spinose; and the propodi of the third and fourth pereopods are armed with strong transverse rows of small corneous spines (see Kensley and Hickman, 2001). Nevertheless, *C. mimasensis* is readily distinguished from *C. galapagensis* by a number of characters. In *C. mimasensis*, the distalmost lateral spines on the rostrum are not particularly strong, and thus the rostrum terminates in simple acuminate point. In *C. galapagensis*, the distal part of the rostrum is clearly tridentate, giving a unique configuration in the genus. The anteriormost division of the gastric median carina consists of a short ridge extending beyond the level of the orbital margin and terminating anteriorly in a tiny blunt point in *C. mimasensis*, while it does not reach to the orbital margin and terminates in a strong acute spine in *C. galapagensis*. The antennal scaphocerite is distinctly longer in *C. mimasensis* than in *C. galapagensis*. The ischium of the third maxilliped bears two ventral spines in *C. mimasensis*, while it is unarmed in *C. galapagensis*. The dorsal surfaces of the palms of the first pereopods are each armed with three spines in *C. mimasensis*, rather than five spines in *C. galapagensis*. The anterolateral margin of the telson is less strongly expanded in *C. mimasensis* than in *C. galapagensis*.

The spinose submedian gastric carinae

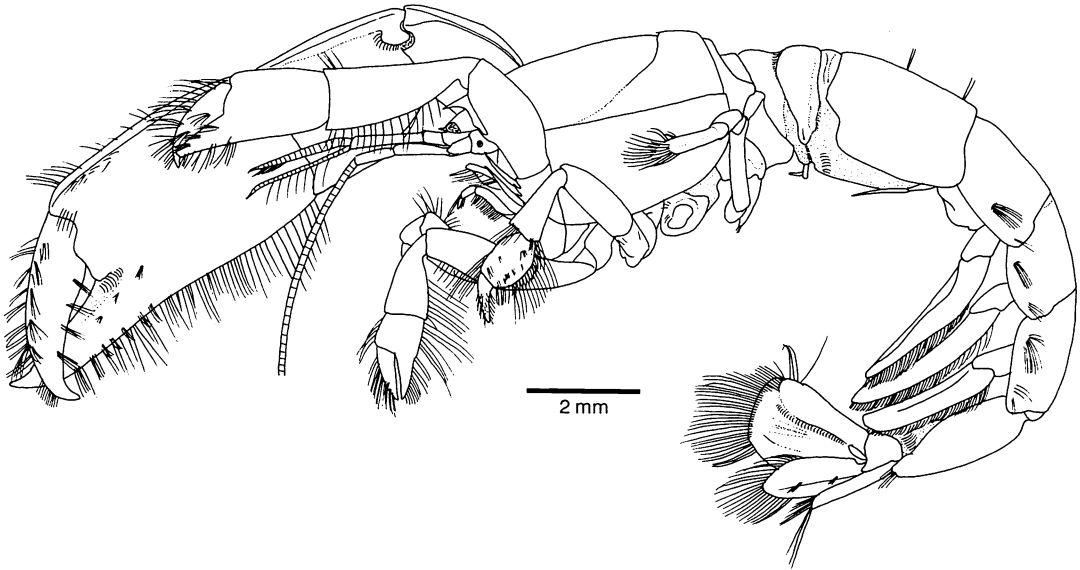


Fig. 7. *Cheramus spinophthalmus* (Sakai, 1970). Male (cl 3.3 mm, CBM-ZC 6166) from off Hagi, Yamaguchi Prefecture (stn 01-10), entire animal in lateral view (fourth pereopod missing).

bearing more than four spines or tubercles also link *C. mimasensis* to *C. pailoloensis*, but the more spinose median gastric carinae, stronger developed transverse rows of corneous spines on the propodus of the third pereopod, and more setose chelae of the first pereopod immediately distinguish *C. mimasensis* from *C. pailoloensis* (cf. Rathbun, 1906; Sakai and de Saint Laurent, 1989).

Family Callianassidae

Cheramus spinophthalmus (Sakai, 1970) (Figs. 7-11)

Callianassa (Cheramus) spinophthalma Sakai, 1970: 40, figs. 2-3, 4a-b [type locality: off Tsushima Island, southern Sea of Japan]; Miyake, 1982: 193 (list); 1991a: 193 (list); 1998a: 193 (list).

Callianassa spinophthalma-Sakai, 1987: 304 (list), 306 (list); Sakai, 1999: 36 (key), 52.

Cheramus spinophthalmus-Tudge *et al.*, 2000: 145.

Material examined. TRV *Toyoshio-maru* 2001-11 cruise: stn 10, off Hagi, Yamaguchi Prefecture, 99 m, 1 male (cl 3.3 mm), 1 female (cl 2.8 mm), 5 ovig (cl 3.3-3.6 mm) (CBM-ZC 6166); stn 12, off Kawajiri-misaki, Yamaguchi Prefecture, 84 m, 1 female (cl 2.8 mm),

4 ovig (cl 2.3-3.5 mm) (CBM-ZC 6170).

Description. Rostrum (Fig. 8A-C) prominent, narrowly triangular with sharply pointed apex in dorsal view, somewhat compressed laterally, directed forward, slightly falling short of anterior end of ocular peduncle; no median carina on dorsal surface.

Carapace (Figs 7, 8A-C) occupying about one-fourth of total length of body; no post-rostral carina present; ocular lobe short, rounded; anterolateral margin just inferior to ocular lobe distinctly concave. Linea thalassinica distinct. Dorsal oval clearly defined, marked posteriorly by deep cervical groove extending anteroventrally to either side above linea thalassinica as shallow dorsally curved groove. Branchiostegite with upper half weakly calcified and ventral half membranous, lacking groove or boss; anterior margin broadly rounded; branchiostegal sclerite not defined.

Abdomen (Figs 7, 8D) long; length ratio of first to sixth abdominal somites 1.0: 1.9: 1.4: 1.3: 1.7: 1.9. First abdominal somite narrowed anteriorly, divided in 2 sections by distinct transverse groove, pleuron weakly developed, but with clearly defined ventral margin. Second abdominal somite with anterior margin of pleuron having shallow notch ventrally, posterior margin slightly

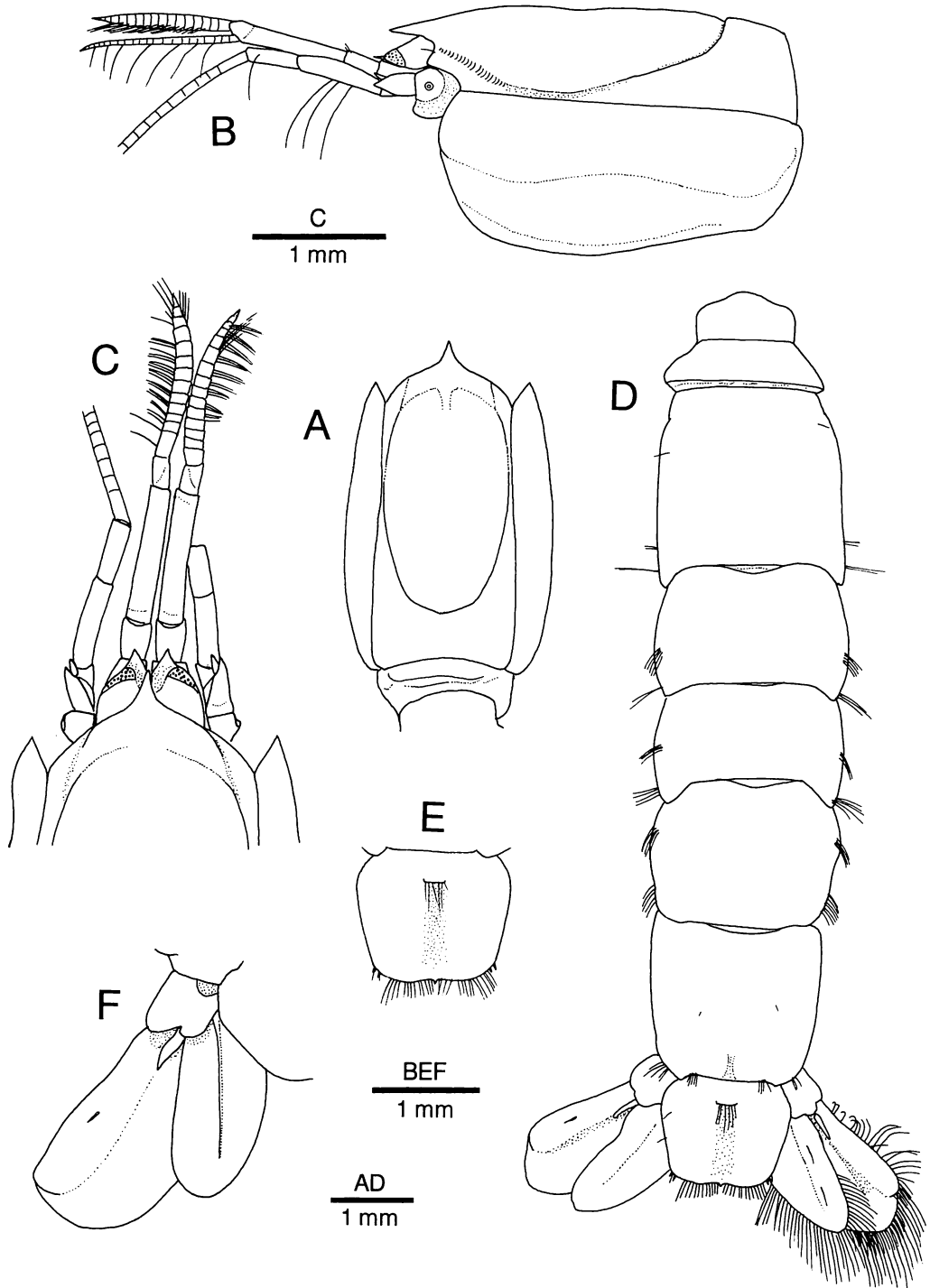


Fig. 8. *Cheramus spinophthalmus* (Sakai, 1970). Male (cl 3.3 mm, CBM-ZC 6166) from off Hagi, Yamaguchi Prefecture (stn 01-10). A, carapace, dorsal; B, carapace and cephalic appendages, lateral; C, anterior part of carapace and cephalic appendages, dorsal (left antennal flagellum missing); D, abdomen and uropods, dorsal; E, telson, dorsal; F, left uropod, dorsolateral, setae omitted.

expanded posterolaterally. Third to fifth somites each distinctly shorter than second somite; pleura each with tuft of moderately long plumose setae (tuft on third somite situated somewhat posterior to level of midlength of somite, that on fourth somite at level of midlength of somite, that on fifth somite at somewhat anterior to level of midlength of somite); each posteroventral margin of pleuron slightly expanded. Sixth abdominal somite subquadrate in dorsal view, very slightly narrowed posteriorly, with 1 pair of tufts of setae on posterodorsal margin; ventrolateral margin with shallow notch at level of posterior 0.25. Telson (Fig. 8E) broader than long (about 1.30 times as broad as long), subhexagonal, broadest at level of anterior 0.20; posterior margin slightly emarginate medially, with tiny median spine; dorsal surface with short transverse carina medially at anterior 0.20 bordered posteriorly by row of setae; posterolateral corners each with 2 movable spinules.

Ocular peduncle (Fig. 8B, C) somewhat flattened, weakly concave dorsally, length slightly exceeding basal width, in dorsal view tip slightly overreaching distal margin of basal antennular segment; mesial surface closely opposed each other over proximal portion of midline, divergent distally; anterolateral margin weakly sinuous in dorsal view, terminating in small acute spine. Cornea dark, area of pigmentation not sexually dimorphic; subtriangular corneal surface relatively large, occupying distal one-third of ocular peduncle, subterminal, anterolateral in position.

Antennular peduncle (Fig. 8B, C) as slender as and slightly longer than antennal peduncle; basal segment short, somewhat dilated, with sparse row of long setae on ventral surface; penultimate segment shorter than basal segment, with few long setae ventrally; ultimate segment elongate, about 3.40-3.60 times as long as penultimate segment, subcylindrical, with few long setae ventrally; flagella subequal in length, slightly longer than ultimate segment of peduncle; dorsal flagellum thicker than ventral flagellum, tapering distally, subdistal 9-11 articles with tufts of aesthetascs; ventral flagellum with

sparse setae. Antennal peduncle (Fig. 8B, C) with first segment stout, with excretory pore on lateral face inferior to short longitudinal carina; second segment short, nearly as long as first segment, with distolateral margin produced in short, blunt projection; third segment shorter than second segment; fourth segment longest, distinctly longer than basal 3 segments combined, cylindrical; fifth segment 0.70 times as long as fourth segment, cylindrical; scaphocerite rudimentary, scale-like with pointed apex; flagellum distinctly longer than carapace, with some long setae every 2 or 3 articles.

Epistome devoid of setae.

Mandible (Fig. 9A) with molar process uneven on inner surface, bearing few teeth on mesial margin; incisor process with row of rounded calcareous teeth on mesial margin, with deeply concave inner surface; palp 3-segmented, ultimate segment elongate, not noticeably tapering, dorsal surface of ultimate segment with long setae on proximal 0.25 and shorter, sometimes stout, curved setae on distal 0.75. Maxillule (Fig. 9B) with subquadrate proximal endite (broken off during dissection); distal endite broadened distally, with row of corneous spines on mesial margin and marginal to submarginal stiff setae; palp consisting of single segment, not noticeably tapering, strongly recurved distally, with 2 apical setae on rounded terminal margin. Maxilla (Fig. 9C) with proximal endite deeply bilobed, proximal lobe somewhat tapering, distal lobe not noticeably tapering; distal endite also deeply bilobed, distal lobe broader than proximal lobe; palp broad, flattened, tapering to acute tip, with row of setae becoming longer distally and subterminal tufts of long setae on mesial margin; scaphognathite moderately broad, narrowed distally. First maxilliped (Fig. 9D) with proximal endite narrowly produced, with several long setae on distomesial margin; distal endite elongate subovate, with dense marginal to submarginal setae mesially; endopod greatly reduced, minute, not visible in outer view; exopod not noticeably broad, weakly curved mesially, with marginal setae; epipod weakly bilobed with distal lobe smaller than proximal lobe, not strongly tapering distally. Second maxilli-

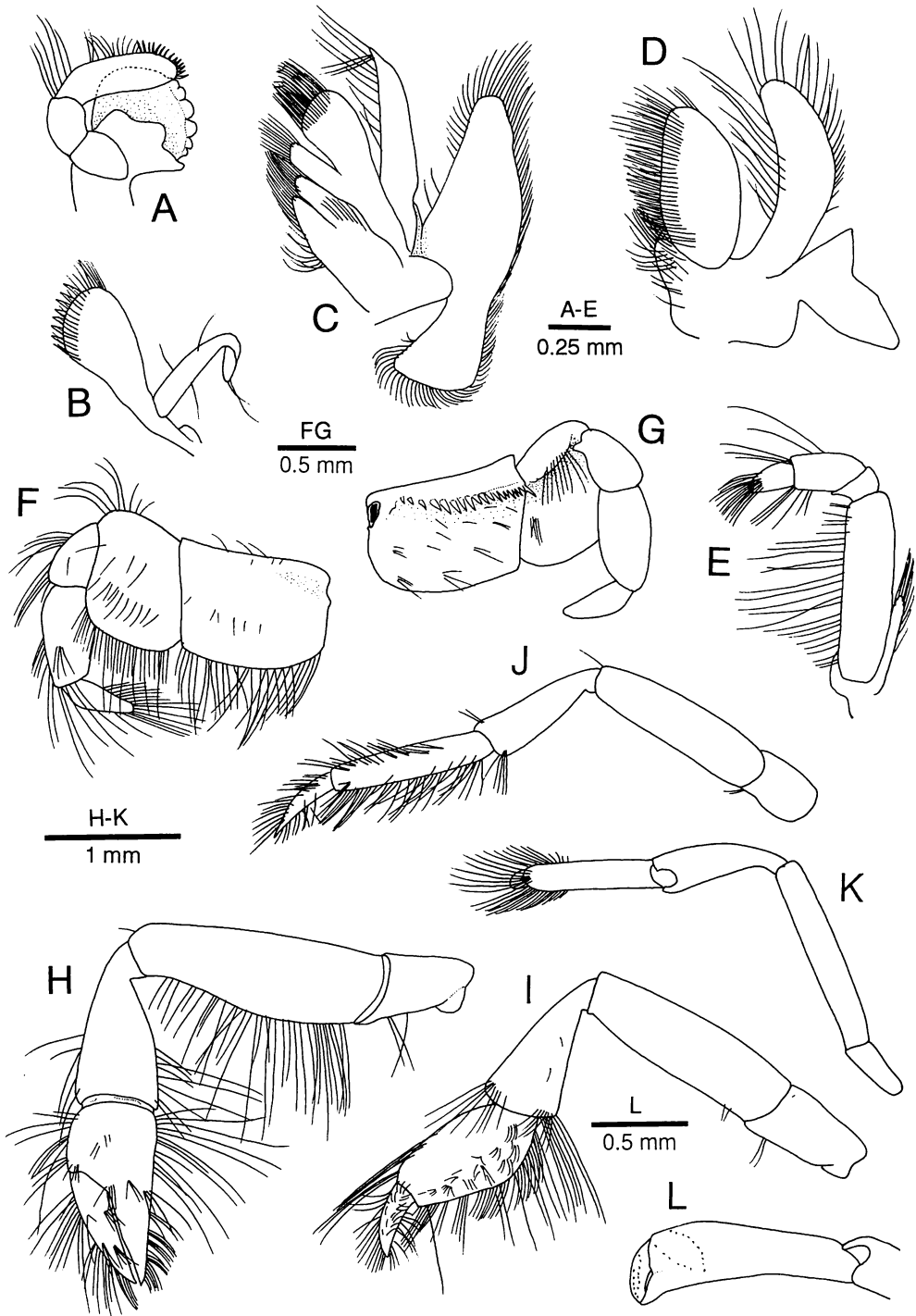


Fig. 9. *Cheramus spinophthalmus* (Sakai, 1970). A-I, K, L, male (cl 3.3 mm, CBM-ZC 6166) from off Hagi, Yamaguchi Prefecture (stn 01-10); J, female (cl 3.5 mm, same lot). Left appendages. A, mandible, inner; B, maxillule, outer (coxal endite broken off); C, maxilla, outer; D, first maxilliped, outer; E, second maxilliped, outer; F, third maxilliped, lateral; G, same, mesial (setae partially omitted); H, second pereopod, lateral; I, third pereopod, lateral; J, fourth pereopod, lateral; K, fifth pereopod, lateral; L, same, dactylus and propodus, flexor (setae omitted).

ped (Fig. 9E) with rather slender endopod consisting of 6 articles (merus and ischium apparently fused completely); merus-ischium fused segment exceeding 3.50 times width, mesial margin with numerous long setae being longer medially; carpus short; propodus not elongate, not arcuate; dactylus short, about half length of propodus, with terminal brush of stiff setae; exopod short, only reaching to midlength of merus-ischium fused segment, bearing marginal setae; epipods absent. Third maxilliped (Fig. 9F, G) without exopod or epipod; endopod consisting of 7 segments; ischium and merus with dense setation on ventral margin, distal 3 segments with long setae on dorsal (extensor) surfaces; length of merus and ischium combined about twice of greatest depth of ischium; ischium subquadrate, slightly longer than deep, proximomesial margin rounded, mesial surface with crista dentata consisting of closely set, small, acute spines, and scattered tufts of short setae; merus subquadrate, distinctly broader than long and shorter than ischium, mesial face with blunt longitudinal ridge bearing row of long setae dorsally; carpus short, subovate; propodus distinctly longer than carpus, longer than deep, slightly tapering distally; dactylus distinctly shorter than propodus, generally straight but with noticeably convex dorsal margin in lateral view.

First pereopods (Figs 7, 10), forming dissimilar, strongly calcified chelipeds. Major first pereopod (Fig. 10A, B) heavy, massive, particularly in male (chela 1.47 times as long as carapace in male, 0.84–0.97 times as long in females). Ischium relatively stout; dorsal margin noticeably sinuous; ventral (flexor) margin with row of 5–7 slender spines. Merus 1.80–1.90 times as long as deep; dorsal margin convex, smooth; ventral margin nearly straight, with 2 prominent spines in proximal 0.25 (proximal spine sometimes much smaller than distal spine) and row of small, rounded tubercles in males or smooth in females in distal 0.75, lacking hook-like projection. Carpus 0.43–0.45 times as long as chela, 0.85–0.95 times as long as deep; dorsal margin straight, forming thin, unserrated carina slightly overhanging mesial face; proximoventral margin evenly rounded in outline, also forming sharply

edged, unserrated carina; ventrodistal corner slightly produced, bluntly or subacutely pointed; mesial face with large decalcified area proximally. Chela 1.70–1.85 times as long as deep; palm rectangular in lateral view, 1.20–1.30 times as long as deep, dorsal margin forming sharp, unserrated carina, straight or very slightly arched in lateral view; ventral margin (including fixed finger) also forming unserrated carina extending to midlength of fixed finger; lateral and mesial faces weakly convex, without spines or tubercles, but with 1 blunt tooth on laterodistal margin adjacent to junction of fixed finger. Fixed finger noticeably curved dorsally, with row of 3 tufts of long stiff setae on lateral face; armature of cutting edge variable, unarmed or with 1 conspicuous tooth subdistally. Dactylus 0.75–0.80 times as long as palm, deep, hooked distally, crossing tip of fixed finger; dorsal surface distinctly carinate in proximal half, rounded in distal half; lateral face with broad, blunt submedian carina in proximal half and with several tufts of long stiff setae; cutting edge with row of small, very low teeth.

Minor first pereopod (Fig. 10C) slender. Ischium moderately slender; dorsal margin almost straight; ventral margin with 5–8 slender spines. Merus 1.10–1.15 times as long as ischium, 2.20 times as long as deep; dorsal margin convex, smooth; ventral margin nearly straight, with 1 slender spine arising from midlength. Carpus distinctly longer than merus, 2.40–2.50 times as long as distal depth, gradually becoming deeper distally; dorsal margin straight, forming thin, unserrated carina not overhanging mesial face; ventral margin weakly convex, also forming sharp, unserrated carina; dorsodistal and ventrodistal corners slightly produced; mesial face with large decalcified area proximally. Chela 2.60–2.70 times as long as deep; palm becoming slightly deeper distally, subrectangular in lateral view, 1.80–1.85 times as long as deep, dorsal surface not forming carina; ventral margin with distinct ventral carina extending to midlength of fixed finger; lateral and mesial faces weakly convex, without spines or tubercles. Fixed finger slightly curved dorsally; cutting edge minutely denticulate. Dactylus 1.10–

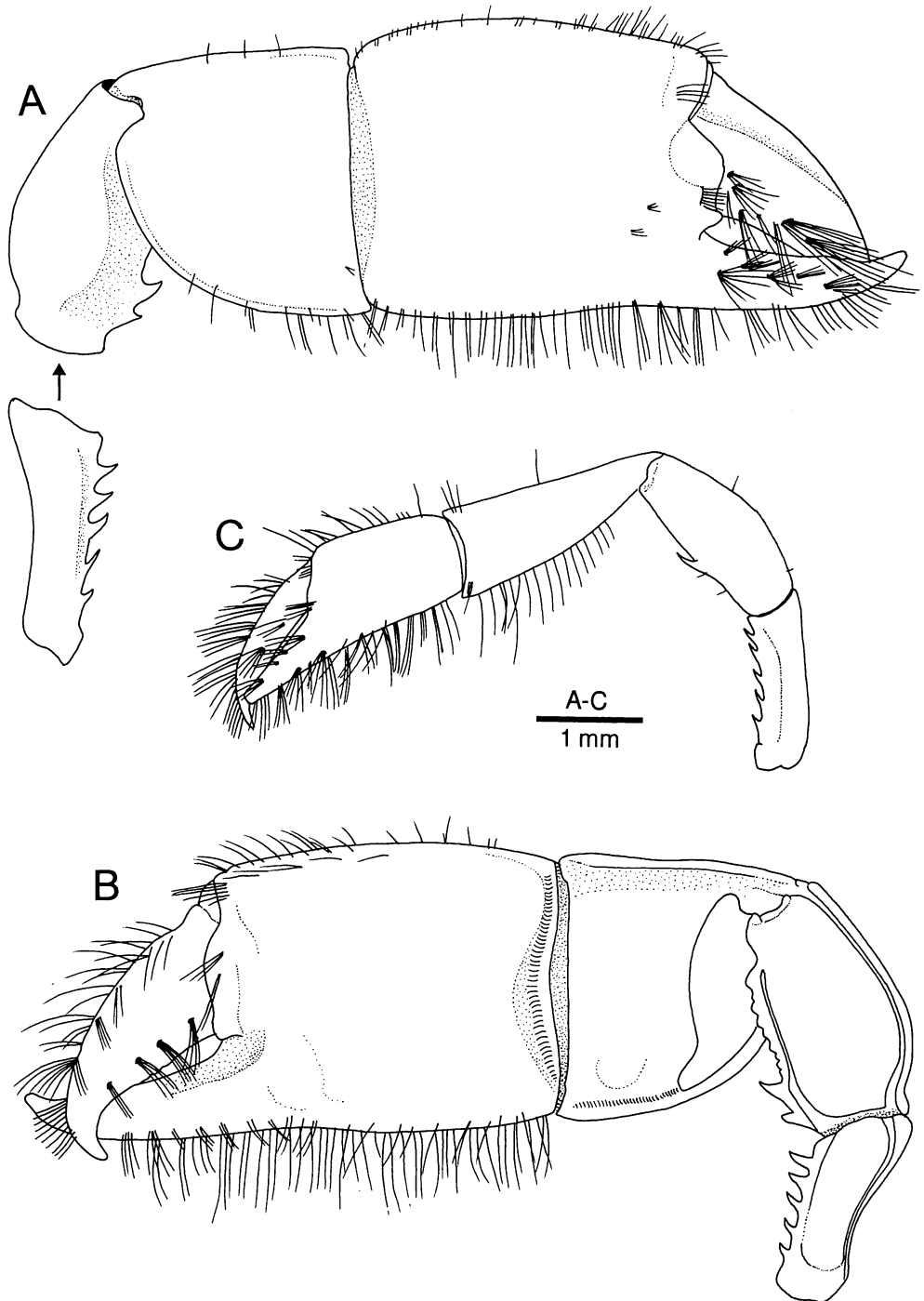


Fig. 10. *Cheramus spinophthalmus* (Sakai, 1970). Male (cl 3.3 mm, CBM-ZC 6166) from off Hagi, Yamaguchi Prefecture (stn 01-10). A, right (major) first pereopod, lateral; B, same, mesial (setae partially omitted); C, left (minor) first pereopod, lateral.

1.20 times as long as palm, deep, somewhat curved distally, crossing tip of fixed finger; dorsal surface not carinate; lateral face with

faint median carina in proximal two-thirds; cutting edge unarmed; very narrow hiatus present when closed.

Table 5. *Cheramus spinophthalmus* (Sakai, 1970). Gill formula.

Thoracic somites	1	2	3	4	5	6	7	8
Appendages	Maxillipeds			Pereopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	—	—	—	—	—
Arthrobranchs	—	—	1	2	2	2	2	—
Podobbranchs	—	—	—	—	—	—	—	—
Epipods	+	—	—	—	—	—	—	—
Exopods	+	+	—	—	—	—	—	—
Setobbranchs	—	—	—	—	—	—	—	—

Second pereopod (Fig. 9H) chelate, overreaching distal end of antennular peduncle by length of chela and half of carpus. Ischium short, with few long setae on ventral margin. Merus becoming shallower in distal half, 3.00–3.10 times as long as greatest depth at midlength; ventral margin slightly sinuous, with row of long setae becoming shorter distally. Carpus strongly becoming deeper distally, about twice as long as deep, with long setae on dorsal and ventral margins; no patches or tufts of short setae on lateral surface. Chela 1.20–1.25 times as long as carpus, with numerous setae becoming shorter distally on both dorsal and ventral margins, in lateral view dorsal outline generally convex, ventral outline straight; palm with few tufts of short setae on lateral surface; dactylus 1.80–1.85 times as long as palm; cutting edges of fixed finger and dactylus forming very thin, sharp edge, but without conspicuous teeth.

Third pereopod (Fig. 9I) overreaching distal end of antennular peduncle by length of dactylus. Ischium with subterminal tuft of setae on ventral margin. Merus 3.50 times as long as deep. Carpus triangular in lateral view, 1.90–2.00 times as long as deep, bearing submarginal row of long setae along dorso-distal margin, and marginal long setae on ventrodistal margin. Propodus subovate in lateral view, 0.80–0.85 times as long as carpus; dorsal margin with long setae on distal half; lateral surface with scattered tufts of short setae on ventral half; ventral margin with row of long setae, denser on proximal half. Dactylus 0.55–0.60 times as long as propodus, weakly curved ventrally, with short to long setae on margins and lateral

face.

Fourth pereopod (Fig. 9J) slender. Coxa large, somewhat flattened, roundly subrectangular in shape, lacking anteromesial lobe. Ischium with distal tuft of short setae on ventral margin. Merus 4.00 times as long as deep. Carpus becoming slightly deeper distally, with distal tuft of setae on ventral margin. Propodus with row of tufts of long setae dorsally and row of simple long setae ventrally; ventral margin with row of long setae on proximal 0.75 and dense cluster of stiff setae on distal 0.25. Dactylus slightly curved, setose.

Fifth pereopod (Fig. 9K, L) slender, chelate. Ischium short, without setae. Merus 5.70–5.80 times as long as deep. Carpus becoming slightly deeper distally, without setae. Propodus slightly longer than carpus, somewhat flattened, slightly curved mesially, becoming broader distally in ventral (flexor) view, bearing numerous setae forming brush-like structure distally; fixed finger very short, slightly deflexed. Dactylus longer than fixed finger, strongly curved, setose on surfaces.

Gill formula summarized in Table 5. No pleurobranchs. Arthrobranchs phyllobranchiate; 1 small, but distinctly lamellate arthrobranch on third maxilliped; 2 arthrobranchs on each first to fourth pereopods well-developed. No epipods or podobbranchs on pereopods.

Sternal plate on seventh thoracic somite trapezoidal in general outline with anterior surface sloping, medially produced anteriorly; anterolateral angles somewhat produced in blunt projection; ventral surface with deep median groove extending to posterior surface.

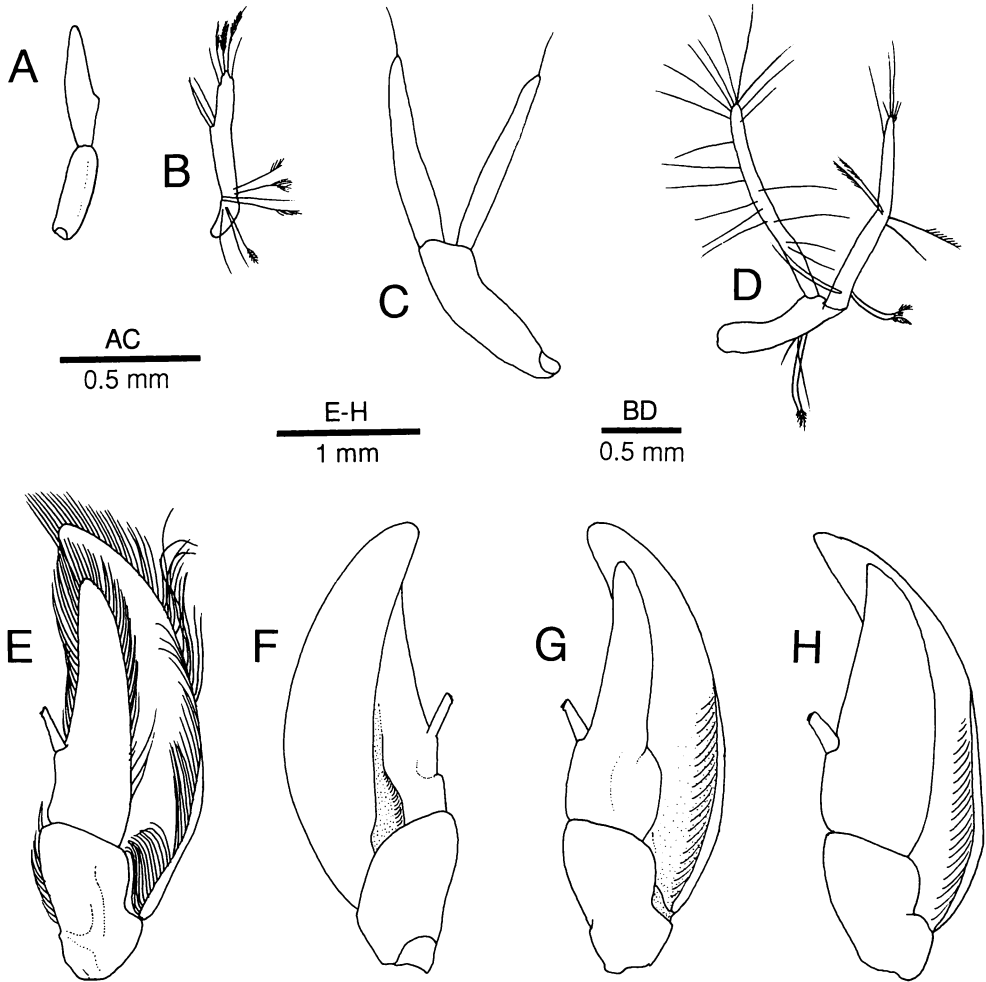


Fig. 11. *Cheramus spinophthalmus* (Sakai, 1970). A, B, E-H, male (cl 3.3 mm, CBM-ZC 6166) from off Hagi, Yamaguchi Prefecture (stn 01-10); C, D, female (cl 3.5 mm, same lot). Left pleopods. A, first pleopod, dorsal (setae omitted); B, same, ventral; C, second pleopod, dorsal; D, same, ventral; E, third pleopod, ventral; F, same, dorsal (setae omitted); G, fourth pleopod, ventral (setae omitted); H, fifth pleopod, ventral (setae omitted).

First pleopod (Fig. 11A, B) uniramous, 2-segmented in both sexes, proportionally longer in females than in males; ramus with small projection arising from midlength of mesial margin in both sexes. Second pleopod (Fig. 11C, D) with endopod and exopod subequal in length in both sexes; both rami more elongate in ovigerous females than in males and non-spawning females, endopod more noticeably curved at midlength in spawning females than in males and non-spawning females; no appendix masculina in males. Third to fifth pereopods (Fig. 11E-H) forming large, posteriorly cupped fans when coupled

at mesial margins of endopods, generally similar for one another and between males and females; protopods broad, somewhat flattened; endopods elongate subtriangular, broad, that of fifth pleopod broadest, each with short, stout appendix interna arising from proximal one-third of endopod length; appendices internae flattened, somewhat tapering distally, each with cincinnuri; each exopod longer than endopod, articulated at mesiodistal part of protopod, somewhat fleshy in proximal part; dorsal surfaces of exopods with deep concavity proximomesially. Uropod (Fig. 8F) with protopod hav-

ing distinctly bilobed posterodorsal margin; endopod nearly ovate, distinctly longer than broad; dorsal surface of endopod carinate medially in anterior 0.50–0.75, with few setae; exopod distinctly longer than endopod, lateral margin slightly sinuous with sparse setae, posterior margin broadly rounded, fringed with double or triple row of thick, long stiff setae; dorsal plate of exopod weakly developed, with slender movable spine arising from level of midlength, its posterior edge slightly falling short of posterior margin of exopod proper, fringed with stiff setae.

Coloration. In formalin. Entirely ivory white. Eggs light yellow.

Distribution. Known only from southern part of the Sea of Japan off Tsushima Island (type locality) and off Yamaguchi Prefecture; at depths of 99–210 m (Sakai, 1970; present study).

Remarks. The present specimens agree closely with the original description of *Callianassa (Cheramus) spinophthalma* by Sakai (1970), although the type material has not been available for study. They enabled us to describe many important supplementary details of this rare species, including morphology of the mouthparts, pereopods, pleopods and thoracic sternum and gill formula. Comparison with other congeneric species is made below.

Our examination suggests that the major first pereopod is sexually dimorphic in this species; the major first pereopod is much more massive in the single male specimen than in the three female specimens. According to Sakai (1970), no male specimen was contained in the type series. However, the illustrated major cheliped from an unknown individual (Sakai, 1970, text-fig. 3d) is similar to that of our male specimen.

Generic classification of the Callianassidae has recently been subject to controversy (Poore, 1994; Sakai, 1999; Tudge *et al.*, 2000). Sakai (1999) reviewed all callianassid genera, but his approach was based on traditional methods using rather limited number of characters. Tudge *et al.* (2000) applied morphology-based phylogenetic analysis using 93 characters in order to infer relationships among callianassid genera. However, their

study is limited by the fact that several species included in their analysis were missing character information to a greater or lesser extent. Sakai (1999) treated the genus *Cheramus* Bate, 1888 as a junior synonym of *Callianassa* Leach, 1814, while Tudge *et al.* (2000) recognized *Cheramus* as a distinct genus. We follow the latter authors in recognizing *Cheramus* as a distinct genus. Tudge *et al.* (2000) reassigned the following ten species previously assigned to various genera to *Cheramus*: *C. longicaudatus* (Sakai, 1967b) from the East China Sea; *C. marginatus* (Rathbun, 1901) from the tropical western Atlantic; *C. oblongus* (Le Leouff and Intés, 1974) from Ivory Coast, West Africa; *C. orientalis* Bate, 1888 from the Arafra Sea; *C. praedatrix* (De Man, 1905) from Indonesia and Western Australia; *C. profundus* Biffar, 1973 from the West Indies (the type species of the genus); *C. propinquus* (De Man, 1905) from Indonesia, New Caledonia and northwestern Australia; *C. rectangularis* (Ngoc-Ho, 1991) from New Caledonia; *C. sibogae* (De Man, 1905) from Indonesia and northwest Australia; and *C. spinophthalmus* (Sakai, 1970) from the southern part of the Sea of Japan. The analysis by Tudge *et al.* (2000) suggested that eight of the ten species of *Cheramus* (two species, *C. oblongus* and *C. orientalis* were not included in the analysis, as insufficient morphological information was available) and *Poti gaucho* Rodriguez and Manning, 1992 form a clade, though *P. gaucho* appears a subordinated taxon within the clade. Unfortunately, Tudge *et al.* (2000) did not give a precise diagnosis of *Cheramus*. However, practically, *Cheramus* is recognized by the following set of characters (modified from Manning and Felder, 1991): rostrum spiniform; carapace with dorsal oval; linea thalassinica complete; cornea of eye subterminal, lateral; third maxilliped pediform, lacking exopod, propodus and dactylus slender; chelipeds greatly unequal, major without meral hook; first pleopod uniramous in both sexes; second pleopod biramous in both sexes; endopods of third to fifth pleopods rather slender, each with digitiform appendix interna; uropodal endopod more than twice length of width. Further, Tudge *et al.* (2000) suggested that the six species

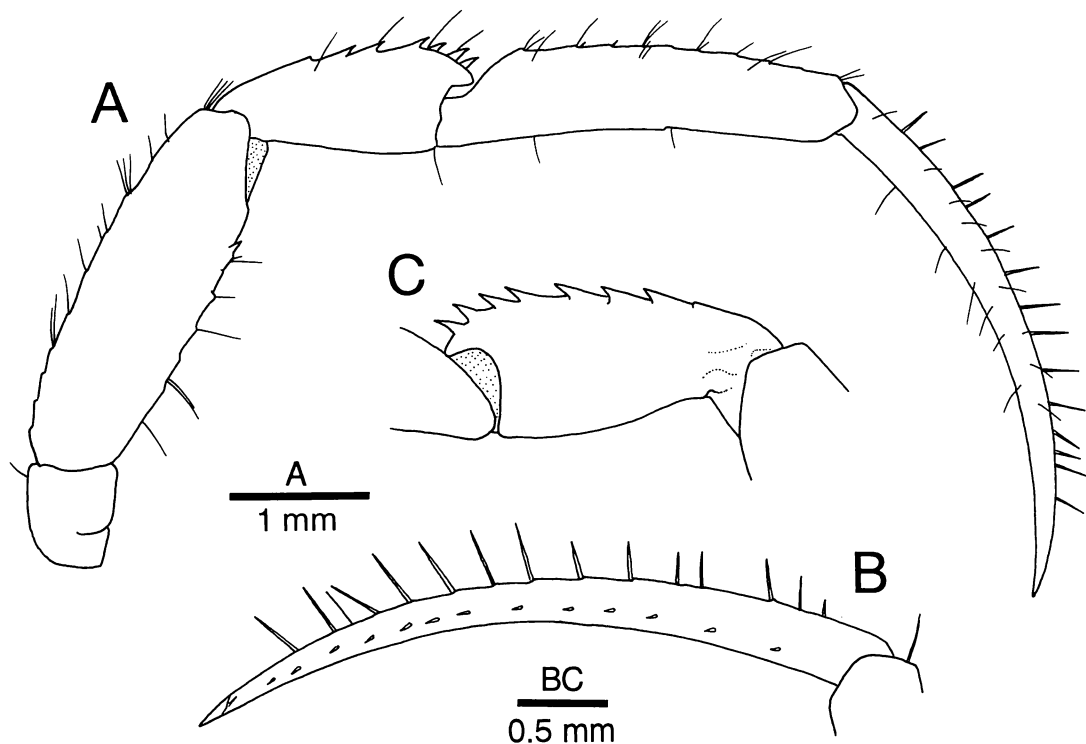


Fig. 12. *Anapagurus japonicus* (Ortmann, 1892). Male (sl 2.3 mm; CBM-ZC 6153) from off Hagi, Yamaguchi Prefecture (stn 01-11). A, right second pereopod, lateral; B, same, dactylus, mesial; C, same, carpus, mesial.

reassigned to *Cheramus* (*C. praedatrix*, *C. propinquus*, *C. rectangularis*, *C. sibogae*, *C. profundus* and *C. marginatus*) are linked by an apomorphic character: telson with one or two spinules at posterolateral corner. The present study shows that *C. spinophthalmus* has two spinules at the posterolateral corner of the telson. This character remains unknown in the other three species.

Cheramus spinophthalmus appears unique within the genus in having the ocular peduncle terminating in an acute tooth. In the other congeners, the ocular peduncle tapers to a blunt or angular point. Further, *C. spinophthalmus*, *C. marginatus* and *C. oblongus* are separated from the other seven species by the telson being broader than long, rather than longer than broad. The antennular peduncle is longer than the antennal peduncle in *C. spinophthalmus* and *C. rectangularis*, but the former is shorter than the latter in the other seven species (morphology of the antennae remains unknown in *C. orientalis*).

Infraorder Anomura Family Paguridae

Anapagurus japonicus Ortmann, 1892 (Fig. 12)

Anapagurus pusillus var. *japonicus* Ortmann, 1892: 296, pl. 12, fig. 11 [type locality: Katsiyama (=Katsuyama), Boso Peninsula, Japan].

Anapagurus japonicus -Miyake, 1978: 139, fig. 55; García-Gómez, 1994: 44, figs. 10-11.

Material examined. TRV *Toyoshio-maru*, 2001-11 cruise: stn 9, off Hagi, Yamaguchi Prefecture, 79-83 m, 1 male (sl 2.3 mm) (CBM-ZC 6153).

Supplemental description. Right second pereopod (Fig. 12A-C) with dactylus slender, 1.67 times as long as propodus, weakly curved ventrally in lateral view, slightly twisted in dorsal view; dorsal surface of dactylus with row of long spiniform setae; lateral face with 2 rows of sparse setae

dorsally and ventrally; ventral surface with row of 14 sparse corneous spinules. Propodus with sparse row of tufts of short setae on dorsal surface. Carpus armed with 7 small spines becoming slightly longer distally on dorsal surface. Merus with slightly protuberant dorsal surface bearing sparse row of short setae; ventral margin also slightly protuberant, with 1 small subdistal spine.

Coloration. In formalin. Shield mottled with light brown. Ocular peduncle generally light brown, lateral and mesial faces each with 1 dark brown spot at about midlength ventrally. Antennular and antennal peduncles light brown; fifth segment of antennal peduncle with 2 broad, darker brown bands; antennal flagellum alternated with light brown (3–4 articles) and white (1 article). Third maxilliped generally light brown; dactylus and propodus each with spot of dark brown on lateral and mesial faces proximally; merus with dark brown spot on dorsal surface proximally. Right cheliped generally light brown; dactylus with tinge of brown on dorsomesial surface and distal part of mesial face; palm with tinge of brown distally and proximally and with dark brown spot on mesial face ventrally; carpus darker brown mostly; merus with irregular blotch of brown. Left cheliped similar to right in general color pattern. Ambulatory pereopods generally light brown; dactyli each with obscure brown band proximally; propodi each with 2 broad brown bands subdistally and proximally; carpi each with broad brown band medially; meri each with rather narrow brown band subdistally.

Distribution. Boso Peninsula, Kii Strait, Amakusa, and Tsushima Island, at depths of 20–83 m (Miyake, 1978; García-Gómez, 1994; present study).

Remarks. This species was redescribed in detail by García-Gómez (1994) based on three specimens, including one male and two females, from Japan. However, García-Gómez did not examine the holotype from Katsuyama (originally spelled as Kadsiyama), Boso Peninsula. The holotype, supposedly deposited in the Musée Zoologique, Strasbourg, could not be found (Komai, 1999a), and it is presumably no longer extant. Our specimen agrees very well with the rede-

scription of *Anapagurus japonicus* by García-Gómez (1994).

Morphology of the second pereopods of this species has remained unknown (García-Gómez, 1994). The present specimen enabled us to describe the second pereopod of this species. It has been found that the armature of the carpus of the right second pereopod provides a further reliable feature in distinguishing *A. japonicus* and its closest relative *A. chiroacanthus* (Lilljeborg, 1856) from the eastern Atlantic (cf. García-Gómez, 1994). In *A. japonicus*, there are seven moderately large spines on the dorsal surface of the carpus of the right second pereopod, but in *A. chiroacanthus*, only two small spines are present.

So far, this species is the sole representative of the genus *Anapagurus* Henderson, 1886 from Japanese waters.

***Catapaguroides japonicus* de
Saint Laurent, 1968**

(Figs. 13–16)

Catapaguroides japonicus de Saint Laurent, 1968: 952, figs. 8, 15, 32 [type locality: Osezaki (originally spelled as Oze Zaki), Suruga Bay, Japan]; Miyake, 1978: 136; 1982: 198 (list), 230 (key); Miyake, 1991a: 198 (list), 230 (key); Miyake, 1998a: 198 (list), 230 (key).

Material examined. TRV *Toyoshio-maru*, 2001–11 cruise: stn 9, off Hagi, Yamaguchi Prefecture, 79–83 m, 1 male (sl 1.5 mm) (CBMZC 6154).

Type material. *Albatross*: stn 3715, off Osezaki (=Osezaki), Suruga Bay, 119–125 m, 11 May 1900, 1 male (sl 1.6 mm, holotype) (USNM 168315); stn 3708, similar locality, 110–128 m, 8 May 1900, 1 male (sl 1.7 mm, paratype) (USNM 168316).

Description. Ten pairs of biserial phyllobranchiate gills (no pleurobranch on seventh thoracic somite).

Shield (Fig. 13A) as long as broad; anterior margin between rostrum and lateral projections weakly concave; anterolateral margins sloping; posterior margin roundly truncate; dorsal surface with pair of tufts of setae just posterior to rostrum and 3 pairs of low, blister-like tubercles anteriorly. Rostrum

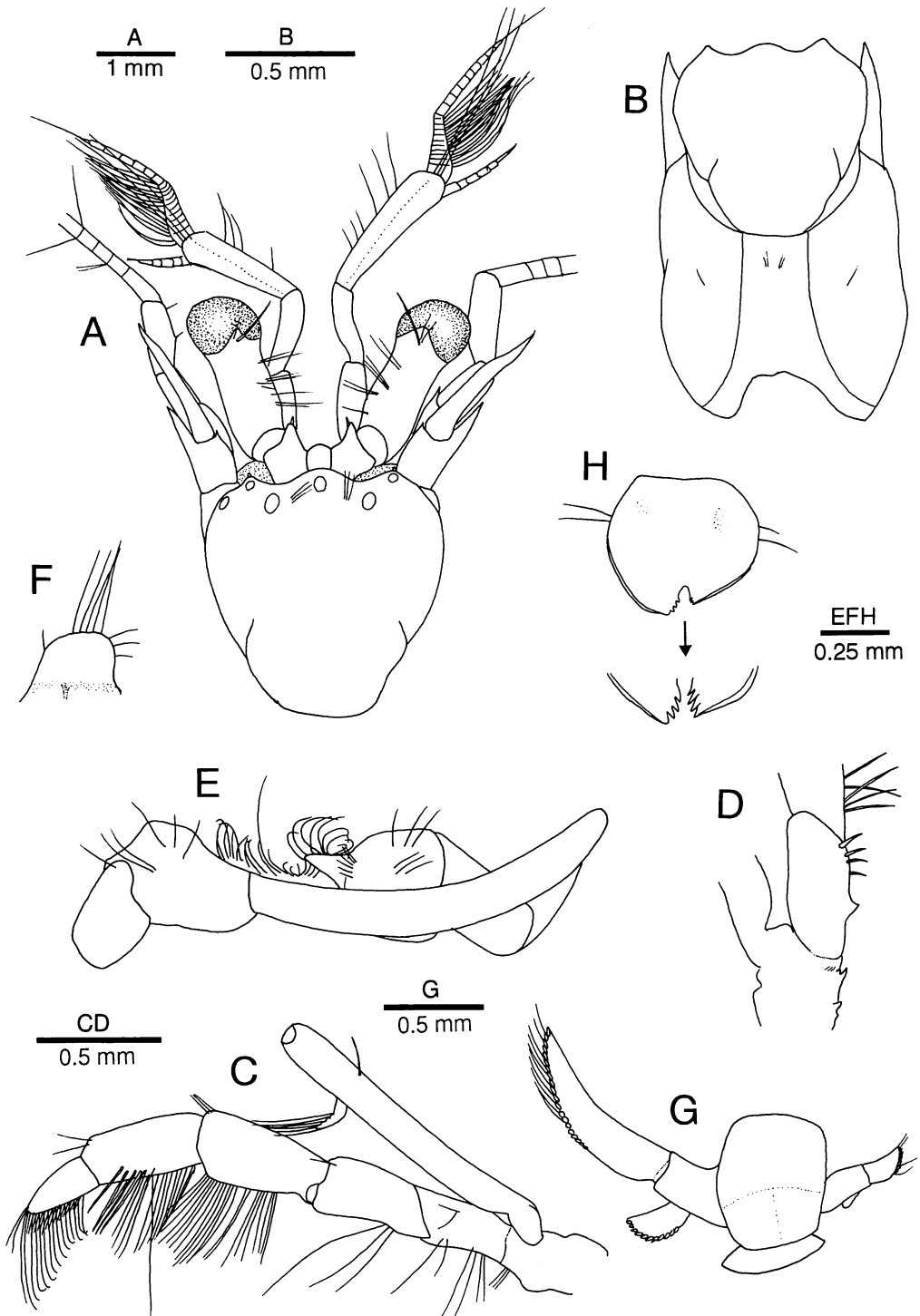


Fig. 13. *Catapaguroides japonicus* de Saint Laurent, 1968. Male (sl 1.5 mm; CBM-ZC 6154) from off Hagi, Yamaguchi Prefecture (stn 01-09). A, shield and cephalic appendages, dorsal; B, carapace, dorsal (setae partially omitted); C, left third maxilliped, lateral; D, ischium of left third maxilliped, dorsal (inner); E, coxae of fifth pereopods and sexual tubes, ventral; F, anterior lobe of sixth thoracic sternite; G, sixth abdominal tergite and uropods, dorsal; H, telson, dorsal; inset, posterior lobes of telson, posterodorsal.

broadly rounded. Lateral projections triangular, not projecting beyond tip of rostrum, each with small submarginal spinule. Posterior carapace (Fig. 13B) with weak calcified posteromedian plate bearing few very short setae anteriorly; cardiac sulci parallel anteriorly, divergent along posterodorsal margin posteriorly; sulci cardiobranchiales apparently absent; branchial region with few short setae.

Ocular peduncle (Fig. 13A) moderately long and moderately stout, 0.70 times shield length, with row of tufts of long setae dorsomesially; cornea weakly dilated, its width greater than basal width of ocular peduncle. Ocular acicle narrowly triangular, with submarginal distal spine.

Antennular peduncle (Fig. 13A) overreaching ocular peduncle by full length of ultimate peduncular segment. Basal segment elongate, with statocyst lobe somewhat inflated laterally and with acute spine on distolateral surface. Ultimate segment about twice length of penultimate segment, noticeably deeper distally, with longitudinal row of thin setae on mesial face and few very long setae on distal margin. Dorsal flagellum with thickened aesthetasc-bearing portion being about 0.30 length of ultimate peduncular segment; aesthetascs elongate, about as long as distal slender part of dorsal flagellum; ventral flagellum slightly longer than thickened aesthetasc-bearing portion of dorsal flagellum, composed of 5 articles.

Antennal peduncle (Fig. 13A) moderately short, reaching distal margin of cornea. First segment without spine on distolateral margin or ventrodorsal margin. Second segment with dorsolateral distal angle produced, reaching midlength of fourth segment, terminating in acute spine; dorsomesial distal angle terminating in small acute spine. Third segment with few setae and acute spine at ventromesial distal margin. Fourth segment glabrous. Fifth segment with few short setae on lateral and mesial faces. Antennal acicle slender, arcuate, reaching nearly to distal margin of cornea, terminating in small acute spine, with sparse row of short setae on mesial margin. Antennal flagellum far overreaching right cheliped, with 1 or 2 moderately long and also 1 or 2

very short setae on every 1 or 2 articles proximally, only very short setae distally.

Third maxilliped (Fig. 13C, D) devoid of crista dentata, but mesial margin of ischium sharply ridged with 1 prominent triangular tooth proximally and row of 4 spiniform setae distally; accessory tooth absent. Merus and carpus without spine. Exopod elongate, proximal segment nearly reaching distal margin of carpus.

Right cheliped (Fig. 14) with dactylus articulating normally with palm; propodal-carpal articulation not rotated. Chela about 2.20 times as long as broad, generally elongate oval in outline in dorsal view. Dactylus about 0.80 times length of palm, terminating in small calcareous claw; dorsal surface without crested ridge, but with tufts of moderately long setae, dorsomesial margin obsoletely delimited, with 1 acute spinule proximal to midlength; mesial and ventral surfaces with tufts of long setae; cutting edge with row of 3 blunt calcareous teeth. Palm 0.85 length of carpus; dorsal surface weakly convex, with scattered small spines distally (including proximal one-third of fixed finger) and tufts of short to moderately long setae; dorsolateral margin obtusely delineated, with row of small spines distally, dorsomesial margin not delimited; lateral and mesial faces smooth, with tufts of short to long setae; ventral surface inflated, with tufts of long setae extending onto fixed finger; fixed finger terminating in small calcareous claw, cutting edge with row of 3 large, low calcareous teeth. Carpus 1.19 times as long as merus; dorsal surface rounded without delineation of dorsolateral and dorsomesial margins, with 1 or 2 small spines or tubercles on midline and few tufts of short setae; lateral face with few tufts of setae, ventrolateral distal angle with 1 small spine; mesial face with several tufts of very long setae, dorsomesial distal angle with 1 small spine; ventral surface slightly inflated, with several tufts of very long setae. Merus with tufts of setae on dorsal surface, dorsodistal margin with 1 spinule mesially; lateral face with tufts of moderately long setae dorsally, distally with 2 small spines adjacent to ventrolateral margin; mesial face with tufts of moderately short to very long setae, with 3

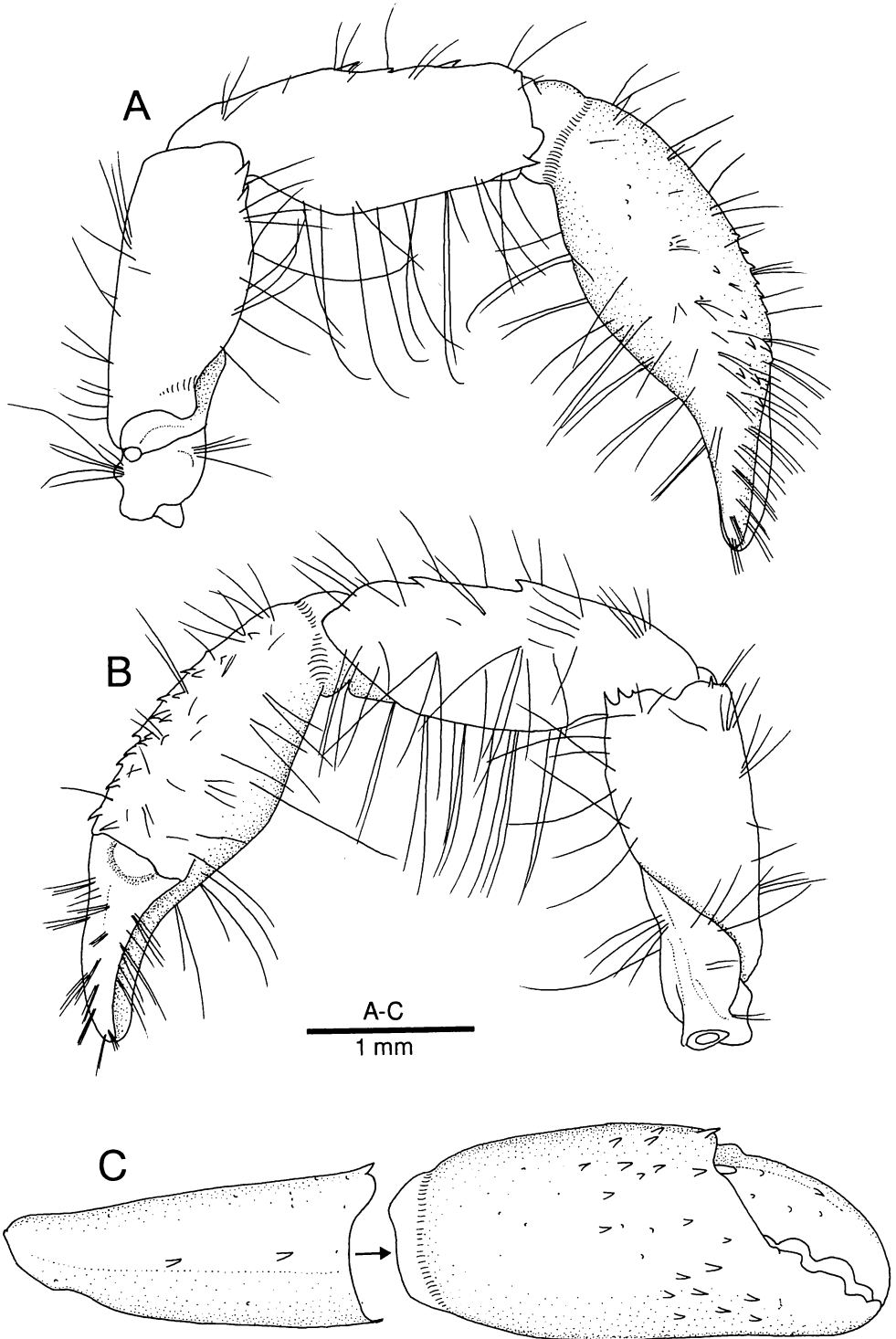


Fig. 14. *Catapaguroides japonicus* de Saint Laurent, 1968. Male (sl 1.5 mm; CBM-ZC 6154) from off Hagi, Yamaguchi Prefecture (stn 01-09). A, right cheliped, lateral; B, same, mesial; C, chela and carpus of right cheliped, dorsal (setae omitted).

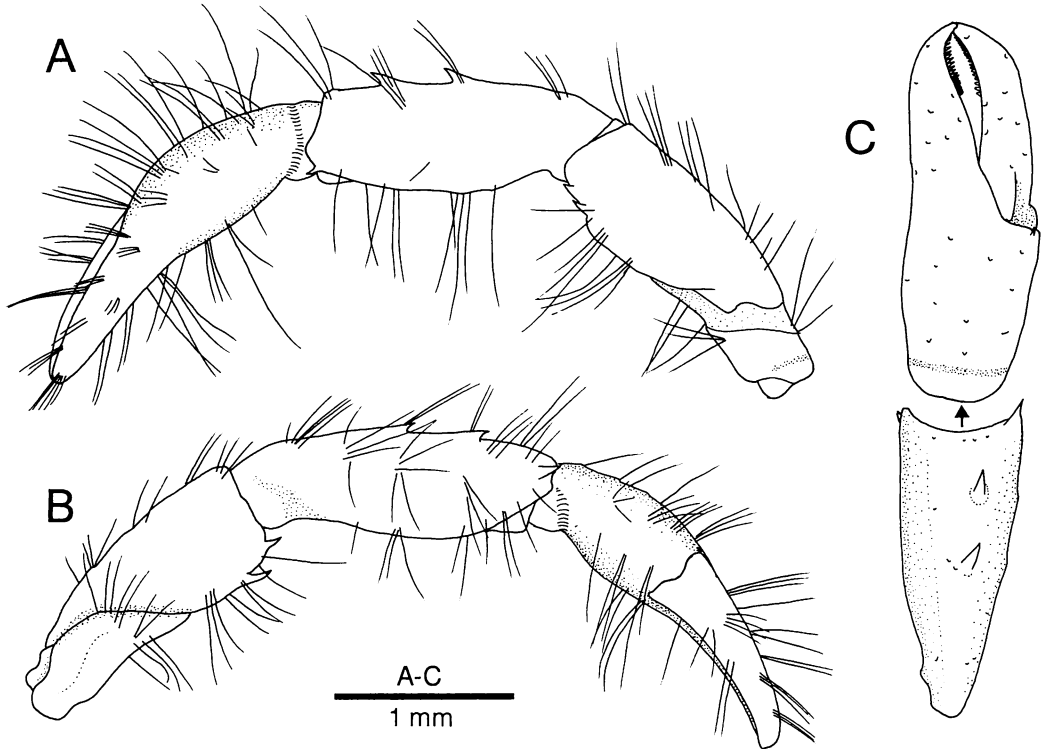


Fig. 15. *Catapaguroides japonicus* de Saint Laurent, 1968. Male (sl 1.5 mm; CBM-ZC 6154) from off Hagi, Yamaguchi Prefecture (stn 01-09). A, left cheliped, lateral; B, same, mesial; C, chela and carpus of left cheliped, dorsal (setae omitted).

spines at ventromesial distal angle; ventral surface smooth, but with row of tufts of long setae adjacent to margins. Ischium with dorsolateral margin produced in 2 low lobes, anterior lobe bearing tufts of very long setae; ventral surface weakly inflated proximally, without row of spinules or tubercles on ventromesial margin. Coxa with small, but prominent spine on distolateral margin.

Left cheliped (Fig. 15) not reaching to proximal margin of dactylus of right, with propodal-carpal articulation twisted 15° counterclockwise from perpendicular; dactylus and fixed finger curved and with narrow hiatus. Chela about 2.70 times as long as broad. Dactylus 1.20 times as long as palm, unarmed, but with scattered tufts of long setae, terminating in minute, acute corneous claw, crossing tip of fixed finger; no clear delineation of dorsomesial margin; cutting edge with row of small corneous teeth in distal half. Palm about half length of carpus; dorsal surface weakly convex, with scattered tufts of short to long setae, sloping to lateral

and mesial faces without delineation of dorsolateral and dorsodistal margins; ventral surface slightly inflated, with tufts of long setae; fixed finger also with tufts of long setae on dorsal and ventral surfaces, tip strongly curved, terminating in small corneous claw; cutting edge of fixed finger with row of small corneous teeth on distal half. Carpus 1.25 times as long as merus; dorsal surface sloping to lateral and mesial faces without delineation of dorsolateral and dorsomesial margins, with 2 widely separated small spines on midline; ventrolateral distal angle with 1 spinule; mesial surface with tufts of moderately to very long setae, distomesial angle with 1 small spine; ventral surface slightly convex, with some tufts of long setae. Merus with tufts of setae on dorsal surface, dorsodistal margin unarmed; ventrolateral and ventromesial margins each with 2 small spines distally; ventral surface with some tufts of long setae. Ischium with small tubercle on dorsal surface bearing tuft of long setae; ventral surface weakly inflated

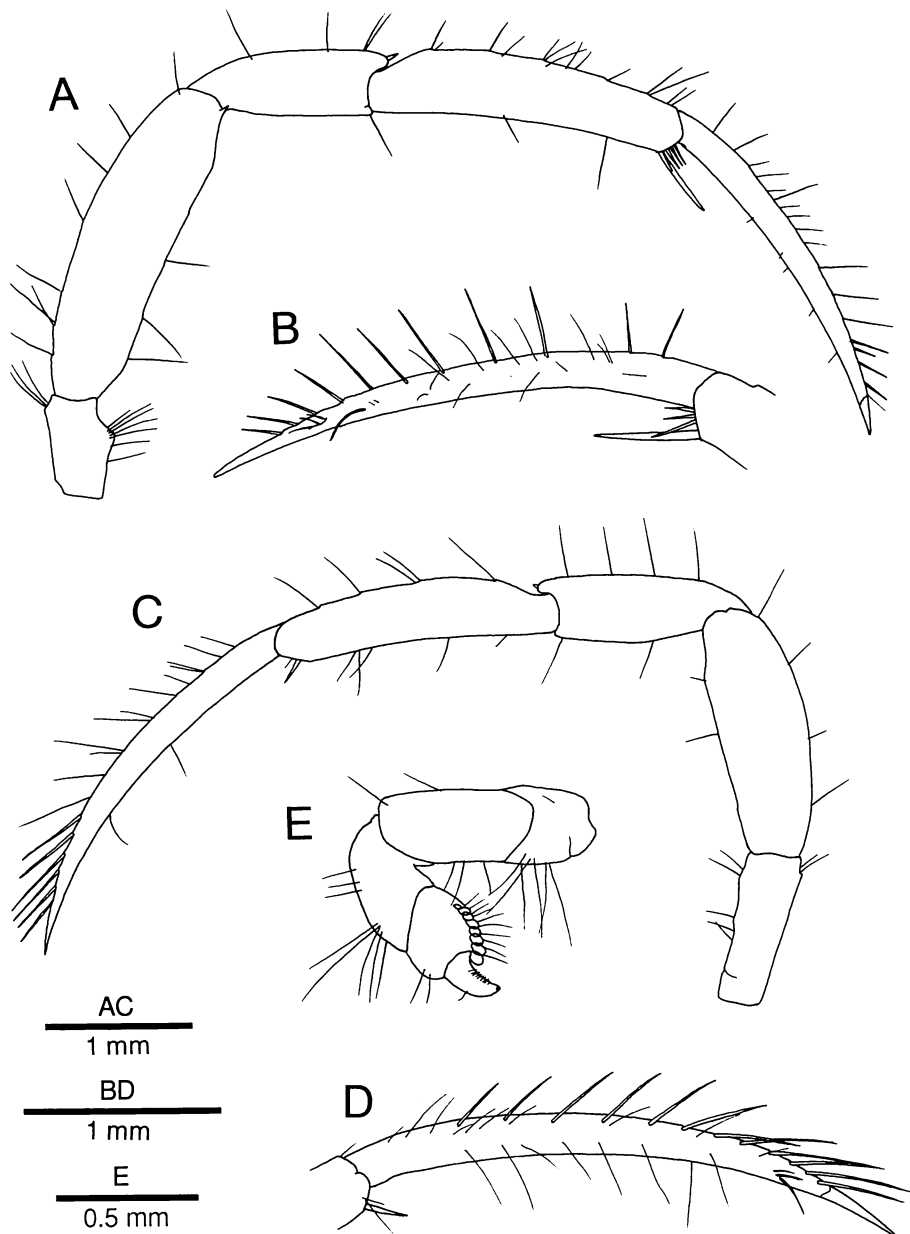


Fig. 16. *Catapaguroides japonicus* de Saint Laurent, 1968. Male (sl 1.5 mm; CBM-ZC 6154) from off Hagi, Yamaguchi Prefecture (stn 01-09). A, right second pereopod, lateral; B, dactylus of right second pereopod, mesial; C, left third pereopod, lateral; D, dactylus of left third pereopod, mesial; E, left fourth pereopod, lateral.

proximally, ventromesial margin unarmed. Coxa with 1 small, but prominent distolateral spine.

Ambulatory pereopods (Fig. 16A–D) elongate, slender, overreaching right cheliped by nearly half length of dactyli, terminating in long, slender claws. Dactyli of second pereopods

1.20–1.29 times as long as propodus, those of third pereopods 1.35–1.45 times as long; dactyli weakly curved in lateral view, slightly curved distally in dorsal view; dorsal margins each with long bristles; lateral faces each with few short to long setae; mesial faces each with 2 rows of thin setae, but no

corneous spinules; ventral margin lacking row of corneous spines or spinules. Propodi of second pereopods each with single elongate spine reaching to proximal 0.20 of dactylus and 3 or 4 shorter spines on either side of elongate spine; propodi of third pereopods with ventrodistal margins each with 1 short corneous spine; dorsal and ventral surfaces all with sparse tufts or single bristles. Carpi each with spinule at dorsodistal angle and few setae dorsally. Meri with ventrodistal spinule in second, but unarmed in third; dorsal and ventral surfaces with sparse tufts of long setae, setae fewest and shortest in left third. Ischia of second pereopods with low protuberance accompanied by tuft of long setae on ventral surface; ventral surfaces of ischia of third pereopods slightly concave, with few tufts of setae diminishing in length proximally.

Fourth pereopod (Fig. 16E) not semichelate, with sparse setae on all segments; dactylus with row of minute denticles on ventral margin; propodal rasp consisting of row of 8 corneous scales. Fifth pereopods semichelate; right coxa (Fig. 13E) with long sexual tube directed from right to left and reaching far beyond coxa of left; left coxa (Fig. 13E) with short sexual tube directed mesially and partially obscured by setae arising from sternal surface.

Anterior lobe of sixth thoracic sternite (Fig. 13F) with roundly rectangular, slightly skewed to left.

Abdomen twisted, with 3 unpaired, unequally biramous left pleopods. Sixth abdominal tergite (Fig. 13G) with trace of transverse groove. Uropods (Fig. 13G) greatly unequal with left exopod moderately to strongly elongate. Telson (Fig. 13H) generally rounded in outline, without lateral indentations; posterior lobes separated by small median cleft; terminal margins strongly oblique, each with 3 small, acute spines; lateral margins each delimited by chitinous plate.

Coloration. In formalin. Shield and posterior carapace generally orange; anterior margin of branchiostegite darker. Ocular peduncle generally orange, with darker transverse band extending to dorsal surface mesially. Antennular peduncle pale orange; ultimate segment with darker orange band at

midlength. Antennal peduncle pale orange; fourth segment with dark orange longitudinal stripe on lateral surface; antennal acicle with dark orange spot basally. Right cheliped generally pale brown; dactylus and fixed finger with broad transverse band of dark orange medially (interrupted on lateral face); palm with scattered dark orange spots on dorsal surface, and with tint of light orange on mesial and ventral surfaces proximally; carpus with 2 longitudinal stripes and 1 large central blotch of dark brown on dorsal surface, and 2 longitudinal stripes (median and ventral) on mesial face; merus bordered with dark orange distally, and with 1 obliquely transverse line and 1 longitudinal stripe on lateral face, and with 2 vertical lines on mesial face. Color pattern of left cheliped similar to that of right, but longitudinal stripes on merus interrupted. Ambulatory pereopods generally pale orange; dactyli each with faint orange band proximally; propodi each with orange transverse band at about distal 0.25 and faint short longitudinal stripe proximally; carpi each with 2 orange longitudinal stripes on dorsal and lateral (median) surfaces; meri each with elongate semicircular line on lateral face.

Distribution. So far known only from the following Japanese localities: Sagami Bay and Suruga Bay (de Saint Laurent, 1968; Miyake, 1978); southern part of the Sea of Japan (present study); at depths of 65–366 m (de Saint Laurent, 1968; Miyake, 1978).

Remarks. *Catapaguroides japonicus* was first described by de Saint Laurent (1968) based on four specimens from Sagami Bay and Suruga Bay, Japan. Since the original description, Miyake (1978) reported this species from Sagami Bay based on a single male specimen. The present male specimen agrees generally with the original description by de Saint Laurent (1968) in most specific characters, particularly in the armature of the right cheliped. At our request, Dr. R. Lemaitre kindly reexamined the holotype and paratype of *C. japonicus* in the collection of USNM (see "Material examined"). There is little doubt that our specimen is conspecific with the type specimens. Minor differences are found in the armature of the carpus of the right cheliped and the shape of the left

uropod. In the types, the dorsal surface of the carpus of the right cheliped bears only a single small tubercle proximally, while in our specimen, there are two widely separated, acute spines on that surface. The distal segment of the left uropod is subequal in length to the sixth abdominal tergite in the types, rather than distinctly longer in the present specimen.

The genus *Catapaguroides* A. Milne Edwards and Bouvier, 1892 is represented by three eastern Atlantic and 13 Indo-Pacific species (de Saint Laurent, 1968; McLaughlin, 1997; McLaughlin and Pittman, 2002). In shape and armature of the right chela, *C. japonicus* appears close to *C. spinulimanus* de Saint Laurent, 1968 from Indonesia. In these two species, the chela is subovate in general outline in the dorsal view; the dorsal surface of the palm is armed with small spines. In the other *Catapaguroides* species, the dorsal surface of the palm bears at most a few spines, except for those on the dorsomesial margin (see de Saint Laurent, 1968; McLaughlin, 1997; McLaughlin and Pittman, 2002). De Saint Laurent (1968) provided a number of distinguishing characters between the *C. japonicus* and *C. spinulimanus*, however, characters such as the armature of the dactylus and carpus of the right cheliped and the proportion of the palm of the right chela are here proved to be unreliable. Nevertheless, *C. japonicus* may be best distinguished from *C. spinulimanus* by the armature of the right chela. In *C. japonicus*, the posterior half of the dorsal surface is devoid of spines or spinules, while in *C. spinulimanus*, the palm bears a single median row of small spines extending nearly from the level of the base of dactylus to near the proximal margin of the palm. The antennal acicle may be longer in *C. japonicus* than in *C. spinulimanus*; it reaches nearly to the distal end of the cornea in *C. japonicus*, rather than only reaching to the base of the cornea in *C. spinulimanus*.

Another congeneric species from Japanese waters, *C. fragilis* (Melin, 1939), is easily distinguished from *C. japonicus* by the presence of a distinct row of spines adjacent to the dorsomesial margin of the right palm (de Saint Laurent, 1968).

Turleania similis Komai, 1999

Turleania similis Komai, 1999b: 50, figs. 27–31 [type locality: Chichi-jima Island, Ogasawara Islands].

Material examined. TRV *Toyoshio-maru*, 2000–10 cruise: stn 12, south of Iki Island, 133 m, 1 male (sl 1.5 mm) (CBM-ZC 5625).

Coloration. In formalin. Shield light orange-brown. Ocular peduncle light orange brown, without markings; ocular acicle with dark orange spot distally (but subterminal spine transparent). Ultimate segment of antennular peduncle with 3 orange transverse bands on white back ground. Antennal peduncle generally light orangish brown; flagellum banded with white and red. Chelae generally light orange; fingers white, each with dark red marking basally on lateral face and with red spot subdistally; palms with tinge of red near articulation with dactyli; carpi generally light orange, dorsolateral distal angle and dorsomesial distal angle dark red, some spines on dorsal surface dark orange; ventral surfaces each with large blotch of orange mesially; meri with some blotches of orange on lateral and mesial faces. Ambulatory legs generally white; dactyli each with 3 obscure bands of orange; propodi each with 1 obscure band of orange distal to midlength, proximally with tinge of orange; carpi each with dark red spot on dorsodistal projection, and with tinge of orange; meri each with obscure band of orange subdistally and some blotches of orange on lateral face.

Distribution. Ogasawara Islands and southern part of the Sea of Japan, at depths of 98–151 m (Komai, 1999b; present study).

Remarks. The present specimen agrees in general with the original description of *Turleania similis* Komai, 1999b, described from the Ogasawara Islands, in both morphology and coloration, except for the following minor particulars: the palm of the right chelipeds has more numerous spinules in the present specimen than in the type material; the dactyli of the second and third pereopods have three obscure orange bands in the present specimen, rather than one proximal band in the type specimens. The

latter difference may be attributable to difference in preservation: the present specimen was fixed in a 3% formalin sea water solution, but the type specimens were preserved in 70% ethanol. The bands on the ambulatory dactyli of the type specimens may have faded away by the time it was described. The difference in the armature of the right cheliped palm could be within a range of intraspecific variation.

Family Galatheidae

Munida japonica Stimpson, 1858

Munida japonica Stimpson, 1858: 252 [type locality: originally Kagoshima Bay, but subsequently changed to off Makura-zaki, Kagoshima, by designation of a neotype by Macpherson and Baba (1993)]; Macpherson and Baba, 1993: 399, fig. 9; Wu et al., 1998: 115, figs. 24, 26F, G).

Material examined. TRV *Toyoshio-maru*, 2000–10 cruise: stn 12, off Tsushima Island, 133 m, 2 males (cl 8.3, 9.3 mm) (CBM-ZC 5626).

Distribution. So far known with certainty only from Japan, the Philippines, Indonesia, and Taiwan, at depths of 102–220 m (Macpherson and Baba, 1993; Macpherson, 1997; Wu et al., 1998).

Remarks. The taxonomy of *Munida japonica* and related species was substantially clarified by Macpherson and Baba (1993). The present specimens are identifiable as *Munida japonica* on account of the following features: carapace with posteriormost striae uninterrupted medially; distal spines of basal segment of antennular peduncle subequal in size; distomesial spine on first segment of antennal peduncle distinctly overreaching third segment; merus of third maxilliped with distal spine on dorsal (= extensor) margin; fourth to seventh thoracic sternites with few striae; lateral parts of seventh thoracic sternite without granules; second abdominal somite with spines on anterodorsal margin. According to the redescription by Macpherson and Baba (1993) based on the neotype and supplemental material from Japan and the Philippines, there are two spines at each anterolateral angle of the second abdominal

somite. In one of the two specimens examined here (larger male cl 9.3 mm), only one spine at the left anterolateral angle of the second abdominal somite is clearly discernible; another spine at the left anterolateral angle and two at the right angle are greatly reduced and only indicated by minute, hardly discernible tubercles. The armature of the second abdominal somite has been considered to be useful in discriminating *Munida* species (cf. Baba, 1988; Macpherson and Baba, 1993; Macpherson, 1994). It would be desirable to examine more material to better understand variability in the development of the spines on the second abdominal somite.

Munida pherusa Macpherson and Baba, 1993

Munida pherusa Macpherson and Baba, 1993: 408, fig. 15 [type locality: south of Luzon, the Philippines]; Wu et al., 1998: 122, figs. 28, 35B.

Material examined. TRV *Toyoshio-maru*, 2001–11 cruise: stn 9, off Hagi, Yamaguchi Prefecture, 79–83 m, 1 male (cl 5.6 mm), 1 ovig (cl 7.0 mm) (CBM-ZC 6157); stn 12, off Kawajiri-misaki, Yamaguchi Prefecture, 84 m, 1 female (cl 7.1 mm) (CBM-ZC 6172).

Coloration. In formalin (47 days after fixation). Carapace and first to fifth abdominal somites generally light orange-red; striae on postcervical carapace dark red; dark red spot at base of first postcervical tooth; striae and posterolateral parts of first abdominal somite dark red; striae on lateral parts of second to fifth somites (including pleura) also dark red. Cheliped generally light orange-red; dactylus with narrow dark red band slightly distal to midlength; palm and carpus each with tinge of red distally, margins of squamiform protuberances darkened with red; merus with red-margined squamiform tubercles in distal 0.25, and with spot of dark red basally; ischium with dark red line on mesial face. Ambulatory pereopods also generally light orange-red; propodi each with 2 transverse rows, each composed of 1 or 2 rows of dark red margined squamiform tubercles on lateral face; meri each with 3 transverse rows, each composed of 3–4 rows of dark red

margined squamiform tubercles on lateral face. Fifth pereopod with dark red spot at base of carpus and midlength of merus respectively. Stiff, non-plumose setae on body and appendages with strong iridescent sheen.

Distribution. Japan, the Philippines, Indonesia and Taiwan, at depths of 73–152 m (Macpherson and Baba, 1993; Wu et al., 1998).

Remarks. This species was recently described by Macpherson and Baba (1993) from the Tsushima Strait, Japan, the Philippines, and Indonesia, and subsequently recorded from Taiwan by Wu *et al.* (1998). The present specimens are referred to *M. pherusa* on account of the following features: carapace with posteriormost striae uninterrupted medially; distal spines of basal segment of antennular peduncle subequal in size; distomesial spine of first segment of antennal peduncle not reaching distal margin of third segment; merus of third maxilliped with distal spine on dorsal (=extensor) margin; third thoracic sternite as wide as anterior margin of following sternite; fourth to seventh thoracic sternites with numerous striae; lateral parts of seventh thoracic sternite without granules; second abdominal somite unarmed on anterodorsal margin.

Infraorder Brachyura
Family Pilumnidae
Subfamily Rhizopinae

***Typhlocarcinops takedai* Ng, 1987**
(Figs. 17, 18)

Typhlocarcinops transversa-Takeda and Miyake, 1968: 569, fig. 8a, b, pl. 6A; Takeda, 1973: 54; Dai and Yang, 1991: 413 (key). Not *Typhlocarcinops transversa* Tesch, 1918.

Typhlocarcinops takedai Ng, 1987: 90 [type locality: East China Sea].

Material examined. TRV *Toyoshio-maru*, 2001–11 cruise: stn 11, off Kawajiri-misaki, Yamaguchi Prefecture, 86–88 m, 3 males (cl 3.0–5.1 mm by cw 4.1–7.1 mm), 2 females (cl 4.2, 4.9 mm by cw 6.5, 7.4 mm), 1 ovig (cl 5.1 mm by cw 7.6 mm) (CBM-ZC 6168); stn 12, similar locality, 84 m, 1 male (cl 2.7 mm by cw 4.2 mm) (CBM-ZC 6176).

Description. Carapace (Figs 17A, 18A) not markedly vaulted, quadrate in general outline in dorsal view, 1.39–1.53 times broader than long, with greatest breadth across third or fourth anterolateral lobe (level of about midlength of carapace). Dorsal surface strongly convex anteriorly and posteriorly, transversely flat, with minute granules most pronounced adjacent to anterolateral to lateral margins and numerous very short, thin setae; margins fringed with sparse short plumose setae. Regional definition not obvious except for very shallow, longitudinal gastric and cardiac grooves. Frontal margin deflexed, faintly bilobed, laterally produced as small lobe; frontal region with shallow, but distinct median groove confluent with gastric grooves, width of frontal region 0.25–0.27 of carapace width. Supraorbital margin smooth, continuous with anterolateral margin; infraorbital margin also smooth, sinuous, without notches or incisions. Anterolateral margin strongly arched, minutely granular, divided in 4 confluent broad lobes (including outer-orbital lobe) separated by 3 distinct, U-shaped notches; outer-orbital lobe longest; first anterolateral lobe longer than second anterolateral lobe; third anterolateral lobe very small. Posterolateral margins slightly converging posteriorly; posterior margin broadly arched.

Orbits (Fig. 18A) 0.55–0.60 as wide as front. Ocular peduncles (Figs 17A, 18A) filling orbital space, immobile, dorsal surface with row of short setae continuing from anterolateral margin of carapace, anteroinferior surface minutely granular; corneas small but distinct, not faceted, with dark pigmentation, not visible in dorsal view.

Antennular fossa (Fig. 18A) moderately wide, occupying most of space inferior to frontal margin, septum separating antennular fossae well developed. Antennular peduncle (Fig. 18A) with basal segment transversely broad, filling inferior half of antennular fossa; distal 2 segments folded transversely; ultimate segment somewhat inflated. Antenna (Fig. 18A) with basal segment movable, reaching level of inferior orbital margin; penultimate segment lying in notch between lateral margin of frontal lobe

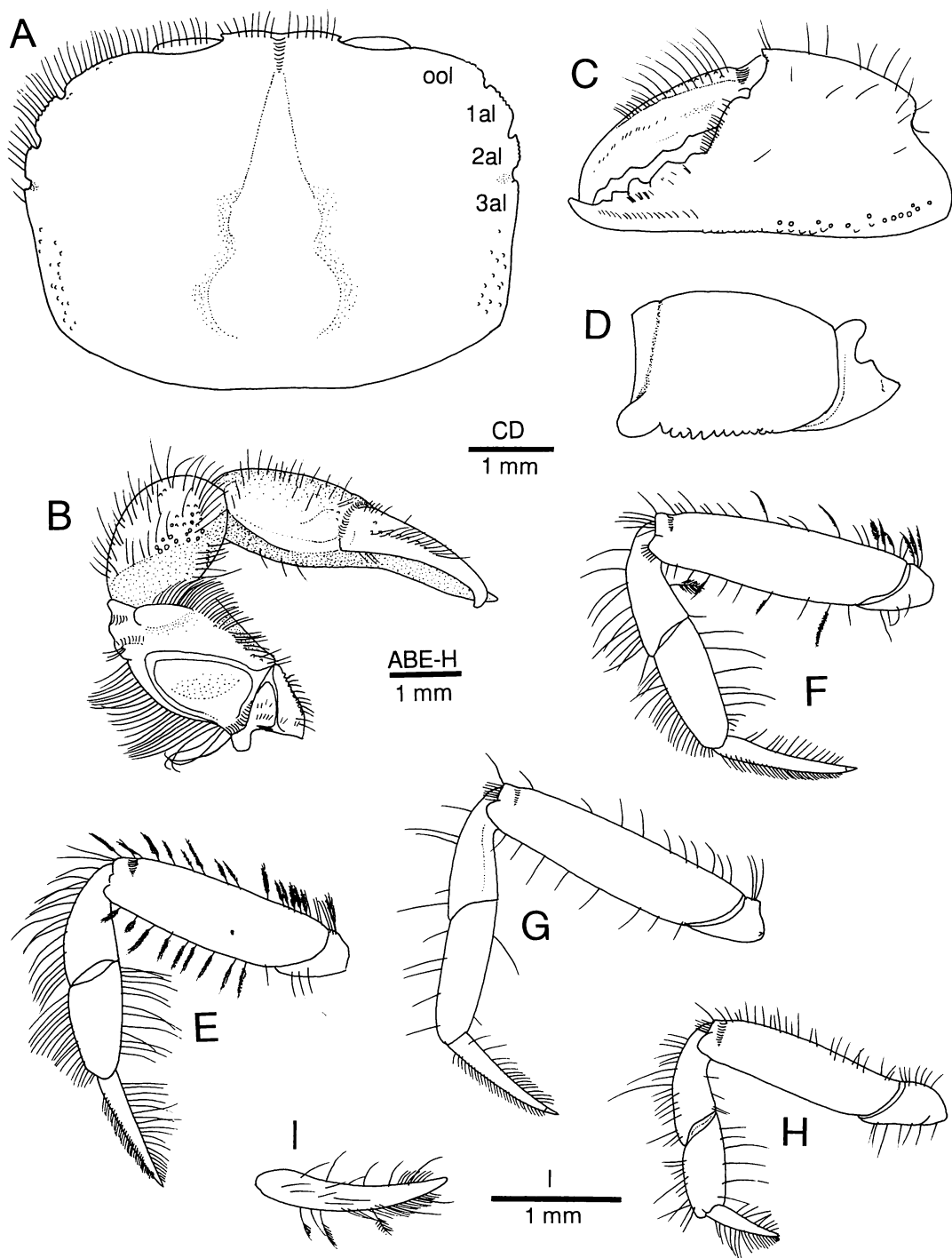


Fig. 17. *Typhlocarcinops takedai* Ng, 1987. Male (cl 4.2 mm by cw 5.8 mm; CBM-ZC 6168) from off Kawajiri-misaki, Yamaguchi Prefecture (stn 01-11). A, carapace, dorsal (setae omitted from right); B, left cheliped, dorsal (setae partially omitted); C, chela, outer (setae partially omitted); D, merus of left cheliped, ventral (setae partially omitted); E, left second pereopod, outer; F, left third pereopod, outer; G, left fourth pereopod, outer; H, left fifth pereopod, outer; I, same, dactylus, extensor. ool, outer-orbital lobe; 1-3 al, first to third anterolateral lobes.

and inferior orbital angle, much shorter than basal segment; ultimate segment reaching anterior end of frontal lobe in anterior view; antennal flagellum very short.

Proepistome very narrow, separated from epistome by distinct, broad suture. Epistome (Fig. 18B) with somewhat elongate anterolateral projection; lateral margins deeply concave; posterior margin very slightly concave; outer surface somewhat depressed medially, with distinct median suture. Suborbital region (Fig. 18A) smooth. Pterygostomial region (Fig. 18A) without long plumose setae along buccal frame; pterygostomial ridge low, blunt. Endostome (Fig. 18B) with low, short submedian ridges separated by distinct median groove and confluent with epistome.

Third maxillipeds (Fig. 18G) occupying most of buccal cavity. Ischium with lateral and mesial margins subparallel except near base where width increasing; mesial margin straight; posterior margin oblique; outer (=ventral) surface faintly granular, with shallow median groove. Merus hexagonal, 1.10–1.15 times broader than long, outer surface slightly uneven with sparse short setae; laterodistal margin broadly rounded, slightly produced; mesial margin straight, minutely granular. Distal 3 segments tapering distally; carpus stout, articulated at distomesial angle of merus; dactylus tapering distally with numerous stiff setae distally. Exopod overreaching midlength of merus but not reaching distal margin, weakly tapering distally, with prominent subdistal triangular projection on inner-mesial margin, outer-mesial margin granular; flagellum well developed.

Chelipeds (Fig. 17B–D) stout, subequal, similar in size between male and female. Ischium without thick mat of plumose setae on inner surface; inner (=anterior) margin with row of granules. Merus with slightly concave dorsal surface; inner-dorsal margin minutely granular, with row of long plumose setae; inner-ventral margin with row of small tubercles and plumose setae on distal 0.75, otherwise smooth; outer (=posterior) margin with numerous long plumose setae, but without subdistal tooth; inner (=anterior) surface nearly flat, with row of small, low tubercles on distal margin, naked except for

margins; ventral surface slightly convex, smooth, naked. Carpus with dorsal surface nearly flat, margins fringed with long plumose setae, dorsodistal inner angle without prominent spine; proximal outer angle not produced; outer surface slightly convex, generally subhexagonal in outer view, with minute granules and few setae; ventral surface nearly flat, with long setae along outer margin. Chela generally subtriangular in general outline in outer view, 1.90–2.10 times longer than greatest depth at base of dactylus. Palm nearly as long as deep; dorsal surface rounded, smooth, with inner margin bluntly ridged, not overhanging inner face; outer surface slightly convex, with scattered short plumose setae, but mostly not granular, but with single or double row of small tubercles ventrally extending onto proximal part of fixed finger; inner surface weakly inflated, smooth; ventral surface rounded, smooth. Fixed finger not curved toward inner side nor deflexed, narrowly triangular with oblique cutting edge, terminating subacutely; outer face with distinct ridge ventrally, continuous with granular row on palm; inner face with broad ridge ventrally; cutting edge bordered with several broadly triangular teeth. Dactylus 1.30–1.40 times longer than palm, weakly curved distally, terminating subacutely; dorsal surface with some granules proximally and row of plumose setae along inner margin extending beyond midlength; outer surface with inconspicuous longitudinal ridge dorsally; cutting edge with row of broadly triangular teeth.

Ambulatory pereopods moderately long and stout with fourth pereopods longest, without coxal plate; most setae plumose. Second pereopod (Fig. 17E) with merus 3.30–3.50 times longer than deep, dorsal surface forming blunt ridge bearing sparse short plumose setae, ventral surface rounded with 2 rows of sparse setae; carpus and propodus combined slightly shorter than merus; carpus with naked dorsal surface bordered by rows of long setae, outer and inner surfaces strongly convex; propodus subequal in length to carpus, dorsal surface slightly convex in outer view, bordered by rows of long setae, ventral margin with row of longer setae; dactylus straight, 1.70–1.85 times

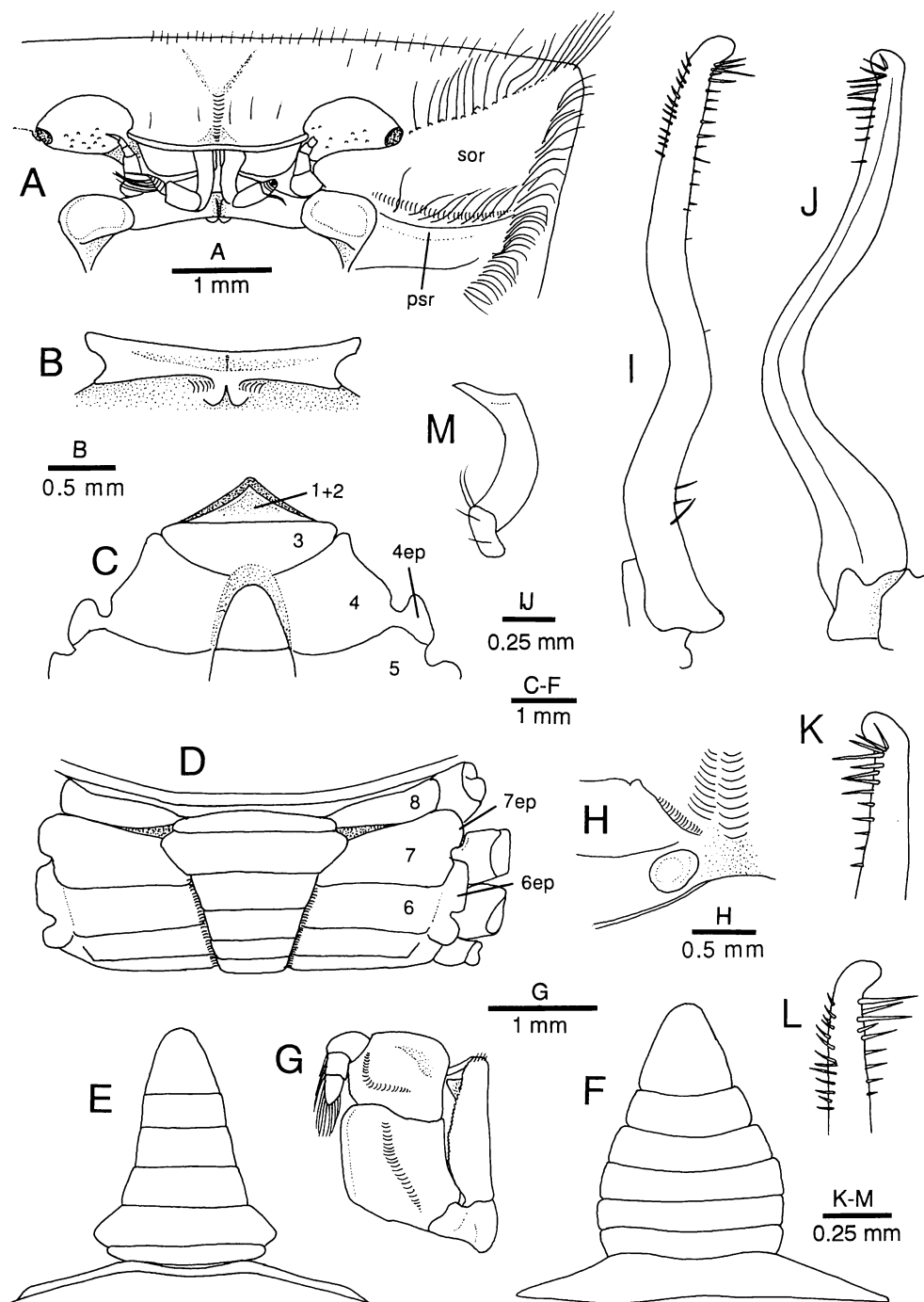


Fig. 18. *Typhlocarcinops takedai* Ng, 1987. A-E, G, I-L, male (cl 4.2 mm by cw 5.8 mm; CBM-ZC 6168) from off Kawajiri-misaki, Yamaguchi Prefecture (stn 01-11); F, H, female (cl 4.9 mm by cw 7.4 mm; same lot). A, carapace and cephalic appendages, anterior; B, epistome and anterior buccal cavity, anterior; C, second to fourth thoracic sternites and telson, ventral; D, thoracic sternum and abdomen, posterior; E, F, abdomen, outer; G, left third maxilliped, outer (setae partially omitted); H, mesial part of thoracic sternum, showing left gonopore; I, left first gonopod, ventral; J, same, lateral; K, distal part of left first gonopod, lateral; L, same, ventral; M, left second gonopod, lateral. ep, episternite; psr, pterygostomian ridge; sor, suborbital region; numerals corresponding to first to eighth thoracic sternites.

longer than propodus measured along ventral margin, terminating in small corneous claw, cross section roundly triangular (ventral margin bluntly ridged), dorsal edge each bearing row of short stiff setae, ventral edge with sparse, longer simple setae. Third pereopod (Fig. 17F) generally similar to second in setation and structure, but distinctly longer; merus 5.50–5.60 times longer than deep, ventral margin not granular, nearly straight in outer view; carpus and propodus combined subequal in length to merus; propodus slightly longer than carpus, with straight dorsal outline in outer view; dactylus 1.05–1.10 times longer than propodus. Fourth pereopod (Fig. 17G) generally similar to third pereopod in setation and structure, but slightly longer and more slender. Fifth pereopod (Fig. 17H) similar in setation to preceding 3 pereopods; merus 3.30–3.50 times longer than deep, slightly sinuous in outer view; carpus and propodus combined shorter than merus; dactylus (Fig. 17I) 0.90–0.95 times as long as propodus, straight in outer view, somewhat curved dorsally in extensor view, with row of rather sparse setae on extensor and flexor surfaces, outer (=dorsal) and inner (=ventral) faces with scattered short setae.

Male thoracic sternum (Fig. 18C, D) noticeably broadened posteriorly; surface not granular, with sparse, very short setae. First and second sternites completely fused, triangular. Third sternite semioval, its anterior margin slightly longer than posterior margin of second sternite. Sixth to eighth sternal plates visible in posterior view, of these seventh and eighth sternites nearly perpendicular to horizontal plane of carapace; each division of sixth to eighth sternites on either side of abdominal cavity subrectangular in general outline. Sulci separating third and fourth sternites, fourth and fifth sternites, and sixth and seventh sternites, interrupted medially; sulcus delimiting seventh and eighth sternites complete. Press-button knobs on fifth sternite distinct, adjacent to fourth sternite. Fourth to seventh episternites developed and broadly lobate posteriorly. Abdominal cavity deep, extending anteriorly to posterior end of sternal plate of third somite.

Female thoracic sternum generally similar to that of male except for shallower and broader abdominal cavity and absence of press-button knobs; gonopore (Fig. 18H) moderately large, transversely oval, not accompanied with flange, operculum consisting of soft chitinous membrane.

Male abdomen (Fig. 18E) consisting of 7 free somites, reaching nearly anterior end of fourth sternal plate; outer surface smooth, with very short, sparse setae. First somite extremely broad, reaching to coxae of fifth pereopods. Second somite distinctly narrower than third. Third somite with lateral margins produced laterally in blunt projection. Fourth to sixth somites slightly tapering distally. Telson rounded triangular, 1.10–1.20 times broader than long, much longer than sixth somite.

Female abdomen (Fig. 18F) broadest at third somite except first somite, 0.35 of carapace width. First somite extremely broad, reaching coxae of fifth pereopods. Second somite slightly narrower than third, becoming slightly broader distally. Fourth to sixth somite tapering distally. Telson roundly subtriangular, as long as broad.

Male genital openings coxal; penis lying concealed in groove between seventh and eighth sternites (Fig. 18D), partially visible through narrow hiatus, consisting of greatly elongate, membranous tube. First gonopod (Fig. 18I–L) slender, distinctly sinuous, completely concealed by abdomen; distal part somewhat compressed laterally, armed subterminally with row of bristles noticeably becoming longer distally on ventral (=outer) margin and row of minute bristles along dorsal (=inner) margin on mesial face; terminal process strongly flattened, directed anterolaterally, roundly truncate. Second gonopod (Fig. 18M) very short, strongly curved, tip obliquely truncate, forming concavity.

Coloration. In formalin. Dirty light brown entirely; distal parts of finger of chelipeds white.

Distribution. East China Sea and southern Sea of Japan; 75–102 m (Takeda and Miyake, 1968; Takeda, 1973; present study).

Remarks. The identification of the crabs of pilumnid subfamily Rhizopinae is usually

extremely difficult due to the confused state of the taxonomy. Although some taxonomic problems have been clarified by Ng (1987, 1989) and Ng and Davie (1991), actual identities of several genera and species still remain indeterminate. Practically, the genus *Typhlocarcinops* Rathbun, 1909 can be recognized by the following features (Ng, 1987): first abdominal somite extremely broad, reaching to coxae of fifth pereopods in both male and female; epistome well developed; ocular peduncles fixed. The genus *Typhlocarcinus* Stimpson, 1858 is very similar to *Typhlocarcinops* in overall appearance, but the former is distinguished from the latter by the much narrower first abdominal somite not reaching the coxae of the fifth pereopods. The genus *Caecopilumnus* Borradaile, 1903 is also superficially similar to *Typhlocarcinops*, but the former differs from the latter in the poorly developed, noticeably depressed epistome and narrower first abdominal somite. *Typhlocarcinops* is now represented by 13 species from the Indo-West Pacific, but a thorough review of the species of the genus is strongly needed.

The present specimens agree closely with the account of *Typhlocarcinops transversa* by Takeda and Miyake (1968), based on specimens from the East China Sea, including one male (ZLKU 12535) and two males and one female (ZLKU 12536). Subsequently Ng (1987) considered that Takeda and Miyake (1968) incorrectly identified their specimens as *T. transversa* Tesch, 1918, and described a new species, *T. takedai* based on the Takeda and Miyake's (1968) description, although he did not examine the material studied by Takeda and Miyake (1968). Ng designated the male specimen (ZLKU 12535; cl 5.2 by cw 7.8 mm) as holotype, and the other three specimens (ZLKU 12536) as paratypes. At our request, Dr. Y. Yabumoto of KMNH kindly checked the registration file of ZLKU collection now deposited in KMNH, and informed us that the above mentioned registration numbers were given for specimens of *Macrobrachium formosense* Bate (Caridea: Palaemonidae). Unfortunately, the type material of *T. takedai* remains elusive. Takeda and Miyake's (1968) description omitted several details, such as the structure of the

antennae, epistome, buccal cavity, thoracic sternum and abdominal somites. Ng (1987) presented only a brief diagnosis of *T. takedai* based on the account of *T. transversa* by Takeda and Miyake (1968). Therefore, a full description based on the present specimens is provided here.

Griffin and Campbell (1969) suggested that species of *Typhlocarcinops* could be divided into two groups based on the proportional breadth of the carapace. *T. takedai* is assignable to the species group characterized by the relatively broader carapace (more than 1.35 times broader than long), including *T. angustifrons* Rathbun, 1914, *T. canaliculata* sensu Serène (1964), *T. stephenseni* Serène, 1964, and *T. transversa* Tesch, 1918. *T. takedai* appears closest to *T. transversa* in having a weakly produced anterolateral angle of the merus of the third maxilliped. In the other three species, the mentioned part is broadly rounded. As Ng (1987) mentioned, *T. takedai* is readily distinguished from *T. transversa* by the following particulars; the anterolateral margin of the carapace is divided into four broad lobes separated by three distinct U-shaped notches in *T. takedai*, rather than having three widely separated tubercles in *T. transversa*; the dorsal surface of the palm of the cheliped is only bluntly ridged in *T. takedai*, rather than sharply ridged in *T. transversa*; the outer surface of the palm of the cheliped is smooth in *T. takedai*, but granular in *T. transversa*; the dactylus of the fifth pereopod is somewhat upcurved in *T. takedai*, rather than slightly downcurved in *T. transversa*. Further, *T. takedai* is separated from *T. angustifrons* by the possession of four, rather than two, anterolateral lobes of the carapace and darkly pigmented cornea of the eye. In *T. angustifrons*, the pigmentation of the cornea of the eye is so faint as to be almost undetectable (Rathbun, 1914). From *T. canaliculata* sensu Serène (1964) and *T. stephenseni*, *T. takedai* differs in the rounded inner distal angle of the carpus of the cheliped, more stout third to fifth pereopods, and slightly curved distal part of the first gonopod. In the two relatives, the inner distal angle of the carpus of the cheliped bears a distinct projection; the distal part of the first gonopod is strongly recurved (Serène, 1964).

***Xenophthalmodes morsei* Rathbun, 1932**

(Figs. 19, 20)

Xenophthalmodes morsei Rathbun, 1932: 35 [type locality: Wakanoura, Kii Peninsula]; Sakai, 1934: 315, fig. 23; 1935: 191, pl. 53, fig. 2; 1939: 572, pl. 66, fig. 4; 1965: 173, pl. 85, fig. 3; Tekeda, 1975: 142, 321, unnumbered fig.; Sakai, 1976: 547 (English text), fig. 295, pl. 194, fig. 2; Takeda, 1982: 199, fig. 589; Miyake, 1983: 221 (list); Nagai, 1990: 43 (list); Miyake, 1991b: 221 (list); 1998b: 221 (list); Chen, 1998: 292, fig. 18.

Xenophthalmodes moersi (sic)-Serère and Soh, 1976: 21 (key).

Material examined. TRV *Toyoshio-maru*, 2001-11 cruise: stn 11, off Kawajiri-misaki, Yamaguchi Prefecture, 86-88 m, 1 male (cl 5.6 mm by cw 7.0 mm) (CBM-ZC 6169).

Other material. TRV *Toyoshio-maru* 1998-04 cruise, stn 1, E of Hashira-jima Island, Seto Inland Sea, 34°00' N, 132°27' E, 40 m, 14 May 1998, dredge, coll. T. Komai, 1 female (cl 9.2 mm by cw 12.1 mm) (CBM-ZC 6039); 2000-10 cruise, stn 2, W of Shuku-jima Island, Seto Inland Sea, 33°45.20' N, 131°50.00' E, 55 m, 10 July 2000, dredge, coll. S. Ohtsuka, 1 male (cl 6.5 mm by cw 8.3 mm), 1 female (cl 7.9 mm by cw 9.8 mm) (CBM-ZC 5609).

RV *Toyohata-maru*: off Tosa, Tosa Bay, 90 m, 8 December 1994, beam trawl, coll. K. Sasaki, 1 male (cl 5.9 mm by cw 7.6 mm) (CBM-ZC 6115).

Description. Carapace (Figs 19A, 20A) vaulted, roundly trapezoidal in general outline in dorsal view, 1.24-1.32 times broader than long, with greatest breadth across posterolateral angles. Dorsal surface strongly arched anteriorly and posteriorly along longitudinal axis, transversely flat, with minute granules adjacent to anterolateral to lateral margins and scattered short, thin setae but devoid of close pubescence; margins thickly fringed with long, sparsely plumose setae, particularly prominent across frontal lobes and ocular peduncles. Regional definition not obvious except for sinuous, longitudinal cardiac grooves associated with trace of obliquely longitudinal branchial grooves. Frontal margin deflexed, weakly bilobed, laterally rounded without antennal

notches; frontal region with conspicuous median groove on dorsal surface, frontal width 0.20 of carapace width. Supraorbital margin smooth, continuous with infraorbital margin; infraorbital margin also smooth, without notches or incisions. Anterolateral margin arched, minutely granular, without trace of teeth or lobes; lateral margins weakly divergent posteriorly; posterior margin broadly arched, with marginal ridge faintly granular laterally.

Ocular peduncle (Fig. 19A, 20A) filling fully orbital space, completely fused to carapace; cornea absent.

Antennular fossae (Fig. 20A) wide, occupying most of space inferior to frontal margin, septum separating antennular fossae poorly developed, thus basal segment of antennular peduncle contiguous. Antennular peduncle with basal segment transversely broad, filling inferior half of antennular fossa; distal 2 segments folded obliquely transverse. Antenna (Fig. 20A) with basal segment movable, reaching level of inferior orbital margin; penultimate segment lying in notch between lateral margin of frontal lobe and inferior orbital angle, much shorter than basal segment; ultimate segment extending to anterior margin of frontal lobe; antennal flagellum 2.50-3.00 times longer than antennal peduncle.

Proepistome very narrow, separated from epistome by distinct suture. Epistome (Fig. 20B) with prolonged anterolateral projection; lateral margins deeply concave; posterior margin nearly straight; outer surface with distinct median suture. Suborbital region smooth (Fig. 20A). Pterygostomial region (Fig. 20A) with row of long plumose setae along buccal frame; pterygostomial ridge blunt, rather broad. Endostome deeply depressed, with broad median groove.

Third maxillipeds (Fig. 20C) occupying most of buccal cavity. Ischium with lateral and mesial margins subparallel except near base where width increasing; mesial margin slightly convex; posterior margin oblique; outer (ventral) surface faintly granular, with shallow median groove. Merus subquadrate, 1.15-1.20 times broader than long, outer surface faintly granular; laterodistal margin broadly rounded, not produced; mesial

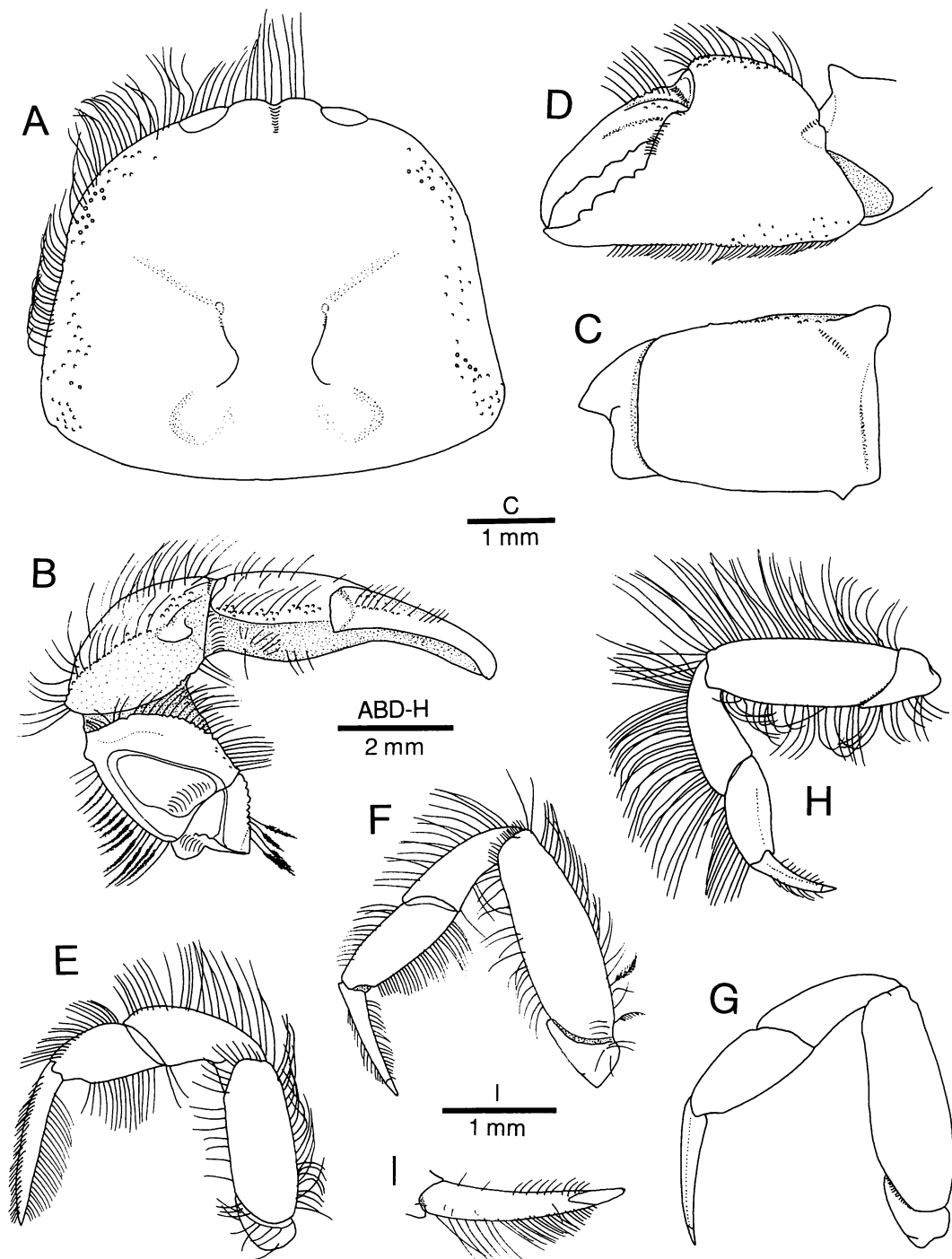
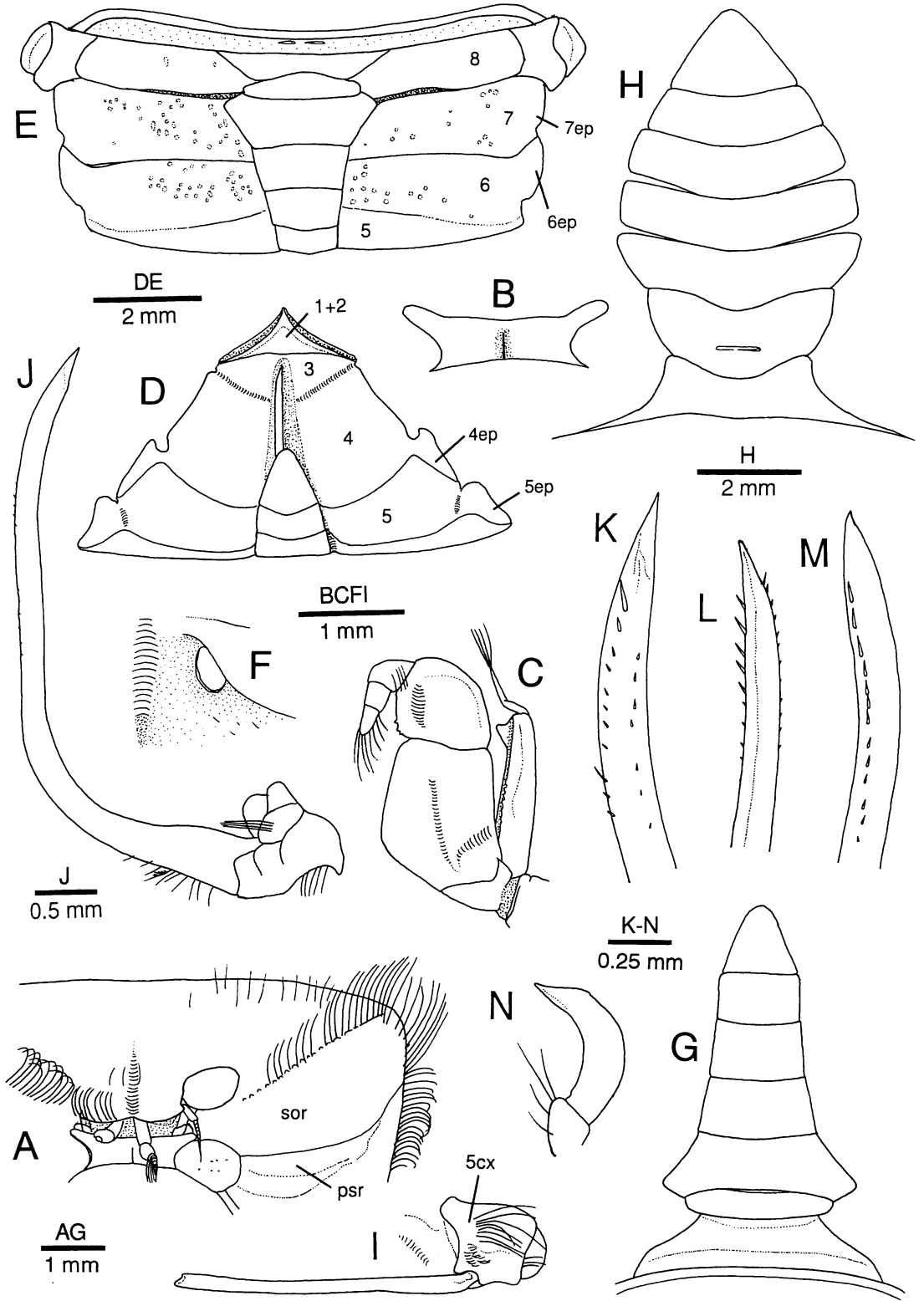


Fig. 19. *Xenophthalmodes morsei* Rathbun, 1932. Male (cl 6.5 mm by cw 8.3 mm; CBM-ZC 5609) from Seto Inland Sea. A, carapace, dorsal (setae omitted from right side); B, left cheliped, dorsal; C, same, merus, ventral (setae omitted); D, same, chela and distal part of carpus, outer (setae partially omitted); E, left second pereopod, outer; F, left third pereopod, outer; G, left fourth pereopod, outer (setae omitted); H, left fifth pereopod, outer; I, same, dactylus, extensor.



margin slightly convex or sinuous, minutely granular. Distal three segments tapering distally; carpus stout, articulated at distomesial angle of merus; dactylus slightly tapering distally with few long stiff setae distally. Exopod reaching to level of midlength of merus, with small, subdistal triangular projection on inner-mesial margin, outer-mesial margin faintly granular; flagellum developed, but relatively short.

Chelipeds (Fig. 19B–D) stout, subequal, similar in size between male and female. Ischium with thick mat of plumose setae of various length on inner surface. Merus with concave dorsal surface; inner-dorsal margin with row of long, thickly plumose setae; outer (=posterior) margin with numerous long plumose setae and 1 blunt to subacute subdistal tooth; inner (=anterior) surface nearly flattened, with some sharp granules dorsally, naked except for margins; ventral surface smooth, but covered with numerous short plumose setae. Carpus with dorsal surface nearly flattened, margins fringed with long plumose setae, dorsodistal inner angle with prominent blunt spines; proximal outer angle weakly produced; outer surface slightly convex, generally rhomboidal in outer view, with sharp granules dorsally and scattered thin, simple setae; ventral surface nearly flat, with long setae, particularly dense on outer margin. Chela generally subtriangular in outline in outer view, 1.65–1.75 times longer than greatest depth at base of dactylus. Palm 1.10–1.20 times deeper than long; dorsal surface distinctly ridged, sloping proximally, slightly overhanging inner face, with double or triple row of granules and long plumose setae; outer surface slightly convex, with scattered thin simple setae and minute granules adjacent to distal margin near base of dactylus and

to ventral margin; inner surface weakly inflated, smooth; ventral margin forming distinct, granular ridge extending onto distal part of fixed finger. Fixed finger weakly curved toward inner side, not deflexed, triangular with oblique cutting edge, terminating subacutely; cutting edge bordered with several blunt teeth. Dactylus 1.20–1.35 times longer than palm, weakly curved distally, terminating subacutely; outer surface with inconspicuous longitudinal ridge dorsally; cutting edge with row of rather low, blunt teeth.

Ambulatory pereopods with fourth pereopods longest; no coxal plates. Second pereopod (Fig. 19E) with merus 2.30–2.40 times longer than deep, dorsal surface forming blunt ridge bearing numerous long plumose setae increasing in length distally, ventral surface rounded with fewer and shorter plumose setae; carpus and propodus combined distinctly longer than merus; carpus with naked, narrow dorsal surface bordered by rows of long simple setae, outer and inner faces strongly convex; propodus subequal in length to carpus, dorsal surface weakly convex in outer view, flanked by rows of numerous simple setae, outer and inner surfaces naked, ventral margin with single row of shorter simple setae; dactylus 1.40–1.50 times longer than propodus measured along ventral margin, terminating in small corneous claw, cross section triangular (ventral margin bluntly ridged), each ridge bearing row of short stiff setae. Third pereopod (Fig. 19F) generally similar to second in setation, but distinctly longer; merus 2.80–2.90 times longer than deep, ventral margin slightly sinuous in outer view, with some granules in proximal half; carpus and propodus combined subequal in length to merus; carpus with outer and inner faces less convex than

Fig. 20. *Xenophthalmodes morsei* Rathbun, 1932. A–E, G, J–N, male (cl 6.5 mm by cw 8.3 mm; CBM-ZC 5609) from Seto Inland Sea; F, H, female (cl 9.2 mm by cw 12.1 mm; CBM-ZC 6039) from Seto Inland Sea; I, male (cl 5.6 mm by cw 7.0 mm; CBM-ZC 6169) from off Kawajiri-misaki, Yamaguchi Prefecture (stn 01–11). A, carapace and cephalic appendages, anterior (setae partially omitted); B, epistome, anterior; C, third maxilliped, outer; D, second to fourth thoracic sternite and distal part of abdomen, ventral, showing exposed distal part of right first gonopod (setae omitted); E, fifth to eighth thoracic sternites, first to sixth abdominal somites and coxae of fifth pereopods, posterior (setae omitted); F, left female gonopore, ventral; G, H, abdomen, outer (setae omitted); I, coxa of left fifth pereopod and penis, posteroventral; J, left first gonopod, lateral; K, same, distal part, lateral; L, same, ventral; M, same, mesial; N, left second gonopod, lateral. cx, coxa; other abbreviations same as Fig. 18.

in second; dorsal outline of propodus less convex than in second; dactylus 1.05–1.10 times longer than propodus, subovate in cross section, with 3 rows of short simple setae (2 rows on outer face and 1 row on inner face). Fourth pereopod (Fig. 19G) generally similar to third pereopod in setation and structure, but slightly longer. Fifth pereopod (Fig. 19H, I) similar in setation to preceding three pereopods; merus 3.05–3.15 times longer than deep, with straight ventral outline in outer view; carpus and propodus combined subequal in length to merus; dactylus (Fig. 19I) 0.90–1.00 times as long as propodus, slightly curved dorsally.

Male thoracic sternum (Fig. 20D, E) noticeably broadened posteriorly; surface not granular, with numerous, but not dense, long setae. First and second sternites completely fused, triangular. Third sternite subtriangular, its anterior margin almost as long as posterior margin of second sternite. Fourth sternite very large. Sixth to eighth sternal plates visible in posterior view, all nearly perpendicular to horizontal plane of carapace, each division on either side of abdominal cavity subrectangular in general outline. Sulcus separating third and fourth sternites represented by conspicuous groove, interrupted medially; sulci separating fourth and fifth sternites, and sixth and seventh sternites, interrupted medially; sulcus delimiting seventh and eighth sternites complete. Press-button knobs on fifth sternite distinct, adjacent to fourth sternite. Fourth and fifth episternites developed in narrow, posterolaterally directed lobes; sixth and seventh episternites only weakly developed, broadly rounded. Abdominal cavity very deep, extending anteriorly to anterior end of third sternite, accommodating exposed part of first gonopods.

Female thoracic sternum generally similar to that of male except for shallower and broader abdominal cavity and absence of press-button knobs; gonopores (Fig. 20F) moderately large, oval in outline, adjacent to suture separating fifth and sixth sternites; operculum membranous.

Male abdomen (Fig. 20G) consisting of 7 free somites, reaching to level of midlength of fourth sternite. First somite slightly

broader than third, falling far short of coxae of fifth pereopods. Second somite distinctly narrower than first or third. Fourth to sixth somites slightly tapering distally. Telson rounded triangular, about as long as broad, longer than preceding somites.

Female abdomen (Fig. 20H) with first somite widest, not reaching base of coxae of fifth pereopods. Third somite widest among second to sixth somites and telson, 0.40 times as wide as carapace. Fourth to sixth somite narrowed distally. Telson roundly subtriangular, 1.30–1.40 times as broad as long.

Male genital openings coxal; penis (Fig. 20I) lying concealed in groove between seventh and eighth sternal plates, consisting of greatly elongate, membranous tube. First gonopod (Fig. 20J–M) very slender, not sinuous, but strongly curved at proximal one-third in lateral or mesial view, extending to suture separating second and third sternal plates, distal parts exposed, contiguous, straight, each tapering to acutely pointed apex; dorsal surface bluntly ridged; lateral surface ventrally with row of spinules diminishing in size proximally and dorsally with row of very minute bristles; mesial surface dorsally with row of spinules diminishing in size proximally. Second gonopod (Fig. 20N) very short, sigmoidal, tip obliquely truncate, forming concavity.

Coloration. In formalin. Entirely dirty light yellowish brown; sternum and abdomen paler. Illustrations of this species in color have been published by Sakai (1935, 1939, 1965, 1976) and Takeda (1975, 1982).

Distribution. Japanese Pacific coast southward from Sagami Bay, Seto Inland Sea, Kyushu, southern part of Sea of Japan, and Nansha Islands, South China Sea, at depths of 30–90 m (Sakai, 1976; Chen, 1998; present study).

Remarks. The rhizopine genus *Xenophthalmodes* Richters, 1880 is rather easily recognized by the following features (Ng, 1987): carapace more elongate, being semicircular or roundly trapezoidal, rather than quadrate; front narrow, but prominent; ocular peduncles completely fused to carapace; antennules folded transversely; anterolateral angle of merus of third maxilliped rounded, not produced; first abdominal somite not reach-

ing to coxae of fifth pereopods in both male and female. It is represented by four species from the Indo-West Pacific (Ng, 1987): *X. moebi* Richters, 1880 known with certainty from Mauritius and Madagascar (type species of the genus); *X. dolichophallus* Tesch, 1918 from Indonesia and East Australia; *X. morsei* Rathbun, 1932 from Japan and Nansha Island; *X. brachyphallus* Barnard, 1955 from South Africa. Griffin and Campbell (1969) suggested a possibility that *X. dolichophallus* and *X. morsei* might be conspecific. Guinot (1979) remarked that a thorough review of the genus is necessary. However, a comprehensive taxonomic study of this genus has not still been undertaken. The present specimens are identified as *X. morsei*, as they agree well with previous accounts of the species (Rathbun, 1932; Sakai, 1934, 1935, 1939, 1965, 1976), although the male holotype (USNM 46403) has not been reexamined.

Although *Xenophthalmodes morsei* has been well represented in previous literature, little descriptive information on morphology of this species has been available. Even the male abdomen and gonopods have not been described or illustrated (cf. Griffin and Campbell, 1969; Serène and Soh, 1976). Therefore, a detailed description based on the present specimens is given in this paper to enable a better understanding of the morphology of this species. As in *X. moebi* (see Guinot, 1979) and *X. dolichophallus* (see Tesch, 1918; Griffin and Campbell, 1969), the distal parts of the male first gonopods are exposed in *X. morsei*. We compared carefully the present specimens with the previous accounts of *X. moebi* (see Guinot, 1979; Türkay, 1981) and *X. dolichophallus* (see Tesch, 1918; Griffin and Campbell, 1969), and found differences between *X. morsei* and the two relatives. From *X. moebi*, *X. morsei* differs in the regularly arched outline of the frontal and lateral margins of the carapace, rather than more quadrate in *X. moebi*, and the less elongate male telson in *X. morsei* than in *X. moebi* (almost as long as broad in *X. morsei*, while 1.27 times longer than broad in *X. moebi*). From *X. dolichophallus*, *X. morsei* is distinguished by the carapace and abdomen lacking a dense pubescence that is present in

X. dolichophallus and less elongate spinules on the distal part of the male first gonopod. Further, Tesch (1918) mentioned that there was a very faint speck of pigment on the ventral side of the ocular peduncle in adult and subadult specimens of *X. dolichophallus*. However, there is no trace of pigmentation in our specimens of *X. morsei*. The absence of the pigmentation representing a vestige of cornea may be useful to discriminate *X. morsei* from *X. dolichophallus*.

The specimen from off Kawajiri-misaki, southern Sea of Japan (CBM-ZC 6169), has a deformed carapace with slightly inflated left branchial region, being probably due to bopyrid isopod parasitism.

It is noteworthy to mention that the greatly enlarged posterior thoracic sternites in both male and female, and the greatly elongate penis, here documented in *Xenophthalmodes morsei* and *Typhlocarcinops takedai*, seem to be unusual not only in the Pilumnidae, but in the other xanthoid families. This suggests that these characters may be useful in assessing phylogenetic relationships among pilumnid taxa. Preliminary survey of literature and specimens in the CBM collection has indicated that the tendency for enlargement of the posterior thoracic sternites and the elongation of the penis are found in the other pilumnid taxa belonging to the Rhizopinae sensu Ng (1987), although the developmental degree of these characters appears rather variable according to taxa. These taxa include *Caecopilumnus* spp., *Ceratoplax* spp., *Cryptolutea* spp., *Luteocarcinus sordidus* Ng, 1990, *Mertonia* spp., *Paraselwynia ursina* Tesch, 1918, *Rhizopa gracilipes* Stimpson, 1858, *Typhlocarcinops* spp., *Typhlocarcinus* spp., and *Xenophthalmodes* spp.

Acknowledgments

We thank Dr. R. Lemaitre, National Museum of Natural History, Smithsonian Institution for examining the type material of *Catapagurooides japonicus* at our request, and Dr. Y. Yabumoto, Kitakyushu Museum of Natural History, for providing information on the type specimens of *Calaxius mimasensis* and *Typhlocarcinops takedai*. Thanks are also due to Drs. K. Takayasu, K. Seto, I.

Kobayashi, Y. Ishida, H. Tanaka, K. Tamura and Y.-G. Lee for their cooperation at sea, and to Dr. M. Osawa for reviewing a draft of the manuscript. The reviews by Drs. P. J. F. Davie, J.-N. Kim, C. L. McLay, and J. Okuno are greatly appreciated.

References

- Baba, K. 1988. Chirostylid and galatheid crustaceans (Decapoda: Anomura) of the "Albatross" Philippine Expedition, 1907–1910. *Res. Crust. Spec. No. 2*: i-v, 1–203.
- Bate, C. S. 1888. Report on the Crustacea Macrura collected by H.M.S. "Challenger" during the years 1873–76. *Rep. Sci. Res. Challenger Exped., Zool. 24*: i-xc, 1–942, pls. 1–150.
- Barnard, K. H. 1955. Additions to the fauna-list of South African decapod Crustacea (crabs and shrimps). *Ann. S. Afr. Mus.* 43: 1–107.
- Biffar, T. A. 1973. The taxonomic status of *Callinassa occidentalis* Bate, 1888, and *C. batei* Borradaile, 1903 (Decapoda, Callinassidae). *Crustaceana* 24: 224–230.
- Borradaile, L. A. 1903. On the classification of the Thalassinidea. *Ann. Mag. Nat. Hist. (7)* 12: 534–551.
- Chen, H.-L. 1998. The Goneplacidae (Crustacea: Brachyura) from Nansha Islands and adjacent waters. *In* Studies on marine fauna and flora and biogeography of the Nansha Islands and neighboring waters III, pp. 265–316. Chinese Academy of Sciences, Beijing.
- Dai, A.-Y. and S.-L. Yang. 1991. Crabs of the China Seas. 682 pp. China Ocean Press, Beijing.
- Edmondson, C. H. 1930. New Hawaiian Crustacea. *Occ. Pap. B. P. Bishop Mus.* 9: 1–18, pl. 1.
- Fujino, T. and S. Miyake. 1970. Caridean and stenopodidean shrimps from the East China and the Yellow Seas (Crustacea, Decapoda, Natantia). *J. Fac. Agr. Kyushu Univ.* 16: 237–312.
- García-Gómez, J. 1994. The systematics of the genus *Anapagurus* Henderson, 1886, and a new genus for *Anapagurus drachi* Forest, 1966 (Crustacea: Decapoda: Paguridae). *Zool. Verhand.* 295: 1–131.
- Griffin, D. J. G. and B. M. Campbell. 1969. The sublittoral Goneplacidae and Pinnotheridae (Crustacea: Brachyura) of Moreton Bay. *Mem. Qld. Mus.* 15: 141–164.
- Guinot, D. 1979. Donnees nouvelles sur la morphologie, la phylogenese et la Crustacés Décapodes Brachyours. *Mém. Mus. natn. Hist. nat. Paris, Zool.* 112: 1–354, pls. 1–27.
- Henderson, J. R. 1886. Higher Crustacea of the Firth Clyde. 34. The decapod and schizopod Crustacea of the Firth Clyde. *Proc. Trans. Nat. Hist. Glasgow, N. Ser.* 1: 315–353.
- Kensley, B. 1996. New Thalassinidean shrimp from the Pacific Ocean (Crustacea: Decapoda: Axiidae and Calocarididae). *Bull. Mar. Sci.* 59: 469–489.
- Kensley, B. and C. B. Hickman, Jr. 2001. A new species of *Calaxius* Sakai & de Saint Laurent, 1989, from the Galapagos Islands (Crustacea: Decapoda: Axiidae). *Proc. Biol. Soc. Wash.* 114: 484–488.
- Kensley, B., F.-J. Lin and H.-P. Yu. 2000. Further records of thalassinidean shrimps from Taiwan (Decapoda: Axiidae and Calocarididae), with descriptions of three new species. *J. Crust. Biol.* 20, Spec. No. 2: 207–217.
- Komai, T. 1999a. Decapod Crustacea collected by L. Döderlein in Japan and reported by Ortmann (1890–1894) in the collection of the Musée Zoologique, Strasbourg. *In* Nishikawa, T. (ed.), Preliminary taxonomic and historical studies on Prof. Ludwig Döderlein's collection of Japanese animals made in 1880–81 and deposited at several European museums, pp. 53–101. Report of Activities in 1997–8 supported by Grant-in-Aid for International Scientific Research (Field Research) No. 09041155.
- Komai, T. 1999b. Hermit crabs of the families Diogenidae and Paguridae (Crustacea: Decapoda: Anomura) collected during the Shin'yo-maru cruise to the Ogasawara Islands and Torishima Island, oceanic islands in Japan. *Nat. Hist. Res. Spec. Issue* 6: 1–66.
- Komai, T. 2000. A new species of the genus *Calaxiopsis* (Decapoda: Thalassinidea: Calocarididae) from Japan. *J. Crust. Biol.* 20, Spec. No. 2: 218–229.
- Leach, W. E. 1814. Crustaceology. *In* Brewster, D. (ed.), *Edinburgh Encyclopedia* Vol. 7, pp. 385–437. Edinburgh. (not seen)
- Le Loeuff, P. and A. Intés. 1974. Les Thalassinidea (Crustacea, Decapoda) du Golfe de Guinée. *Systématique-Écologique. Cahiers ORSTOM, sér. Oceanogr.* 12: 17–69.
- Lilljeborg, W. 1856. Om Hafs-Crustaceer vid Kullabergs Skane. *Ofv. Kongl. Vetensk. Forhand.* 12: 117–138. (not seen)
- Macpherson, E. 1994. Crustacea Decapoda: Studies on the genus *Munida* Leach, 1820 (Galatheidae) in New Caledonian and adjacent waters with descriptions of 56 new species. *In* Crosnier, A. (ed.), *Résultats des Campagnes MUSORSTOM* 12. *Mém. Mus. natn. Hist. nat. Paris* 161: 421–569.

- Macpherson, E. 1997. Crustacea Decapoda: Species of the genera *Agononida* Baba & de Saint Laurent, 1996 and *Munida* Leach, 1820 (Galatheidae) from KARUBAR cruise. In Crosnier, A. and P. Bouchet (eds.), Résultats des Campagnes MUSORSTOM 16. Mém. Mus. natn. Hist. nat. Paris 172: 597-612.
- Macpherson, E. and K. Baba. 1993. Crustacea Decapoda: *Munida japonica* Stimpson, 1858, and related species (Galatheidae). In Crosnier, A. (ed.), Résultats des Campagnes MUSORSTOM 10. Mém. Mus. natn. Hist. nat. Paris 156: 381-420.
- Man, J. G. de. 1905. Diagnosis of new species of macrurous decapod Crustacea from the "Siboga-Expedition." Tijdschr. Neder. Dierk. Vereen. (2) 9: 587-614. (not seen)
- Man, J. G. de. 1925. The Decapoda of the Siboga Expedition. Part VI. The Axidae collected by the Siboga-Expedition. Siboga Exped. 39a5: 1-127, pls 1-10.
- Manning, R. B. and D. F. Felder. 1991. Revision of the American Callianassidae (Crustacea: Decapoda: Thalassinidea). Proc. Biol. Soc. Wash. 104: 764-792.
- McLaughlin, P. A. 1997. Crustacea Decapoda: Hermit crabs of the family Paguridae from the KARUBAR Cruise in Indonesia. In Crosnier, A. and P. Bouchet (eds.), Résultats des Campagnes MUSORSTOM 16. Mém. Mus. natn. Hist. nat. Paris 172: 433-572.
- McLaughlin, P. A. and C. Pittman. 2002. Reinstatement and rediagnosis of *Catapaguroides setosus* and description of a second Hawaiian species of the genus (Decapoda: Anomura: Paguridea: Paguridae). Pac. Sci. 56: 41-48.
- Melin, G. 1939. Paguriden und Galatheiden von Prof. Dr. Sixten Bocks Expedition nach den Bonin-Inseln, 1914. K. Svens. Vetensk. Handl. Ser. 3, 18: 1-119.
- Milne Edwards, A. 1873. Description de quelques Crustacés ou peu connus provenant du Musée de M. C. Godeffroy. J. Mus. Godeffroy 4: 77-88.
- Milne Edwards, A. and E. L. Bouvier. 1892. Observations préliminaires sur les paguriens recueillis par les expéditions du Travailleur et du Talisman. Ann. Sci. Nat. Zool. Paléontol. sér. 7, 13: 185-226.
- Miyake, S. 1978. The crustacean Anomura of Sagami Bay. 200 pp. (in English), 161 pp. (in Japanese). Biological Laboratory, Imperial Household, Tokyo.
- Miyake, S. 1982. Japanese Crustacean Decapoda and Stomatopoda in Color. I. Macrura, Anomura and Stomatopoda. First printing. 261 pp., 56 pls. Hoikusha, Osaka. (in Japanese)
- Miyake, S. 1983. Japanese Crustacean Decapoda and Stomatopoda in Color. II. Brachyura (Crabs). 277 pp., 64 pls. First printing. Hoikusha, Osaka. (in Japanese)
- Miyake, S. 1991a. Japanese Crustacean Decapoda and Stomatopoda in Color. I. Macrura, Anomura and Stomatopoda. Second printing. 261 pp., 56 pls. Hoikusha, Osaka. (in Japanese)
- Miyake, S. 1991b. Japanese Crustacean Decapoda and Stomatopoda in Color. II. Brachyura (Crabs). 277 pp., 64 pls. Second printing. Hoikusha, Osaka. (in Japanese)
- Miyake, S. 1998a. Japanese Crustacean Decapoda and Stomatopoda in Color. I. Macrura, Anomura and Stomatopoda. Third printing. 261 pp., 56 pls. Hoikusha, Osaka. (in Japanese)
- Miyake, S. 1998b. Japanese Crustacean Decapoda and Stomatopoda in Color. II. Brachyura (Crabs). 277 pp., 64 pls. Third printing. Hoikusha, Osaka. (in Japanese)
- Miyake, S., K. Sakai and S. Nishikawa. 1962. A fauna-list of the decapod Crustacea from the coasts washed by the Tsushima warm current. Rec. Oceanogr. Works Japan, Spec. No. 6: 121-131.
- Nagai, S. 1990. Brachyuran fauna of Wakayama Prefecture III. Nankisenbutu 32: 41-46 (in Japanese).
- Ng, P. K. L. 1987. The Indo-Pacific Pilumnidae II. A revision of the genus *Rhizopa* Stimpson, 1858, and the status of the Rhizopinae Stimpson, 1858 (Crustacea, Decapoda, Brachyura). Indo-Malayan Zool. 4: 69-111.
- Ng, P. K. L. 1989. The Indo-Pacific Pilumnidae IV. On *Cryptocoeloma haswelli* Rathbun, 1923 (Crustacea, Decapoda, Brachyura). Crustaceana 56: 47-57.
- Ng, P. K. L. 1990. *Luteocarcinus sordidus*, new genus and species, from mangrove swamps in Peninsular Malaysia (Crustacea: Decapoda: Brachyura: Pilumnidae: Rhizopinae). Proc. Biol. Soc. Wash. 103: 95-99.
- Ng, P. K. L. and P. J. F. Davie. 1991. The Indo-Pacific Pilumnidae VII. Notes on *Heteropilumnus sasekumari* (Serène, 1971) and *Cryptolutea* Ward, 1936 (Crustacea: Decapoda: Brachyura). Mem. Queensland Mus. 30: 517-524.
- Ngoc-Ho, N. 1991. Sur quelques Callianassidae et Upogebiidae de Nouvelle-Calédonie (Crustacea, Thalassinidea). In Richer de Forges, B. (ed.), Le benthos des fonds meubles des lagons de Nouvelle Calédonie Vol. 1, pp. 281-311. ORSTOM, Paris.

- Ortmann, A. E. 1892. Die Abtheilungen Galathei-
dea und Paguridea. Die Decapoden-Krebse des
Strassburger Museums, mit besonderer Berück-
sichtigung der von Herrn Dr. Döderlein bei Japan
und bei den Liu-Kiu Inseln gessammelten und zur
Zeit im Strassbourger Museum aufbewahrten
Formen. IV. Theil. Zool. Jahrb., Abt. Syst. Geogr.
Biol. Thiere 6: 241–326, pls. 11–12.
- Poore, G. C. B. 1994. A phylogeny of the families of
Thalassinidea (Crustacea: Decapoda) with keys
to families and genera. Mem. Mus. Victoria 54:
79–120.
- Poore, G. C. B. and D. J. G. Griffin. 1979. The Tha-
lassinidea (Crustacea: Decapoda) of Australia.
Rec. Aust. Mus. 32: 217–321.
- Rathbun, M. J. 1901. The Brachyura and Macrura
of Porto Rico. Bull. U. S. Fish. Comm. 20: 1–137,
pls. 1–2.
- Rathbun, M. J. 1906. The Brachyura and Macrura
of the Hawaiian Islands. Bull. U. S. Fish. Comm.
23: 827–930, pls. 1–24.
- Rathbun, M. J. 1909. New crabs from the Gulf of
Siam. Proc. Biol. Soc. Wash. 22: 107–114.
- Rathbun, M. J. 1914. Scientific results of the Philip-
pine cruise of the fisheries steamer "Albatross,"
1907–1910, 32. A new genus and some new
species of crabs of the family Goneplacidae. Proc.
U.S. Natn. Mus. 48: 137–154.
- Rathbun, M. J. 1932. Preliminary descriptions of
new species of Japanese crabs. Proc. Biol. Soc.
Wash. 45: 28–38.
- Richters, F. 1880. Decapoda. In Möbius, K. A. (ed.),
Beiträge zur Meeresfauna der Insel Mauritius
und der Seychellen, bearbeitet von K. Möbius, F.
Richters und von Martens, pp. 137–178, pls. 15–
18. Berlin. (not seen)
- Rodriguez, S. de A. and R. B. Manning. 1992. *Poti
gaucho*, a new genus and species of ghost shrimp
from southern Brazil (Crustacea: Decapoda: Calli-
anassidae). Bull. Mar. Sci. 51: 9–13.
- Saint Laurent, M. de. 1968. Révision des genres
Catapaguroides et *Cestopagurus* et description de
quatre genres nouveaux. I. *Catapaguroides* A.
Milne Edwards et Bouvier et *Decaphyllus* nov.
gen. (Crustacés Déapodes Paguridae). Bull. Mus.
natn. Hist. nat. (2) 39: 923–954.
- Sakai, K. 1967a. Three new species of Tha-
lassinidea (Decapoda, Crustacea) from Japan.
Res. Crust. 3: 39–51.
- Sakai, K. 1967b. Three new species of Tha-
lassinidea (Decapod Crustacea) from south-west
Japan. Publ. Seto Mar. Biol. Lab. 15: 319–328, pl.
11.
- Sakai, K. 1970. A small collection of thalassinids
from the waters around Tsushima Islands, Ja-
pan, including a new species of *Callianassa*
(Crustacea, Anomura). Publ. Seto Mar. Biol. Lab.
18: 37–47.
- Sakai, K. 1987. Two new Thalassinidea (Crustacea:
Decapoda) from Japan, with the biogeographical
distribution of the Japanese Thalassinidea. Bull.
Mar. Sci. 41: 296–308.
- Sakai, K. 1992. Axiid collections of the Zoological
Museum, Copenhagen, with the description of
one new genus and six new species (Axiidae,
Thalassinidea, Crustacea). Zool. Scr. 21: 157–180.
- Sakai, K. 1994. Eleven species of Australian
Axiidae (Crustacea: Decapoda: Thalassinidea)
with descriptions of one new genus and five new
species. Beagle, Rec. Mus. Art Gall. Northern
Territory 11: 175–202.
- Sakai, K. 1999. Synopsis of the family Callianassi-
dae, with keys to subfamilies, genera and species,
and the description of new taxa (Crustacea:
Decapoda: Thalassinidea). Zool. Verhand. 326:
1–152.
- Sakai, K. and M. de Saint Laurent. 1989. A check
list of Axiidae (Decapoda, Crustacea, Tha-
lassinidea, Anomura), with remarks and in addi-
tion descriptions of one new subfamily, eleven
new genera and two new species. Naturalists 3:
1–104.
- Sakai, T. 1934. Brachyura from the coast of Kyu-
shu, Japan. Sci. Rep. Tokyo Bunrika Daigaku.
Sect. B, 1: 281–330.
- Sakai, T. 1935. Crabs of Japan. 237 pp., pls 1–66.
Sanseido, Tokyo. (in Japanese)
- Sakai, T. 1939. Studies on the crabs of Japan, IV.
Brachygnatha, Brachyrhyncha. pp. 365–741, pls.
42–111. Yokendo, Tokyo.
- Sakai, T. 1965. The crabs of Sagami Bay collected
by His Majesty the Emperor of Japan. 206 pp.,
200 pls. Maruzen, Tokyo.
- Sakai, T. 1976. Crabs of Japan and adjacent seas.
xxix + 773 pp. (English text), 251 pls. Kodansha,
Tokyo.
- Serène, R. 1964. Papers from Dr. Th. Mortensen's
Pacific Expedition 1914–1916, 80. Goneplacidae
et Pinnotheridae réoltés par le Dr. Mortensen.
Vidensk. Med. Dansk Nat. Forening I København
126: 181–282, pls. 16–24.
- Serène, R. and C. L. Soh. 1976. Brachyura collected
during the Thai-Danish Expedition (1966).
Phuket Mar. Biol. Center Res. Bull. 12: 1–37, figs.
1–28, pls. 1–8.
- Squires, H. J. 1977. A new species of *Axiopsis* (*Ax-
iopsis*) (Thalassinidea, Axiidae) from the Pacific
coast of Colombia. Can. J. Zool. 55: 1885–1891.

- Stimpson, W. 1858. Prodrum descriptionis animalium evertibratorum, quae in expeditione ad oceanum Pacificum septentrionalem, a Republica Federata missa, Cadwaldaro Ringgold et Johanne Rodgers ducibus, observavit et descripsit. VII. Proc. Acad. Nat. Sci. Philadelphia 1858: 225-252.
- Takeda, M. 1973. Report on the crabs from the sea around the Tsushima Islands collected by the research vessel "Genkai" for the trustees of the National Science Museum, Tokyo. Bull. Lib. Arts & Sci. Course, Nihon Univ. Sch. Med. 1: 17-68.
- Takeda, M. 1975. Brachyura. In Utinomi, F. (ed.), Freshwater and Marine Animals, pp. 120-149, 187-331. Gakken Co. Ltd., Tokyo. (in Japanese)
- Takeda, M. 1982. Keys to the Japanese and foreign crustaceans fully illustrated in colors. 58 pp. (keys), 284 pp. (text and illustrations). (in Japanese)
- Takeda, M. and S. Miyake. 1968. Crabs of the East China Sea, I. Corystoidea and Brachygnatha Brachyrhyncha. J. Fac. Agr. Kyushu Univ. 14: 541-582, pl. 6.
- Takeda, M. and S. Miyake. 1972. New crabs from the sea around the Tsushima Islands. Bull. Natn. Sci. Mus. 15: 253-265.
- Tesch, J.J. 1918. The Decapoda Brachyura of the Siboga Expedition, II. Goneplacidae and Pinnotheridae. Siboga Exped. Monogr. 39c: 1-147, pls. 1-12.
- Tudge, C., G. C. B. Poore and R. Lemaitre. 2000. Preliminary phylogenetic analysis of generic relationships within the Callianassidae and Ctenochelidae (Decapoda: Thalassinidea: Callianassoidea). J. Crust. Biol. 20, Spec. No. 2: 129-149.
- Türkay, M. 1981. Die Expedition von Karl Möbius nach Mauritius und den Seychellen (1874-75) und die dort gessammelten Decapoden Reptantia. I. Brachyura excl. Dromiacea, mit Beschreibung von *Menaethiops moebii*. Mitt. Zool. Mus. Univ. Kiel 1: 35-64.
- Williams, A. B. 1974. Two new axiids (Decapoda: Thalassinidea: Calocaris) from North Carolina and the Straits of Florida. Proc. Biol. Soc. Wash. 87: 451-464.
- Wu, M.-F., T.-Y. Chan and H.-P. Yu. 1998. On the Chirostylidae and Galatheidae (Crustacea: Decapoda: Galatheidea) of Taiwan. Ann. Taiwan Mus. 40: 75-154. (in Chinese with English abstract).
- Yokoya, Y. 1933. On the distribution of decapod crustaceans inhabiting the continental shelf around Japan, chiefly based upon the materials collected by S. S. "Soyo-maru," during the year 1923-1930. J. Coll. Agr., Tokyo Imp. Univ. 12: 1-226.

(Accepted 26 February 2002)

練習船“豊潮丸”による調査航海 (2000~2001年)で日本海南部 から採集された十脚甲殻類

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広島大学生物生産学部附属練習船“豊潮丸”により 2000~2001年にかけて実施された日本海南部における調査航海で採集された十脚甲殻類資料を検討した。これらの十脚甲殻類資料は大陸棚上部の水深 43~133 m でドレッジを用いて採集されたものである。検討の結果、5 下目 20 科に属する 41 種が同定された(未同定種を除く)。これらの種のうち、分類学的な情報が不十分な以下の 3 下目 4 科 6 種に詳細な再記載を与えた: *Axiopsis tsushimaensis* Sakai, 1992 (アナジャコ下目 アナエビ科); *Calaxius mimasensis* (Sakai, 1967) (アナジャコ下目 アナエビ科); *Chearmus spinophthalmus* (Sakai, 1970) (アナジャコ下目 スナモグリ科); *Catapaguroides japonicus* (de Saint Laurent, 1968) (ヒメヤドカリ; 異尾下目 ホンヤドカリ科); *Typhlocarcinops takedai* Ng, 1987 (短尾下目 ケブカガニ科); *Xenophthalmodes morsei* Rathbun, 1932 (モールスガニ; 短尾下目 ケブカガニ科)。さらに、いくつかの種について補足的な分類学的情報を与えた。