

HETEROPOLYONYX BIFORMA, NEW GENUS AND SPECIES,
FROM JAPAN, AND REDESCRIPTION OF *POLYONYX UTINOMII*
(DECAPODA: PORCELLANIDAE)

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A B S T R A C T

Heteropolyonyx, new genus (type species: *H. biforma*, new species), is established on the basis of the presence of transverse ridges on the cervical regions of the carapace and the telson being divided into five plates, characters quite different from its related genera *Polyonyx* Stimpson, 1858, and *Euleniaios* Ng and Nakasone, 1993. The male/female pair of *H. biforma* was found in a tube of an unidentified polychaete of the genus *Chaetopterus*. *Polyonyx utinomii* Miyake, 1943, is re-described from the holotype specimen and recently obtained material from Japan and the Maldives. This species is readily distinguishable from the other Indo-West Pacific species of *Polyonyx* by the carapace and chelipeds covered with numerous transverse and oblique striae on the dorsal surface and the meri of the chelipeds having a very large, broadly rounded lobe on the dorsoflexor margin. The present record of *P. utinomii* from the Maldives is the first report outside Japan and greatly extends its geographical distribution westwards into the Indian Ocean.

The *Polyonyx sinensis* group, as recognized by Johnson (1958), may be defined by a suite of characters of the carapace, chelipeds, and dactyli of ambulatory legs, and is currently represented by 10 Indo-West Pacific species: *P. sinensis* Stimpson, 1858; *P. transversus* (Haswell, 1882); *P. pedalis* Nobili, 1905; *P. utinomii* Miyake, 1943; *P. loimicola* Sankolli, 1965; *P. maccullochi* Haig, 1965; *P. haigae* McNeil, 1968; *P. vermicola* Ng and Sasekumar, 1993; *P. plumatus* Yang and Xu, 1994; and *P. bella* Hsueh and Huang, 1998 (Ng and Sasekumar, 1993; Yang and Xu, 1994; Hsueh and Huang, 1998). Six members of the *P. sinensis* group are known to be associated with tube-dwelling polychaete worms belonging to the genera *Chaetopterus*, *Meso-chaetopterus*, and *Sasekumaria* of the family Chaetopteridae and *Loimia* of the Terebellidae (see Miyake, 1965; Ng and Sasekumar, 1993; Hsueh and Huang, 1998). Of these host genera, *Sasekumaria* was recently found to be a junior synonym of *Mesochaetopterus* by Nishi (1999).

During a faunal research of cryptic decapod crustaceans from Kushimoto, southern part of Wakayama Prefecture, Japan, by Mr. K. Nomura of the Yeayama Marine Park Research Station, a pair of unusual porcellanid crabs was collected from a tube of an uniden-

tified species of *Chaetopterus*. Through his kind cooperation, I could examine the specimens and found that they belong to an undescribed species. This species resembles members of the *Polyonyx sinensis* group in general appearance, but differs from all species of *Polyonyx* Stimpson, 1858, and its relative *Euleniaios* Ng and Nakasone, 1993, in the structures of the cervical regions of the carapace and the telson. I herein describe the specimens as a new genus and species.

In addition, I include here a redescription of *Polyonyx utinomii*, a rarely recorded species of the *P. sinensis* group. This species was originally described by Miyake (1943) based on a single specimen from Tanosaki (Tanabe Bay, Shirahama, Wakayama Prefecture, Japan) and the records are restricted to just a few localities in Japan (Miyake, 1943; Miyake *et al.*, 1962; Nakasone, 1978). Although the original description and figures revealed that the species was quite different from the other Indo-West Pacific species of *Polyonyx*, a more detailed examination of the type specimen and additional material is needed for evaluating the intraspecific variations and more precise systematic relationships with the allied species. I examined the holotype and recently obtained material from Japan and the Maldives and redescribe *P.*

utinomii in detail. The presence of this species in the Maldives is the first record outside Japan and greatly extends its geographical distribution westwards into the Indian Ocean.

The carapace length (CL) was measured from the anteromedian apex of the rostrum to the posteromedian end of the carapace, and the carapace width (CW) at the broadest point. Measurements of chelipeds and ambulatory legs follow those of Osawa (1998a). The description presented includes the detailed morphology of the ocular peduncle, thoracic sternites, antennular and antennal peduncles, third maxilliped, and male pleopods. These structures have not been frequently described for porcelain crabs in general, but can prove useful in systematic studies of the Porcellanidae (see Kropp, 1986; Ng and Nakasone, 1994; Osawa, 1998b; Harvey, 1999). The holotype specimen of *P. utinomii* was borrowed from the Seto Marine Biological Laboratory, Kyoto University, Japan (SMBL), and the additional material of that species and the type specimens of the present new species are deposited in the Natural History Museum and Institute, Chiba, Japan (CBM).

SYSTEMATIC ACCOUNT

Family Porcellanidae Haworth, 1825

Heteropolyonyx, new genus

Diagnosis.—Carapace, chelipeds, and ambulatory legs fringed with short and long plumose setae marginally. Carapace transversely ovate; dorsal surface convex, regions not well defined; protogastric ridges weakly marked; cervical regions with no grooves, but each with transverse ridge. Rostrum broad, slightly bent ventrally, weakly produced and trilobate anteriorly; median lobe without longitudinal groove. Pterygostomian flaps entire. Third thoracic sternite strongly depressed, trilobate anteriorly; median lobe flattened, with longitudinal sulcus. Ocular peduncles small. Basal segment of antennular peduncles unarmed, slightly concave on anterior face. Antennal peduncles slender; first segment immovable, strongly produced forward in lateral view, broadly in contact with anterior margin of carapace; second to fourth segments movable, excluded from orbit; third segment longest. Third maxillipeds with coxa bearing distomedian projection incompletely articulated; basis articulated with ischium; ischium short, without longitudinal ridge along ven-

tro-extensor margin; propodus elongate; exopod robust, without distal flagellum. Chelipeds unequal, subcylindrical, not showing distinct sexual dimorphism in shape; carpus unarmed; chela narrow; dactyl opening at strongly oblique angle, not twisted. Ambulatory legs short, subcylindrical; merus without distinct decalcified region on mesial surface; dactyl with bifurcate claw, flexor claw much larger than extensor. Male with pair of developed pleopods on second abdominal somite; endopod with broadly rounded apex; no exopod; pleopods of female present only on fourth and fifth abdominal somites. Telson composed of 5 plates; proximal lateral plates each with very shallow suture on proximal part; distal plates of female much more strongly elongated than those of male.

Etymology.—This name is derived from the Greek, *heteros*, meaning different, in combination with the generic name *Polyonyx*. The gender is masculine.

Type species.—*Heteropolyonyx biforma*, new species.

Remarks.—*Heteropolyonyx* agrees with the *Polyonyx sinensis* species group of Johnson (1958) based on the morphological structures, but is distinguished from this group and all other members of *Polyonyx* and its relative *Euleniaios* by the following characters: (1) the carapace has a pair of transverse ridges along the cervical regions; and (2) the telson is divided into five plates, the distal two plates of female are much more strongly elongated than those of male. All the known porcellanid genera, including *Polyonyx* and *Euleniaios*, lack cervical transverse ridges on the carapace. *Polyonyx* and *Euleniaios* have the telson composed of seven plates; the distal plates of female are rather short. In addition to the two distinctions, *Heteropolyonyx* is distinguished from *Euleniaios* by the following features: (1) the regions on the carapace are not well defined in *Heteropolyonyx*, whereas they are very well defined and clearly demarcated by the pattern of shallow and deep grooves in *Euleniaios*; and (2) the rostrum is broad and weakly produced anteriorly in *Heteropolyonyx*, but it is rather narrow and strongly produced in *Euleniaios*.

The proximal lateral plates of the telson of *Heteropolyonyx* have a very shallow suture

on the proximal part, which is rather difficult to observe, especially on the male. Paul *et al.* (1993) described the juvenile morphology of two porcellanids, *Petrolisthes rufescens* (Heller, 1861) and *Pisidia gordonii* (Johnson, 1970), and revealed that the division of the telson plates started in the juvenile phase and developed from proximal to distal (see their Fig. 2p for *Petrolisthes rufescens*, Fig. 4q for *Pisidia gordonii*). Following their results, the division of the proximal lateral plates of the telson of *Heteropolyonyx* must be completed because that of the distal plates has already occurred. In a developmental sense, the presence of a rudimentary suture on the proximal lateral plates should be treated as not an incomplete condition but a constant character in the adult phase. The well-developed pleopods showing sexual dimorphism indicate that the present specimens of *H. biforma* are fully mature. Although *Heteropolyonyx* is assigned to a genus having a five-plated telson as a constant adult character, the telson may actually represent a rudimentary condition of seven plates in a phylogenetic sense.

The absence of a flagellum on the exopod of the third maxilliped also seems to be a generic character of *Heteropolyonyx* because this is unusual in other species of the Porcellanidae, as far as I know, except for *Petrolisthes coccineus* (Owen, 1839) (personal observation).

***Heteropolyonyx biforma*, new species**
Figs. 1–3, 7B

Type Material.—Holotype, CBM–ZC 5158; ovigerous ♀ (CL 3.3 mm, CW 5.0 mm); Andonohana, Shionomisaki, Kushimoto, Wakayama Prefecture, Japan; 20 m; in tube of *Chaetopterus* sp.; November 1995; coll. K. Nomura. Allotype (paratype), CBM–ZC 5159; ♂ (CL 2.5 mm, CW 3.5 mm); data as in holotype.

Diagnosis.—See “Diagnosis” for the genus.

Description.—Carapace (Fig. 1A–C) moderately (male) or strongly (female) convex dorsally, 1.4 (male) or 1.5 (female) times as broad as long, broadest on median branchial margin, fringed with soft or delicate plumose setae marginally, setae on anterior margin of rostrum longer; dorsal surface with scattered, short delicate plumose setae, more densely distributed in male than female. Branchial margins strongly convex, female much more inflated on median margins than male; lateral faces each with distinct, longitudinal

ridge extending to mesobranchial region; posterior regions with short and long oblique rugae bearing plumose setae anteriorly. Rostrum (Fig. 1D) not produced beyond eyes; median lobe broadly rounded, slightly exceeding and broader than laterals; lateral lobes each with broadly rounded apex. Orbits (Fig. 1J, K) very shallow; supraorbital margins oblique, unarmed; outer orbital angles rounded. Frontal region slightly depressed, with very short striae or small pit and minute setae as in hepatic regions. Protogastric ridges weakly marked. Gastric and cardiac regions slightly striate and elevated in male but smooth in female. Cervical regions without marked grooves, but each with strong (male) or weak (female) transverse ridge. Median parts of branchial regions each with transverse ridge weaker than that on cervical regions (ridge of female indistinct).

Pterygostomial flaps (Fig. 1C) with strong longitudinal ridges, weakly narrow posteriorly; anterior angle acutely pointed; anterodorsal margin unarmed.

Third thoracic sternite (Fig. 1E, F) with median lobe broad and indistinct; lateral lobes narrow, distinctly exceeding median, each with rounded apex. Fourth thoracic sternite with series of short striae (male) or small pits (female) bearing plumose setae along concave anterior margin.

Ocular peduncles (Fig. 1J, K) smooth on dorsal surface; dorsal extension onto cornea weakly developed, broadly rounded.

Basal segment of antennular peduncles (Fig. 1I) with no lobes on anterodorsal margin, anteroventral margin minutely tuberculated, ventral surface smooth, mesial and lateral margins fringed with plumose setae.

Antennal peduncles (Fig. 1J, K) unarmed. First segment largest, with strong longitudinal ridge along ventral margin; anterior angle narrowly pointed in lateral view. Second segment short. Third segment elongate, slender. Fourth segment small, rounded.

Third maxillipeds (Fig. 2A) with coxa bearing small, rounded distoflexor projection. Basis small, subtriangular. Ischium broad, ovate; ventral surface slightly rugose on distomesial region; disto-extensor projection weakly developed, broadly rounded. Merus with laminate, broad, rounded subrectangular lobe bearing small tubercles on ventroflexor margin, slightly rugose on ventral surface. Carpus with triangular projection on proxi-

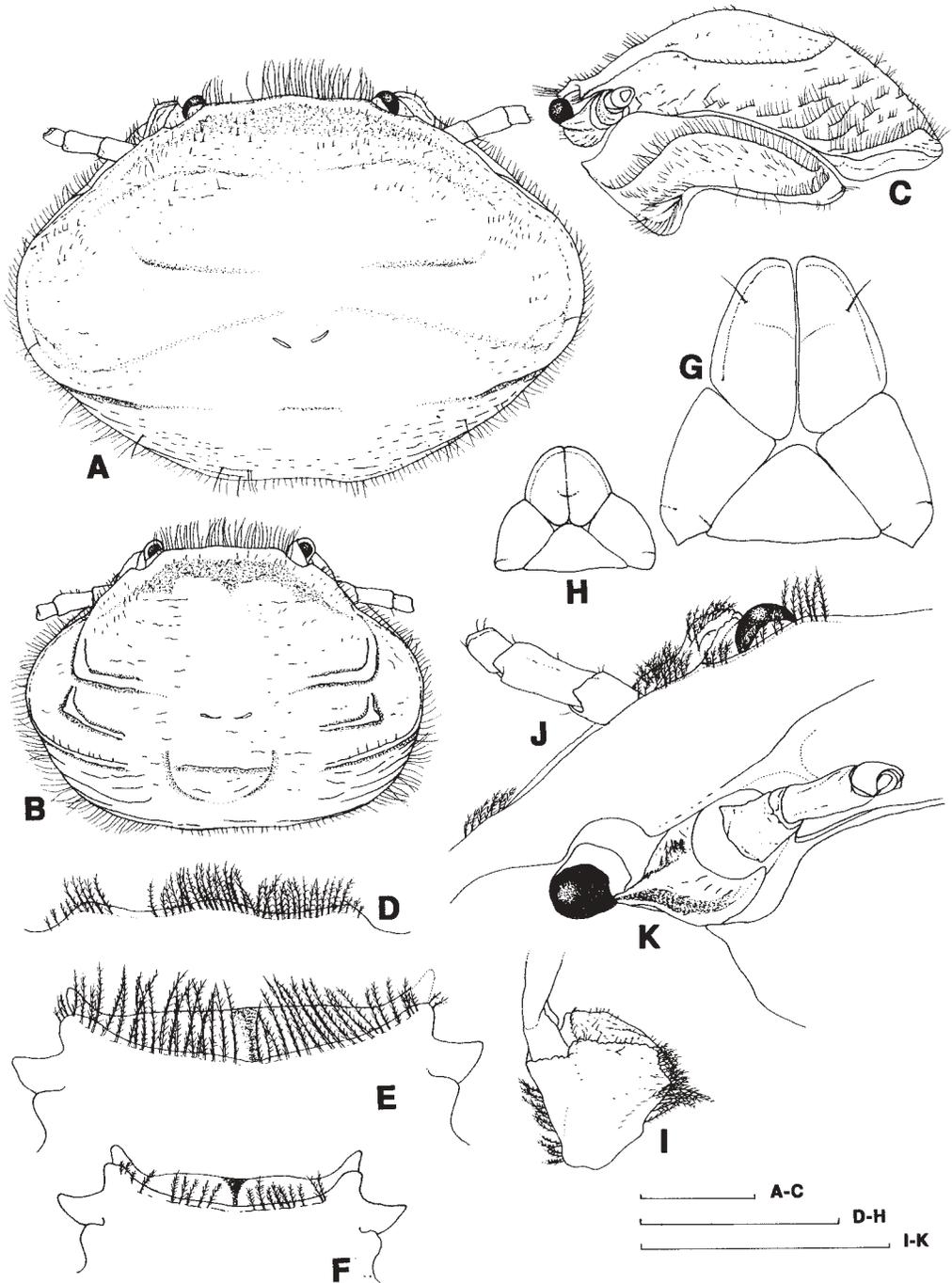


Fig. 1. *Heteropolyonyx biforma*, new genus and species. A, C–E, G, I–K, holotype, ovigerous female (CL 3.3 mm, CBM–ZC 5158); B, F, H, allotype, male (CL 2.5 mm, CBM–ZC 5159). A, B, carapace, dorsal; C, carapace and left pterygostomian flap, lateral; D, rostrum, frontal; E, F, anterior thoracic sternites, ventral; G, H, telson, exposed; I, left basal segment of antennular peduncle, ventral; J, left anterior lateral part of carapace, eye, and antennular peduncle, dorsal; K, same, lateral. Scales equal 1.0 mm.

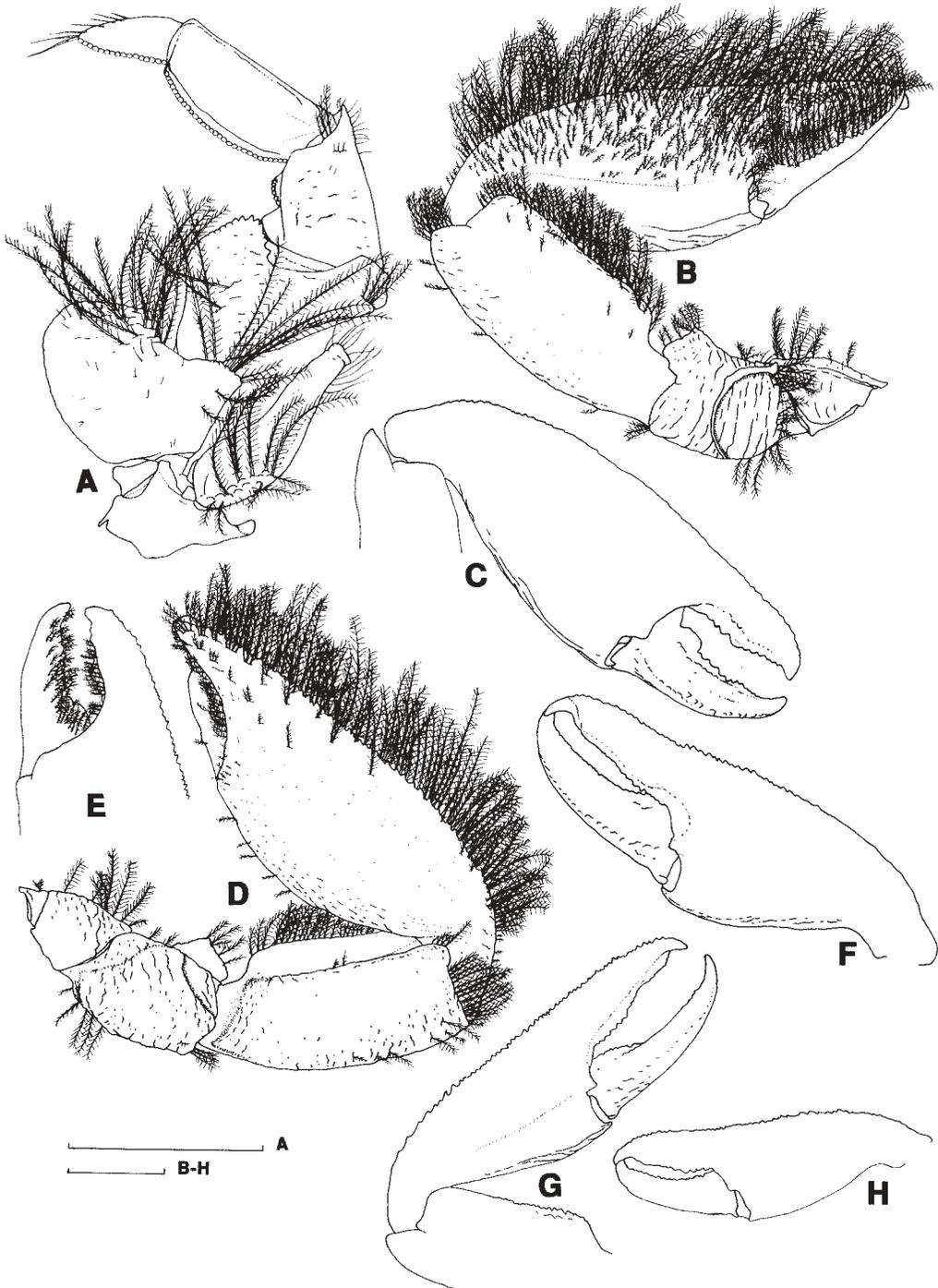


Fig. 2. *Heteropolyonyx bifirma*, new genus and species. A–F, holotype, ovigerous female (CL 3.3 mm, CBM–ZC 5158); G, H, allotype, male (CL 2.5 mm, CBM–ZC 5159). A, left third maxilliped; B, larger cheliped, left, dorsal; C, G, same, chela, dorso-extensor, setae omitted; D, same, ventral; E, same, distal part of chela, ventroflexor; F, H, smaller cheliped, chela, right, dorso-extensor, setae omitted. Scales equal 1.0 mm.

mal region of flexor margin, no longitudinal rows of short rugae along extensor margin on ventral surface. Propodus elongate subrectangular, smooth except for several short rugae along extensor margin. Dactyl small, ovate, tapering distally; ventral surface smooth. Ventral rugae and disto-extensor projection of ischium, and flexor margin of merus to dactyl with long plumose setae (setae on merus to dactyl not illustrated). Exopod laminate, robust, inflated and bearing long plumose setae on proximal region.

Chelipeds (Fig. 2B–H) moderately inflated, slender, without distinct spines or teeth. Larger cheliped (Fig. 2B–E, G) with merus having distinct transverse ridge submedially on transversely rugose dorsal surface and scattered plumose setae marginally; dorsoflexor margin with broad subrectangular lobe slightly crenulated, distal corner rounded in male but weakly pointed in female; ventral surface with short transverse rugae, flexor corner unarmed. Carpus 2.0 (female) or 2.3 (male) times as long as broad; dorsal surface with numerous short transverse rugae in male but nearly smooth except for short rugae and small pits along flexor and extensor margins in female; dorsoflexor margin with inflated lobe, transverse, slightly crenulated in male but nearly smooth in female, bearing plumose setae densely; dorsodistal margin with rounded lobe with fringe of plumose setae on extensor part; ventral surface with short rugae along margins, flexor margin transverse, slightly crenulated. Chela rather elongate, 1.8 (male) or 1.9 (female) times as long as carpus, 2.9 (female) or 3.2 (male) times as long as high, lying on extensor side; fingers crossed distally; narrower and more sharply pointed distally in male than in female; extensor margin thin, transverse (male) or weakly convex (female), crenulated or serrated on distal $\frac{4}{5}$. Palm with dorsal surface convex, covered with short and long plumose setae on extensor half; dorsomedian longitudinal ridge indistinct; dorsoflexor margin with longitudinal rugose ridge; ventral surface nearly smooth except for short rugae and small pits on flexor region, distal extensor part with few short rugae bearing plumose setae. Fixed finger with moderately curved distal claw; dorsal surface with numerous plumose setae as in extensor half of palm; dorsoflexor proximal part with broad (female) or narrow (male) subtriangular projection extending

onto dactyl; cutting edge with small, rounded or subtriangular teeth, no distinct large teeth or projections; ventral surface with short rugae bearing plumose setae along extensor margin, and fringe of plumose setae on proximal flexor part and along cutting edge. Dactyl 0.4 (female) or 0.5 (male) length of chela, slightly longer than fixed finger, with strongly curved distal claw; dorsal surface with longitudinal ridge composed of minute tubercles along flexor margin and numerous plumose setae along cutting region; concave cutting edge minutely granulated and with low, broadly rounded projection on proximal part in male, but with small, rounded or subtriangular teeth on distal $\frac{2}{3}$ and large, rounded tooth on proximal part in female; ventral surface with plumose setae along cutting edge more densely than that of fixed finger.

Smaller cheliped (Fig. 2F, H) almost identical to larger, especially in male, except for: chela slightly narrower, 3.1 (female) or 3.3 (male) times as long as high, extensor margin slightly concave on distal $\frac{1}{3}$; fingers with more sharply pointed and more strongly curved distal claw, cutting edge of dactyl with low, broadly rounded projection on proximal part; dactyl as long as fixed finger.

Ambulatory legs (Fig. 3A–E) marginally with long and short plumose setae on ischium to large part of propodus and with short simple setae on distal end of propodus and dactyl; lateral surface with short rugae along extensor margin on meri but nearly smooth on carpus and propodus. Ischium without decalcified region. Merus elongated ovate, with lengths decreasing as first > second > third legs; extensor margin unarmed but slightly crenulated, slightly inflated in proximal $\frac{1}{3}$ (first leg) to distal $\frac{1}{3}$ (third leg); distoflexor margins of lateral and mesial surfaces without spines, minutely granulated; mesial surface weakly decalcified on proximal region in first and second legs of female, but not decalcified in third leg of female and all legs of male. Carpus elongate, with lengths decreasing as first > second > third legs; disto-extensor corner unarmed; distoflexor corner with minutely pointed apex. Propodus 1.1 (first and second legs)–1.3 (third leg) times as long as carpus, 3.7 (second leg)–3.8 (first and third legs) times as long as high; flexor margin with 3 small movable spines, distal pair slightly smaller than subdistal. Dactyl terminating in strongly curved, bifurcate

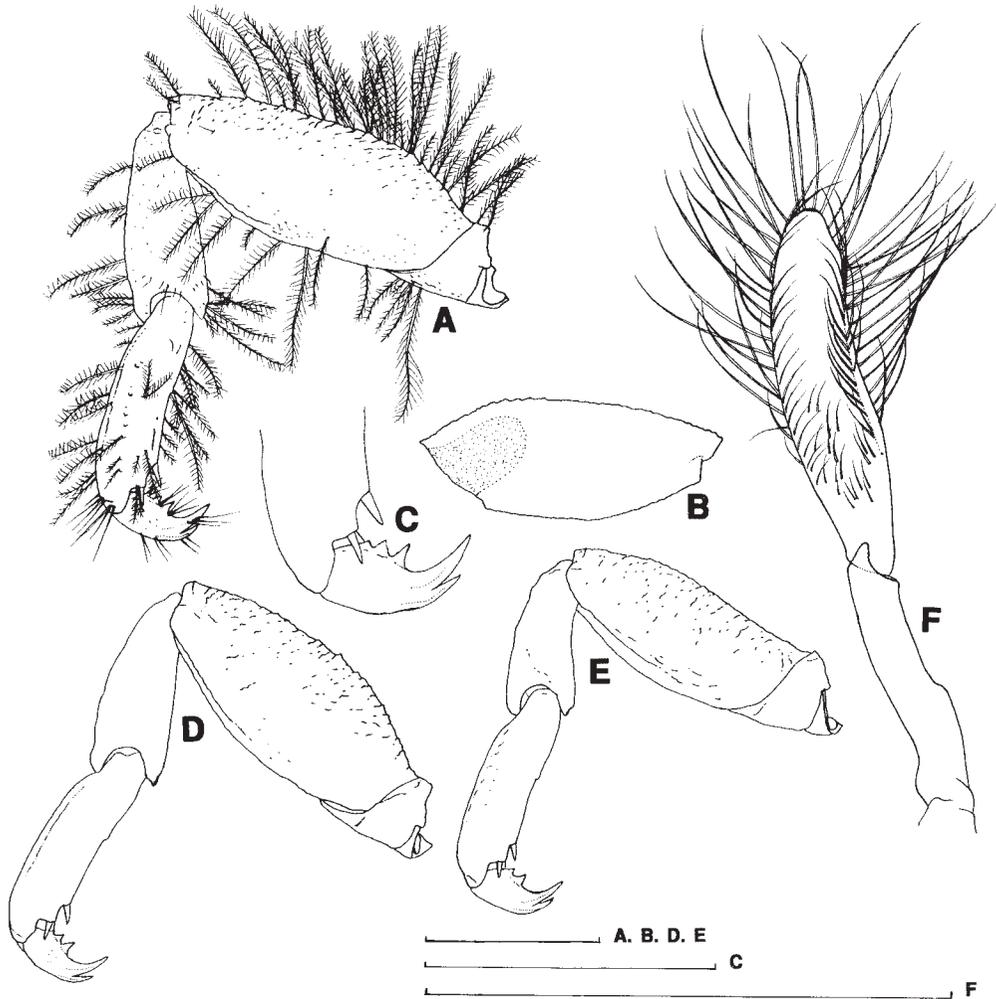


Fig. 3. *Heteropolyonyx biforma*, new genus and species. A–E, holotype, ovigerous female (CL 3.3 mm, CBM–ZC 5158); F, allotype, male (CL 2.5 mm, CBM–ZC 5159). A, left first ambulatory leg, lateral; B, same, merus, mesial; C, same, distal part, lateral; D, left second ambulatory leg, lateral; E, left third ambulatory leg, lateral; F, left male pleopod, internal. Scales equal 1.0 mm.

claw; flexor margin with 2 or 3 small corneous, fixed spines, proximal spine very small, distal spine largest.

Fifth pereopod small, slender, chelate; propodus with numerous short simple setae and 1 or 2 hooked setae.

Male with pair of developed pleopods on second abdominal somite (Fig. 3F); protopod naked; endopod elongated ovate, not tapering, with numerous marginal setae except for proximal part. No trace of pleopods (including small pore) on third to fifth abdominal somites. Female with no pleopods on third abdominal somite, but with well-developed

pleopods on fourth and fifth abdominal somites.

Telson (Fig. 1G, H) weakly calcified; plates weakly marked, approximately same size in male, but distal 2 plates larger and more strongly elongated than proximal 3 plates in female; proximal lateral plates each with very shallow suture on proximal part, suture of male shorter than that of female and indistinct; distal plates each with short faint suture on median part.

Etymology.—The specific name is a noun in apposition from the combination of the Latin,

“bis”, meaning two and “forma”, meaning shape, in reference to the sexually dimorphic structure on the carapace and telson.

Color in Life (Fig. 7B).—Carapace light brown, with white ovate markings on protogastric, anteromedian branchial, and cardiac regions; markings on posterior regions irregularly distributed. Chelipeds with mottled pattern of white, and light and dark brown. Ambulatory legs with white background, meri with irregular shaped spots of light brown, propodi with transverse band of dark brown on distal part.

The characteristic pattern on the body immediately sets this species apart from all other known commensal porcellanids.

Habit.—This species inhabits the tube of a polychaete, *Chaetopterus* sp., and occurs as a male/female pair. The habit agrees with those of *Eulenia cometes* (Walker, 1887) and species of the *Polyonyx sinensis* group (see Ng and Nakasone, 1993; Ng and Sasekumar, 1993).

Remarks.—See “Remarks” for the genus.

Polyonyx utinomii Miyake, 1943

Figs. 4–6, 7A

Polyonyx asiaticus: Miyake, 1937: 216. [not *P. asiaticus* Shen, 1936]

Polyonyx utinomii Miyake, 1943: 141, figs. 58, 59; 1960: 97, pl. 48, fig. 1; 1982: 204 (list); Johnson, 1958: 99 (key), 114; Miyake *et al.*, 1962: 125 (list); Nakasone, 1978: 29 (list).

Material Examined.—**Japan**: Holotype, SMBL 61; ♂ (CL 4.2 mm, CW 5.6 mm); Tanosaki (Tanabe Bay, Shirahama, Wakayama Prefecture); in tube of *Chaetopterus variope-datus*; 12 May 1937; coll. H. Utinomi. CBM–ZC 5155; 1 ♂ (CL 2.9 mm, CW 3.6 mm); off Sumizaki, Shionomisaki, Kushimoto, Wakayama Prefecture; 25 m; host unrecorded; 20 December 1988; coll. K. Nomura. CBM–ZC 5156; 1 ♂ (CL 2.5 mm, CW 3.2 mm), 1 ovigerous ♀ (CL 3.0 mm, CW 4.0 mm); Futo, Ito, Shizuoka Prefecture; 12 m; in tube of *Chaetopterus* sp.; 15 December 1995; coll. E. Nishi. **Maldives**: CBM–ZC 5157; 1 ♂ (CL 1.7 mm, CW 2.0 mm), 1 ovigerous ♀ (CL 2.1 mm, CW 2.7 mm); Vadoo; outer side of eastern reef; 20 m; in tube of *Chaetopterus* sp.; 22 April 1996; coll. K. Nomura.

Diagnosis.—Carapace transversely ovate; dorsal surface weakly convex, entirely covered with delicate, short and long transverse striae; cervical grooves unmarked. Rostrum rather narrow, trilobate anteriorly. Ocular peduncles small. Third thoracic sternite strongly depressed, median lobe with broadly rounded anterior margin. Third maxillipeds with merus provided with broad subovate lobe on ven-

troflexor margin. Chelipeds unequal, sub-cylindrical, not showing distinct sexual dimorphism in shape; dorsal surface covered with short delicate striae; merus with very large, broadly rounded lobe on dorsoflexor margin; carpus with strongly inflated lobe on dorsoflexor margin; chela narrow, fringed with short and long simple setae on extensor margin. Ambulatory legs short, with scattered simple setae marginally; dactyl with strongly curved, bifurcate claws, flexor claw much larger than extensor. Male with pair of developed pleopods on second abdominal somite; exopod present; pleopods of female present only on fourth and fifth abdominal somites.

Redescription.—Carapace (Fig. 4A–D) transversely ovate, 1.2–1.3 times as broad as long in both male and female, broadest on median branchial margin. Dorsal surface weakly convex, entirely covered with very shallow, delicate transverse striae bearing minute setae on anterior margin; striae on frontal, inner postero-branchial and cardiac regions usually short, those on other regions long and usually interrupted (several striae sometimes uninterrupted). Branchial margins strongly convex, median margins subparallel in male but inflated in female; lateral faces each with distinct longitudinal ridge; posterior regions with long oblique rugae. Rostrum (Fig. 4E) rather narrow, bent ventrally, very weakly or not produced beyond eyes, trilobate, bearing short setae on anterior margin; median lobe rounded, approximately as broad as and distinctly or slightly extending laterals, without median longitudinal groove; lateral lobes each with rounded apex. Orbits (Fig. 4I, J) shallow; supraorbital margins oblique, unarmed; outer orbital angles rounded. Protogastric ridges and cervical grooves unmarked.

Pterygostomian flaps (Fig. 4B) entire, with strong oblique and longitudinal ridges, weakly narrow posteriorly; anterior angle rather sharply pointed; anterodorsal margin unarmed.

Third thoracic sternite (Fig. 4F) strongly depressed, trilobate anteriorly; median lobe much broader than laterals, with broadly rounded anterior margin; lateral lobes narrow, distinctly exceeding median, each with rounded apex. Fourth thoracic sternite without distinct series of short striae but bearing several short or minute setae along concave anterior margin incompletely marked.

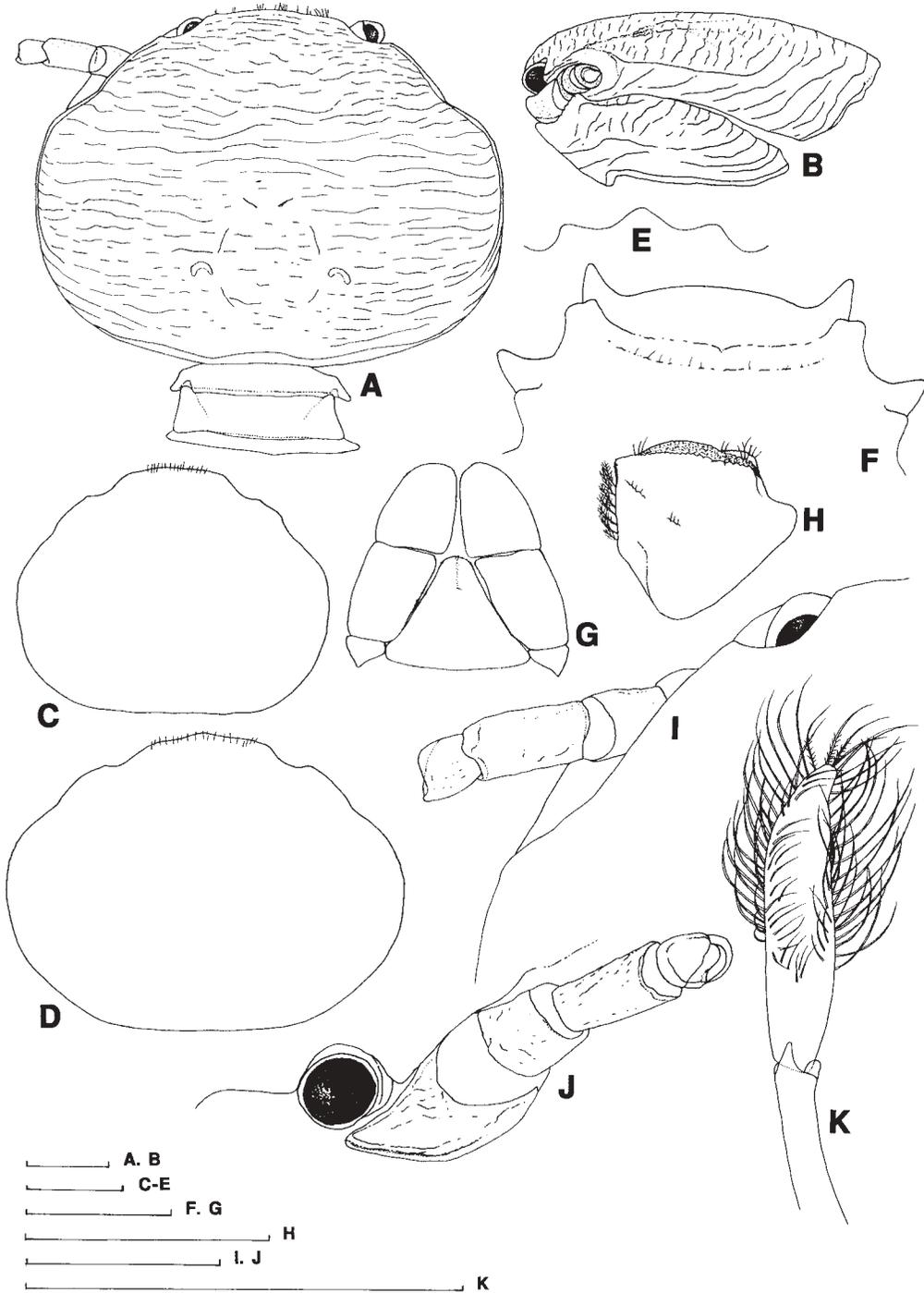


Fig. 4. *Polyonyx utinomii* Miyake, 1943. A, B, E-J, holotype, male (CL 4.2 mm, SMBL 61); C, male (CL 2.5 mm, CBM-ZC 5156); D, ovigerous female (CL 3.0 mm, CBM-ZC 5156); K, male (CL 2.9 mm, CBM-ZC 5155). A, C, D, carapace, dorsal; B, carapace and left pterygostomial flap, lateral; E, rostrum, frontal; F, anterior thoracic sternites, ventral; G, telson, exposed; H, left basal segment of antennular peduncle, ventral; I, left anterior lateral part of carapace, eye, and antennal peduncle, dorsal; J, same, lateral; K, left male pleopod, internal. Scales equal 1.0 mm.

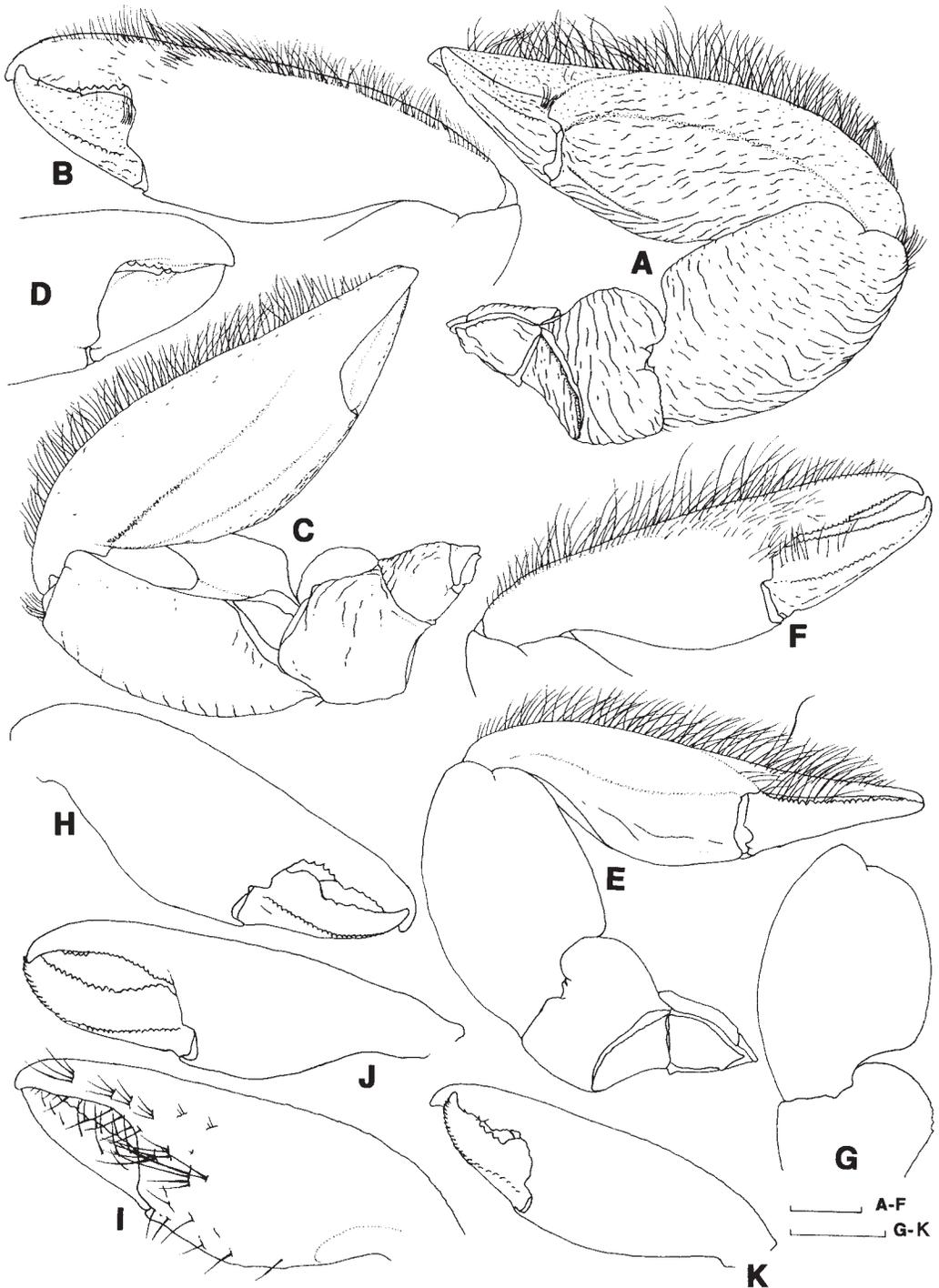


Fig. 5. *Polyonyx utinomii* Miyake, 1943. A-F, holotype, male (CL 4.2 mm, SMLB 61); G-J, male (CL 2.9 mm, CBM-ZC 5155); K, ovigerous female (CL 3.0 mm, CBM-ZC 5156). A, larger cheliped, right, dorsal; B, same, chela, dorso-extensor; C, same, ventral; D, same, distal part of chela, ventroflexor; E, smaller cheliped, left, dorsal; F, same, chela, dorso-extensor; G, larger cheliped, merus and carpus, left, dorsal; H, same, chela, dorso-extensor, setae omitted; I, same, ventral; J, smaller cheliped, chela, left, dorso-extensor, setae omitted; K, larger cheliped, chela, dorso-extensor, setae omitted. Scales equal 1.0 mm.

Ocular peduncles (Fig. 4I, J) small, with 1 or 2 transverse striae on dorsal surface; dorsal extension onto cornea weakly developed, broadly triangular with rounded apex.

Basal segment of antennular peduncles (Fig. 4H) unarmed; anterior face slightly concave, with 2 weakly developed, broadly rounded lobes on dorsomesial margin, minutely tuberculated on ventral margin; ventral surface smooth except for 1 or 2 short, oblique rugae; lateral margin fringed with plumose setae.

Antennal peduncles (Fig. 4I, J) slender, slightly rugose; first segment immovable; following 3 segments movable, excluded from orbit, unarmed. First segment largest, strongly produced forward in lateral view, broadly in contact with anterior margin of carapace, with longitudinal ridge along ventral margin; anterior angle narrowly rounded. Second segment short. Third segment elongate, slender. Fourth segment small, rounded.

Third maxillipeds (Fig. 6A) with coxa with broadly (holotype) or narrowly (other specimens examined) pointed distoflexor projection, distomedian projection incompletely articulated. Basis articulated with ischium, subtriangular with rounded edges. Ischium broad, ovate, slightly rugose on ventral surface, with longitudinal ridge along extensor margin; disto-extensor angle rather weakly produced, rounded. Merus with laminate, broad subovate lobe on ventroflexor margin, moderately rugose on ventral surface. Carpus with triangular projection on proximal region of flexor margin and weakly developed longitudinal rows of short and minute rugae along extensor margin on ventral surface. Propodus rather elongated, subrectangular (tapering distally in holotype), nearly smooth except for short rugae along extensor margin. Dactyl small, subtriangular; ventral surface smooth. Merus to dactyl with long plumose setae on flexor margin (not illustrated). Exopod laminate, robust, inflated proximally, with distal flagellum.

Chelipeds (Fig. 5B–K) unequal, subcylindrical, inflated, without distinct spines or teeth, not showing distinct sexual dimorphism in shape; dorsal surface covered with short delicate, oblique and transverse striae; ventral surface nearly smooth except for rugae along flexor margins of ischium, merus and palm, and extensor margin of carpus. Larger cheliped (Fig. 5B–D, G–I, K) with merus

having distinct transverse ridge submedially on dorsal surface; dorsoflexor margin with very large, broadly rounded lobe, slightly crenulated; ventral surface with distoflexor corner unarmed (mesial margin near its corner bearing small low projection). Carpus 1.3–1.5 times as long as broad; dorso-extensor margin strongly rugose; dorsoflexor margin with strongly inflated lobe, transverse or slightly convex, occasionally slightly crenulated; dorsodistal margin with broad rounded lobe on extensor part and tuft of short simple setae at extensor end; ventral surface with flexor margin slightly concave. Chela narrow, elongate, 1.9–2.0 times as long as carpus, approximately 3.3 times as long as high, lying on extensor side; fingers crossed distally, cutting edges nearly transverse; dactyl opening at moderately or strongly oblique angle; extensor margin thin, weakly convex, granulated or minutely serrated on distal $\frac{2}{3}$, fringed with soft or moderately stiff, short and long, simple setae entirely. Palm with dorsal surface convex; dorsomedian longitudinal ridge indistinct; dorsoflexor margin with longitudinal rugose ridge; ventral surface with weakly or moderately developed longitudinal ridge along midline, distal flexor part usually with several simple setae (no setae in holotype). Fixed finger with moderately or strongly curved distal claw; dorsal surface with short simple setae; dorsoflexor proximal part with broad, weakly developed, subtriangular projection extending onto dactyl; cutting edge with small, rounded or subtriangular teeth, submedian teeth forming broad, subtriangular projection in both male and female; ventral surface usually with fringes of several simple setae on proximoflexor part and along cutting edge (no setae in holotype). Dactyl 0.3–0.4 length of chela, as long as or slightly shorter than fixed finger, with strongly curved distal claw; dorsal surface with longitudinal ridge composed of minute tubercles along flexor margin (distal part serrated in female) and simple setae along cutting edge; cutting edge usually with small, rounded or subtriangular teeth on distal $\frac{2}{3}$, proximal part with weakly or strongly developed, large rounded tooth in both male and female; ventral surface with simple setae along cutting edge (no setae in holotype).

Smaller cheliped (Fig. 5E, F, J) almost identical to larger, except for: chela narrower, 3.6 times as long as high, granulated or

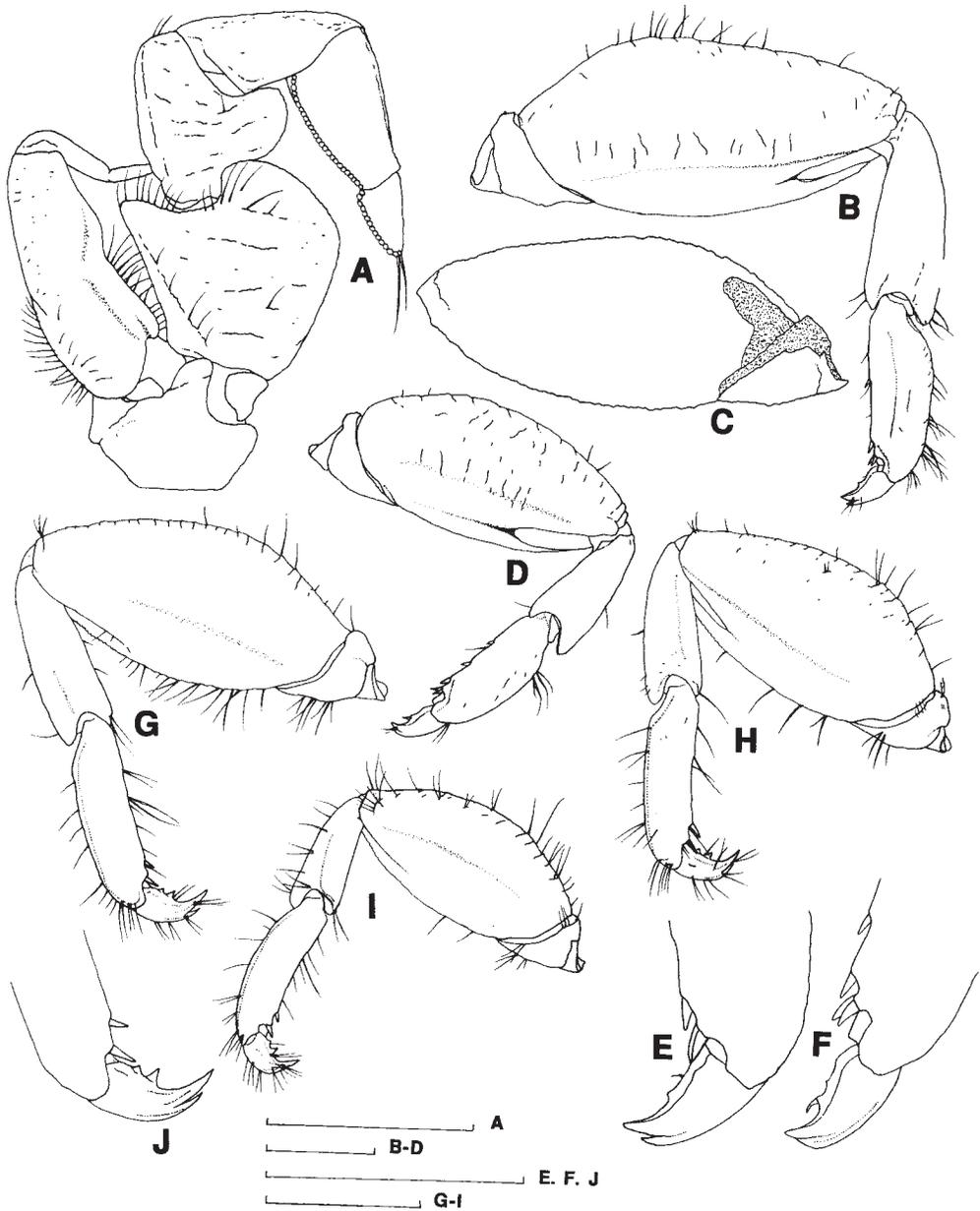


Fig. 6. *Polyonyx utinomii* Miyake, 1943. A-F, holotype, male (CL 4.2 mm, SMBL 61); G-J, male (CL 2.9 mm, CBM-ZC 5155). A, left third maxilliped, ventral; B, right probable second ambulatory leg, lateral; C, same, mesial; D, right probable third ambulatory leg, lateral; E, distal part of right probable second ambulatory leg, lateral; F, distal part of right probable third ambulatory leg, lateral; G, left first ambulatory leg, lateral; H, left second ambulatory leg, lateral; I, left third ambulatory leg, lateral; J, distal part of left first ambulatory leg, lateral. Scales equal 1.0 mm.

minutely serrated on distal $\frac{3}{4}$ of extensor margin, with dactyl opening at nearly vertical angle; fingers with more sharply pointed, distal claw, cutting edges usually concave (nearly transverse in holotype), without large tooth or projection on fixed finger side; dactyl as long

as or slightly longer than fixed finger, with more strongly developed, longitudinal ridge along flexor margin, distal part usually serrated (minutely tuberculated in holotype).

Ambulatory legs (Fig. 6B-J) short, sub-cylindrical, with scattered simple setae mar-

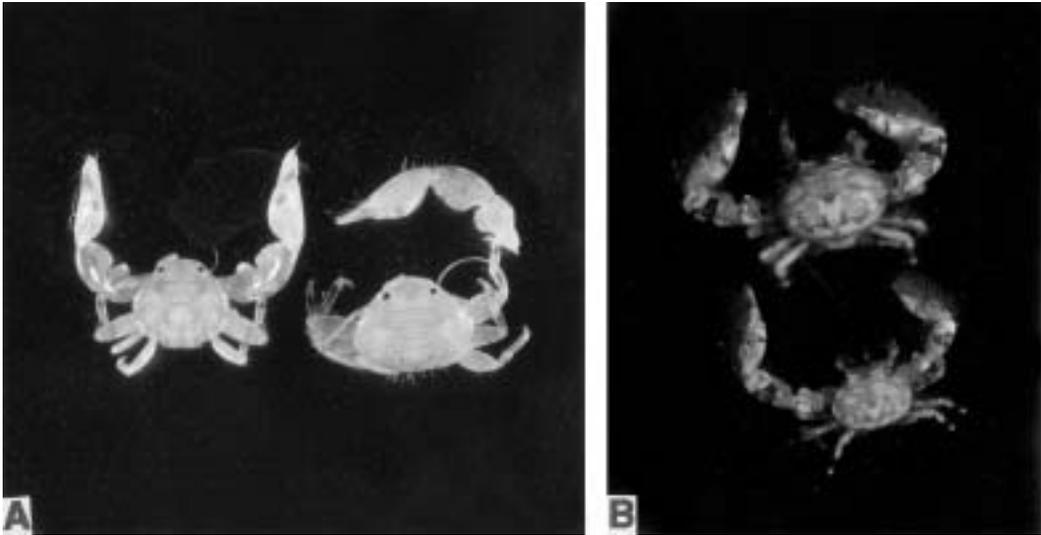


Fig. 7 Entire animal, dorsal. A, *Polyonyx utinomii* Miyake, 1943; left, male (CL 2.5 mm); right, ovigerous female (CL 3.0 mm); CBM-ZC 5156. B, *Heteropolyonyx biforma*, new genus and species; upper, holotype, ovigerous female (CL 3.3 mm, CBM-ZC 5158); lower, allotype, male (CL 2.5 mm, CBM-ZC 5159).

ginally; lateral surface nearly smooth except for short rugae on meri (especially along extensor margin). Ischium decalcified on distal region of mesial surface. Merus elongated ovate, with lengths decreasing as first > second > third legs; extensor margin unarmed but slightly crenulated, inflated in proximal $\frac{1}{3}$ (second leg) to half (first and third legs); distoflexor margins of lateral and mesial surfaces without spines, latter minutely granulated; mesial surface nearly transparent, decalcified on proximo-extensor region (in smaller specimens, decalcified region reduced in size). Carpus elongate, with lengths decreasing as first > second > third legs; disto-extensor and distoflexor corners unarmed. Propodus 0.8 (right probable second leg of holotype)–1.3 (third leg of Wakayama specimen, CBM-ZC 5155) times as long as carpus, 2.7 (right probable third leg of holotype)–3.8 (first and third legs of Wakayama specimen, CBM-ZC 5155) times as long as high; flexor margin usually with 3 small movable spines, distal pair larger than subdistal (4 spines on right probable second leg and 5 spines on right probable third leg in holotype). Dactyl terminating in strongly curved, bifurcate claws, flexor claw sharply pointed, much larger than extensor; flexor margin with 2 small corneous, fixed spines, proximal spine much smaller than distal and sometimes indistinct (these spines broken in holotype).

Fifth pereiopod small, slender, chelate; propodus with numerous short simple setae and 0–2 hooked setae.

Male with pair of developed pleopods on second abdominal somite (Fig. 4K); protopod naked; endopod elongated ovate with narrowly rounded apex (not tapering, with broadly rounded apex in holotype), bearing numerous marginal setae except for proximal part; exopod small, ovate, naked. No trace of pleopods (including small pore) on third to fifth abdominal somites. Female with no pleopods on third abdominal somite, but with well-developed pleopods on fourth and fifth abdominal somites.

Telson (Fig. 4G) composed of 7 plates; proximolateral plates much smaller than others; distal plates moderately broad and short.

Color (Fig. 7A).—The fresh specimens collected from Futo (CBM-ZC 5156) had a characteristic pattern, although the other material examined was entirely faded into white color because of preservation in ethanol. The color and spot pattern generally agrees with that of the figure of male specimen of *P. utinomii* shown by Miyake (1960: pl. 48, fig. 1).

Carapace and pereiopods semitransparent white in ground color. Carapace with orange-brown transverse lines, in the male most lines along cervical grooves and lateral margins are fused to each other; such lines are absent on

cardiac and inner branchial regions. Chelipeds with reddish-brown spots and indistinct transverse lines on carpus; chela with few scattered, orange-brown spots on distal half. Ambulatory legs with reddish- or orange-brown transverse bands on propodi, carpi, and distal parts of meri.

Habit.—The specimens examined inhabit tubes of polychaetes of the genus *Chaetopterus*. *Polyonyx utinomii* probably occurs as a male/female pair in normal case.

Distribution.—Only known from Japan (central Pacific coast of Honshu mainland and western coast of Kyushu) and the Maldives. The present record of this species from the Maldives greatly extends its geographical distribution westwards into the Indian Ocean.

Remarks.—The holotype specimen differs somewhat from the other specimens examined in the form of the ambulatory legs. The relative lengths of the propodus against the carpus and its height are shorter, and there are more spines on the flexor margin of propodus in the holotype (see above description and Fig. 6B, D, G–I). These may be due to the holotype being older and considerably larger than the rest of the specimens (see “Material Examined”). Minor morphological differences between the holotype and the other specimens examined are also found in the forms of the coxa and propodus of the third maxilliped and the fingers of the smaller cheliped, and the setation on the ventral surface of the chelae. Although the form of chelipeds does not show a distinct sexual dimorphism, the median branchial margins of the carapace are different in a male/female pair. They are subparallel in male but are inflated in female (see Fig. 4C, D).

Although *P. utinomii* belongs to the *P. sinensis* group of Johnson (1958), it is still very distinct. This species is readily distinguishable from the other Indo-West Pacific species of *Polyonyx* by the carapace and chelipeds having numerous transverse and oblique striae on the entire dorsal surface and the meri of the chelipeds provided with a very large, broadly rounded lobe on the dorsoflexor margin. The numerous striae on the transversely ovate carapace may be also observed in an eastern Pacific species, *P. confinis* Haig, 1960 (see Haig, 1960: pl. 17, fig.

1), and two eastern Atlantic species, *P. bouvieri* de Saint-Joseph, 1900 and *P. senegalensis* Chace, 1956 (see Chace, 1956: figs. 13A, 14A), but those striae of *P. utinomii* are distinctly longer.

As pointed out by Miyake (1943), Miyake (1937) had reported the holotype specimen of *P. utinomii* as *P. asiaticus* Shen, 1936. *Polyonyx asiaticus* is currently regarded as a junior subjective synonym of *P. sinensis*, as discussed by Johnson (1958). In addition to the two distinguishing characters of *P. utinomii* from the other *Polyonyx* species of the Indo-West Pacific mentioned above, *P. utinomii* differs from *P. sinensis* in the following features: (1) the rostrum has short setae on the anterior margin (no setae in *P. sinensis*); (2) the merus of the third maxilliped is provided with a broad lobe on the ventroflexor margin (narrow and smaller lobe in *P. sinensis*); and (3) the carpus of the cheliped has a more strongly inflated dorsoflexor lobe, and the margin of the lobe is transverse or slightly convex (the dorsoflexor margin is moderately or strongly convex in *P. sinensis*) (see Shen, 1936: figs. 1a, 2a, as *P. asiaticus*; Miyake, 1943: figs. 56, 57C).

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