

A NEW SPECIES OF *PERAMPHITHOE* (AMPHIPODA: AMPITHOIDAE) FROM SOUTH KOREA, WITH MORPHOLOGICAL DIAGNOSES OF THE WORLD CONGENERIC SPECIES

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ABSTRACT

We describe and illustrate a new species *Peramphithoe guryongensis* found in South Korea. This new taxon has distinctively enlarged pereopods 5-7. Four species are known to have broadened pereopods 5-7: *P. chujaensis*, *P. falsa*, *P. parmerong*, and *P. spuria*. However, *P. guryongensis* n. sp. is distinguished from the others by the following characters: the concave palm of gnathopod 2, the expanded basis of pereopod 5 in males, and the distinct posterodistal lobes at the bases of pereopods 5-7 in both males and females. Morphological diagnoses and keys to all current species of *Peramphithoe* are provided based on their descriptions and illustrations.

KEY WORDS: Amphipoda, Ampithoidae, morphology, new species, *Peramphithoe guryongensis*, South Korea, taxonomy

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INTRODUCTION

Ampithoidae Stebbing, 1899, one of the herbivorous amphipod groups, is known to live in self-constructed, tube-like houses among macroalgae and seagrasses in the coastal regions of the world. Within this family, the members with the inflated bases of pereopods 3 and 4 have glands that secrete amphipod-silk for the purposes of nest building. More than 170 species belonging to 15 genera have been described so far (Conlan and Bousfield, 1982; Conlan and Chess, 1992; Myers and Lowry, 2003; Shin et al., 2010; Hughes and Peart, 2013; Peart, 2014; Peart and Hughes, 2014). For most members of Ampithoidae, the second gnathopod is considered an important taxonomic characteristic for species discrimination. This appendage, however, exhibits strong sexual dimorphism and variations depending on the developmental stages of the specimens (Barnard, 1965; Shin et al., 2010). Therefore, accurate identification of species of immature specimens as well as matching males and females among young individuals often pose a challenge in morphological studies.

The genus *Peramphithoe* Conlan and Bousfield, 1982, was split from *Ampithoe* Leach, 1814 based on the propodus of gnathopod 1 having a transverse palm. The members of *Peramphithoe* are currently characterized by the presence of the mandibular palp, a transverse palm of gnathopod 1, inflated bases of pereopods 3-4, and a strong ventrodistal peduncular process of uropod 1 (Barnard and Karaman, 1991; Conlan and Bousfield, 1982; Kim et al., 2012). With the establishment of the genus *Peramphithoe*, 12 species, *P. annenkovae* (Gurjanova, 1938), *P. aorangi* (J. L. Barnard, 1972), *P. eoa* (Brüggem, 1907), *P. falsa* (K. H. Barnard,

1932), *P. femorata* (Krøyer, 1845), *P. humeralis* (Stimpson, 1864), *P. lindbergi* (Gurjanova, 1938), *P. mea* (Gurjanova, 1938), *P. orientalis* (Dana, 1853), *P. plea* (J. L. Barnard, 1965), *P. spuria* (Krapp-Schickel, 1978), and *P. tea* (J. L. Barnard, 1965), were transferred from the genus *Ampithoe*, and later *P. lessoniophila* was described by Conlan and Bousfield (1982). Then, *P. baegryeongensis* and *P. namhaensis* were described in Korea by Kim and Kim (1988). *Peramphithoe stypotrurpetes* was reported to be a kelp-boring member by Conlan and Chess in 1992. Subsequently, *P. parmerong* Poore and Lowry, 1997, was isolated from Australian waters. Recently, *P. chujaensis* Kim, Hong, Conlan and Lee, 2012 was described, and a mitochondrial COI-gene was sequenced to examine the relationship among Korean species of *Peramphithoe*. Additionally, *P. bungareei* Hughes and Peart, 2013, was reported in Australia. Consequently, a total of 19 species belonging to this genus have been recorded worldwide thus far.

During a scientific survey of Korean ampithoid amphipods, we collected a new species, *P. guryongensis* from South Korea. This species has distinctly enlarged pereopods 5-7, a characteristic that is found in four other species, *P. chujaensis*, *P. falsa*, *P. parmerong*, and *P. spuria*. In the present study, we describe and illustrate the new species, *P. guryongensis*, review morphological diagnoses and species information for all members of the genus *Peramphithoe* based on their descriptions and illustrations, and provide keys to males and females. Additionally, we discuss the species with inconsistencies in morphological characters between original descriptions and other available literature.

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MATERIALS AND METHODS

Samples were collected from brown algae in shallow water (30 to 70 cm depth) at low tide, from the southwestern East Sea, Guryongpo, South Korea, on 10 July 2009 (Fig. 1). The specimens were preserved in 95% ethanol, and glycerol was used as a medium for dissection and mounting. Dissected appendages were stained with lignin pink, observed under a dissection microscope (SMZ1500; Nikon, Tokyo, Japan), and drawn with pencil under a compound microscope (BX-51; Olympus, Tokyo, Japan) equipped with a camera lucida. The line drawings were made using the technique described by Coleman (2003, 2009). Body length was measured along the intestinal line from the tip of the rostrum to the posterior end of urosomite 3. The type materials were deposited at the National Institute of Biological Resources, Incheon, South Korea, the Marine Arthropod Depository Bank of Korea (MADBK), Seoul National University, Seoul, South Korea, and the Museum für Naturkunde, Berlin, Germany.

Description of the specimens, diagnoses, and keys to the species of *Peramphithoe* were prepared using the DELTA database (Dallwitz, 2005) of the amphitoid genera and species. Morphological characters were recorded and verified against the amphitoid database based on the original descriptions and illustrations. The supplementary references by other authors were adopted when original descriptions were deficient.

SYSTEMATICS

Ampithoidae Stebbing, 1899

Peramphithoe Conlan and Bousfield, 1982

Type Species.—*Peramphithoe femorata* (Krøyer, 1845).

Diagnosis.—Mandible palp 3-articulate, molar well developed, triturating; gnathopod 1 palm transverse or nearly so,

propodus narrow; uropod 1 with large, acute distoventral spur; uropod 3 with 2 large recurved distal robust setae.

Peramphithoe guryongensis n. sp.

Figs. 2-6

Type Locality.—Guryongpo, Pohang, Gyeongsangbuk-do, South Korea (36°0'15"N, 129°34'32"E).

Type Material.—Holotype: male, 10.1 mm (KOSPI0000213405), Samjeong 2-ri, Guryongpo-eup, Pohangsinamgu, 10 July 2009, coll. Shin and Hong.

Paratype: female (ovigerous), 8.9 mm (MADBK220116_002), same data as the holotype; male, 7.3 mm (MADBK220116_003), same data as the holotype; male, 8.7 mm and female (ovigerous) 8.3 mm (MADBK220116_004), same data as the holotype; 3 females, 8-10 mm (MADBK220116_005), same data as the holotype; male, 7.5 and female, 9.6 mm (ZMB 28219), same data as the holotype (Fig. 2).

Diagnosis.—Antenna 2 flagellum with plumose setae on ventral margin. Gnathopod 1 carpus of male straight on posterior margin. Gnathopod 2 propodus of male about 2 times as long as width; palm extremely acute, concave near base of dactylus; palmar border minutely crenulated; dactylus bent down at one fourth of proximal part. Pereiopods 5-7 enlarged and bases with posterodistal lobe. Pereiopod 5 basis of male posterodistal lobe reaching to end of ischium; pereiopod 7 of male distal articles very broad; uropod 2 rami subequal in length. Uropod 3 peduncle about 2 times as long as rami. Telson apically subacute.

Description.—Based on holotype male, 10.1 mm.

Head as long as deep (Fig. 3A).

Antenna 1 (Fig. 3B) longer than antenna 2; peduncular article 1 longer than article 2 (1.2 times article 2); article 2 longer than article 3 (3.3 times article 3); article 3 shorter than article 1 (0.26 times article 1); primary flagellum 40 articles.

Antenna 2 (Fig. 3C) slender, similar to antenna 1; peduncle not densely setose on ventral margin; peduncular article 4 longer than article 5; flagellum longer than peduncular article 5, 16-articulate, with sparse plumose setae on flagellar articles 1-11, ventrally.

Upper lip (Fig. 3D) without mid-lateral notches on margins.

Mandible (Fig. 3E, F) molar well developed, triturating; accessory setal row of right with 11 robust setae; accessory setal row of left with 10 robust setae; palp 3-articulate, apically setose; palp article 1 shorter than article 2 (0.4 times article 2); article 2 longer than article 3 (1.2 times article 3); article 3 long (2.3 times width), longer than article 1 (2 times article 1).

Lower lip (Fig. 3G) outer plate forming a distal excavation, medial and lateral lobes subequal in size; mandibular lobe with curved margins, subacute apically.

Maxilla 1 (Fig. 3H) inner plate with 1 slender seta; palp well developed, with apical robust setae. Maxilla 2 (Fig. 3I) inner plate narrower than outer plate.

Maxilliped (Fig. 4A) outer plate with developed row of large robust setae along medial margin.

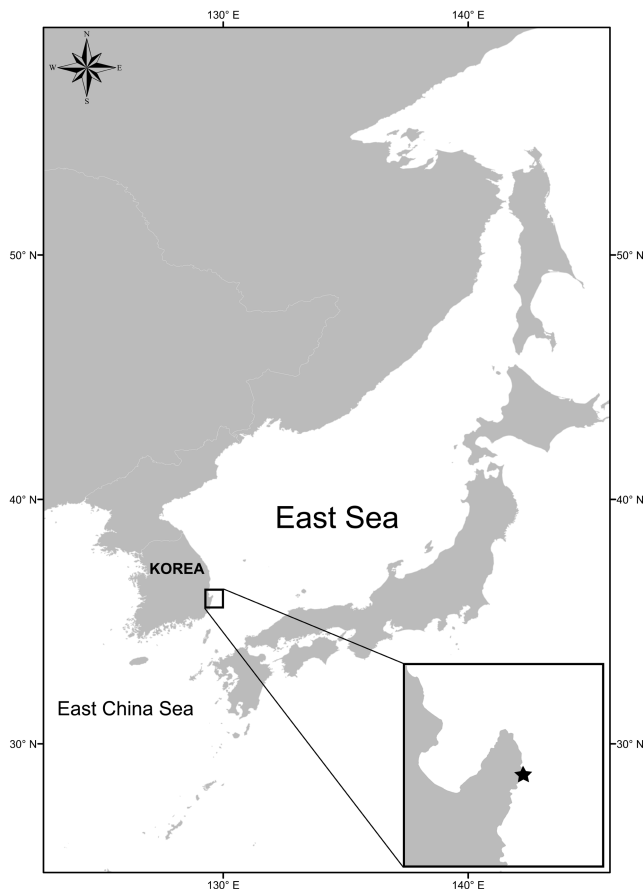


Fig. 1. The type locality of *Peramphithoe guryongensis* n. sp. in South Korea.

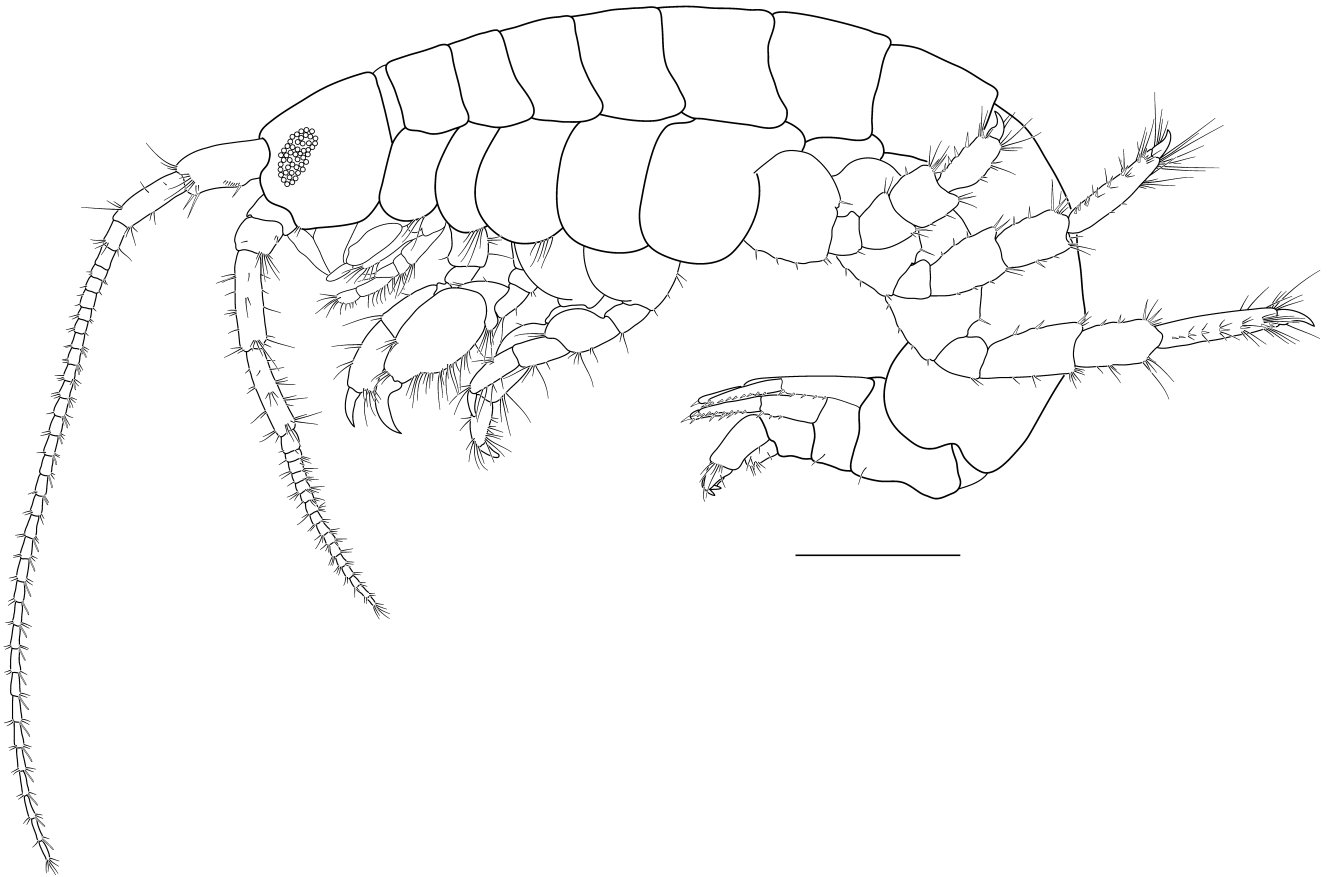


Fig. 2. *Peramphithoe guryongensis* n. sp., male paratype (MADBK220116_003). Habitus. Scale bar = 1 mm.

Pereion. Coxae 1 to 4 longer than broad.

Gnathopod 1 (Fig. 4B) not sexually dimorphic, smaller than gnathopod 2, without densely setose margins; coxa distinctly smaller than coxa 2, deeper than broad, anteroventral corner not produced, anterior margin straight, with slender setae in posteroventral corner; basis longer than coxa, posterior margin with sparse slender setae, anterodistal lobe small and subacute; carpus about twice as long as broad, longer than merus, shorter than propodus (0.9 times propodus), posterior margin straight; propodus subrectangular, narrow, 2.4 times as long as width; palm transverse, straight, palm defined by subquadrate corner, with 1 robust seta; dactylus overreaching palm, inner margin crenate.

Gnathopod 2 (Fig. 4C) sexually dimorphic, without densely setose margins; coxa with a tuft of slender setae in posteroventral corner; basis subequal in length to coxa, with slender setae, anterodistal lobe small and subacute, not reaching beyond ischium; ischium anterior margin without lobe; carpus much shorter than propodus (0.2 times propodus), cup-shaped. Propodus of gnathopod 2, narrow, 1.8 times as long as broad, subovoid, enlarged, anterior margin rounded proximally, not produced into an anterodistally setose lobe; palm extremely acute, with excavation near basal part of dactylus, minutely crenulated, and with fine granules on surface, without proximal or midmedial tooth, without palm defining robust setae; dactylus subequal in length to palm, overreaching two thirds of propodus length, tapering

and curved evenly, apically acute, without unguis, inner margin smooth.

Pereiopod 3 (Fig. 4D) basis expanded; merus expanded distally; carpus about twice as long as broad.

Pereiopod 4 (Fig. 4E) similar to pereiopod 3.

Pereiopods 5-7 enlarged; propodi with 3 distal striated robust setae, defining robust setae simple; dactyls strongly curved.

Pereiopod 5 (Fig. 5A) basis round, extremely expanded posteriorly, posterodistal lobe reaching to end of ischium, with medial slender setae; distal articles very broad; merus subtriangular; propodus slightly expanded distally.

Pereiopod 6 (Fig. 5B) basis posterior margin round proximally, posterodistal lobe reaching to middle of ischium, with marginal robust setae on anterior margin, without medial slender setae; distal articles very broad; merus subtriangular; propodus not expanded, subrectangular, slightly expanded distally.

Pereiopod 7 (Fig. 5C) similar to pereiopod 6; basis with marginal robust setae on anterior margin, without medial slender setae; distal articles very broad; propodus not expanded.

Pleon. Epimeron 3 (Fig. 5D) posteroventral corner subquadrate, concave in middle of posterior margin, expanded distally.

Urosome. Uropod 1 (Fig. 5E) reaching to end of uropod 2 rami; peduncle with 13 robust setae, with slender setal

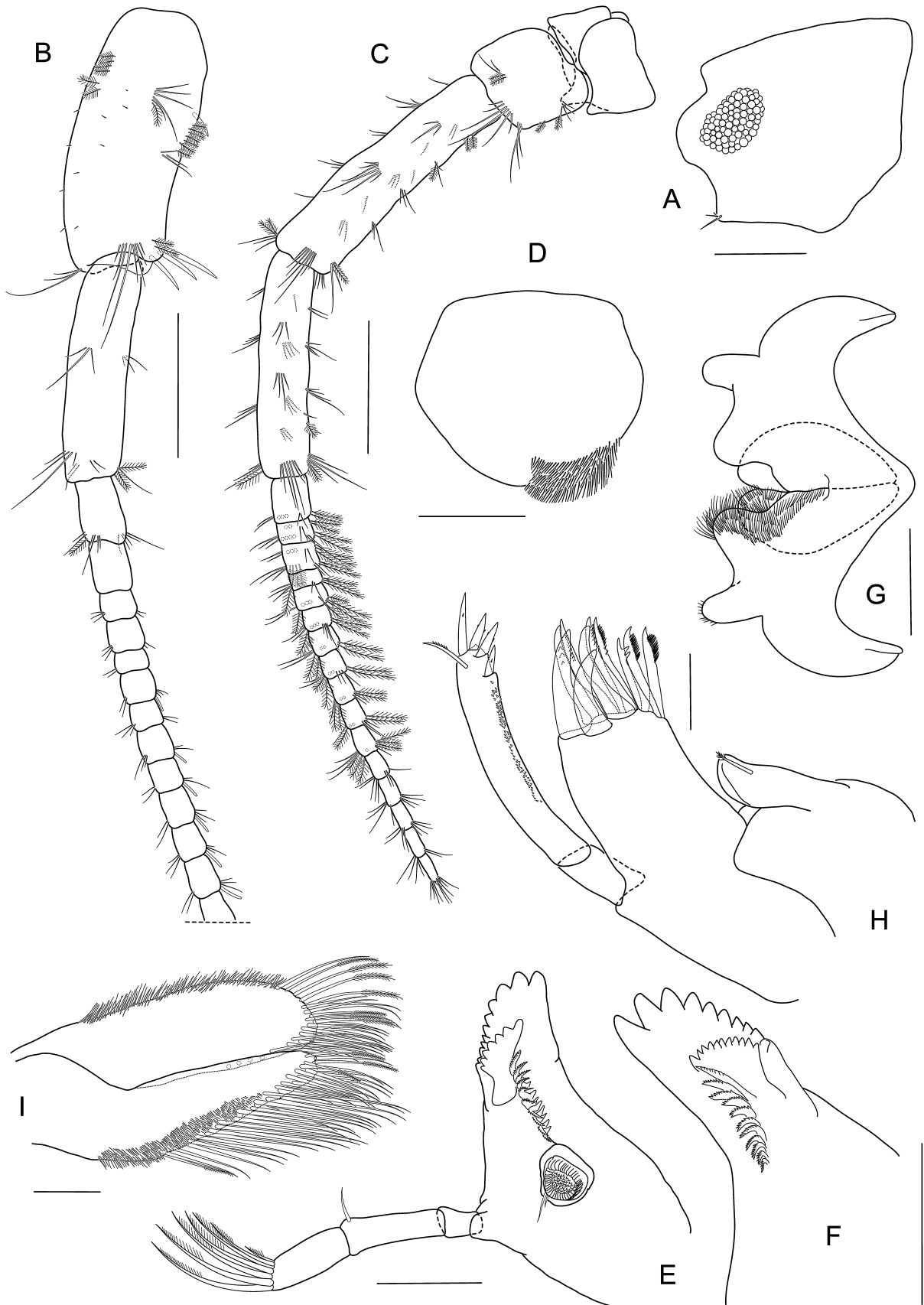


Fig. 3. *Peramphithoe guryongensis* n. sp., male holotype (KOSPI0000213405). A, head; B, antenna 1; C, antenna 2; D, upper lip; E, left mandible; F, right mandible; G, lower lip; H, maxilla 1; I, maxilla 2. Scale bars: A-C = 0.4 mm; D-G = 0.2 mm; H, I = 0.1 mm.

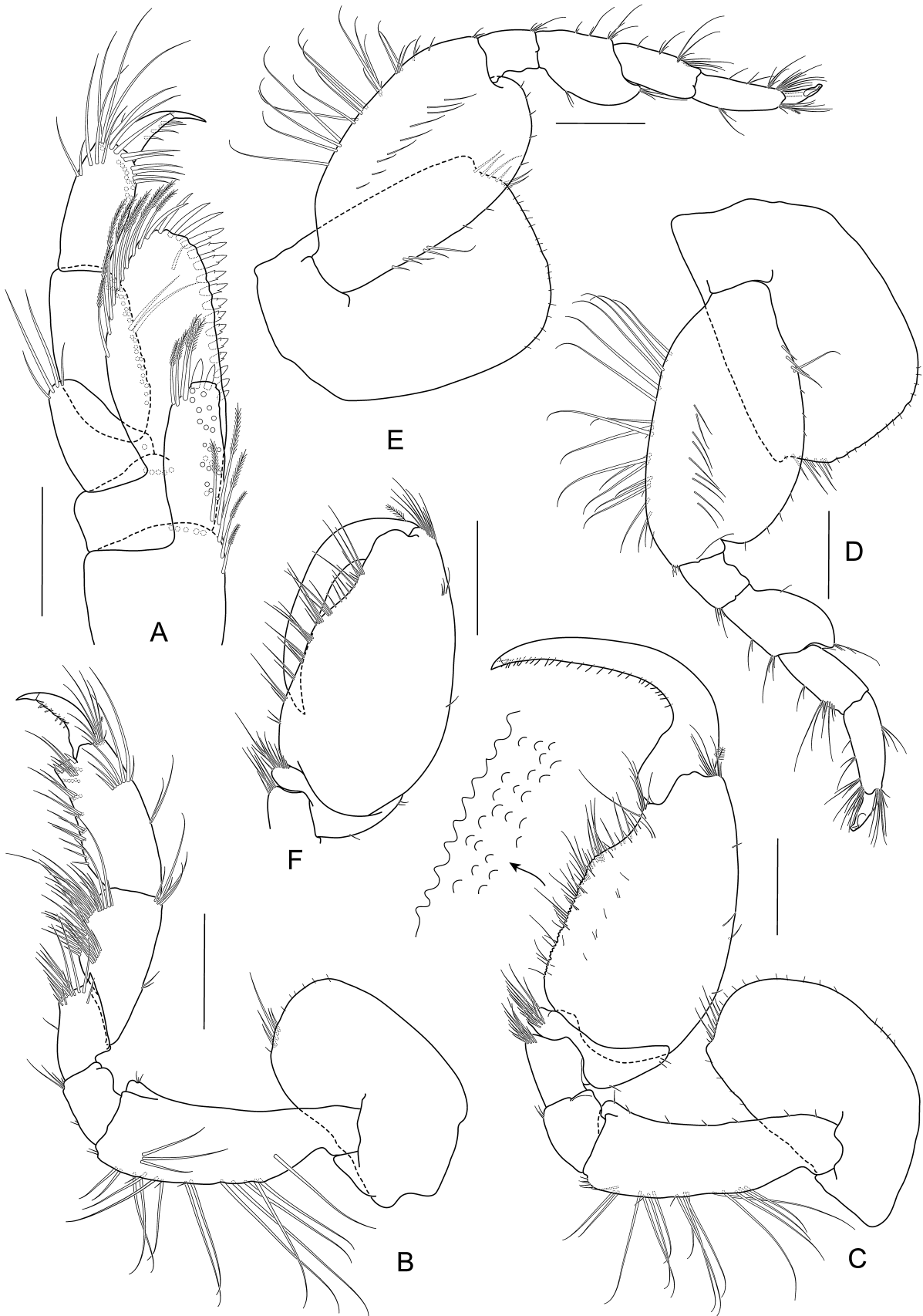


Fig. 4. *Peramphithoe guryongensis* n. sp., male holotype (KOSPI0000213405). A, maxilliped; B, gnathopod 1; C, gnathopod 2; D, pereiopod 3; E, pereiopod 4. Scale bars: A = 0.2 mm; B-E = 0.4 mm.

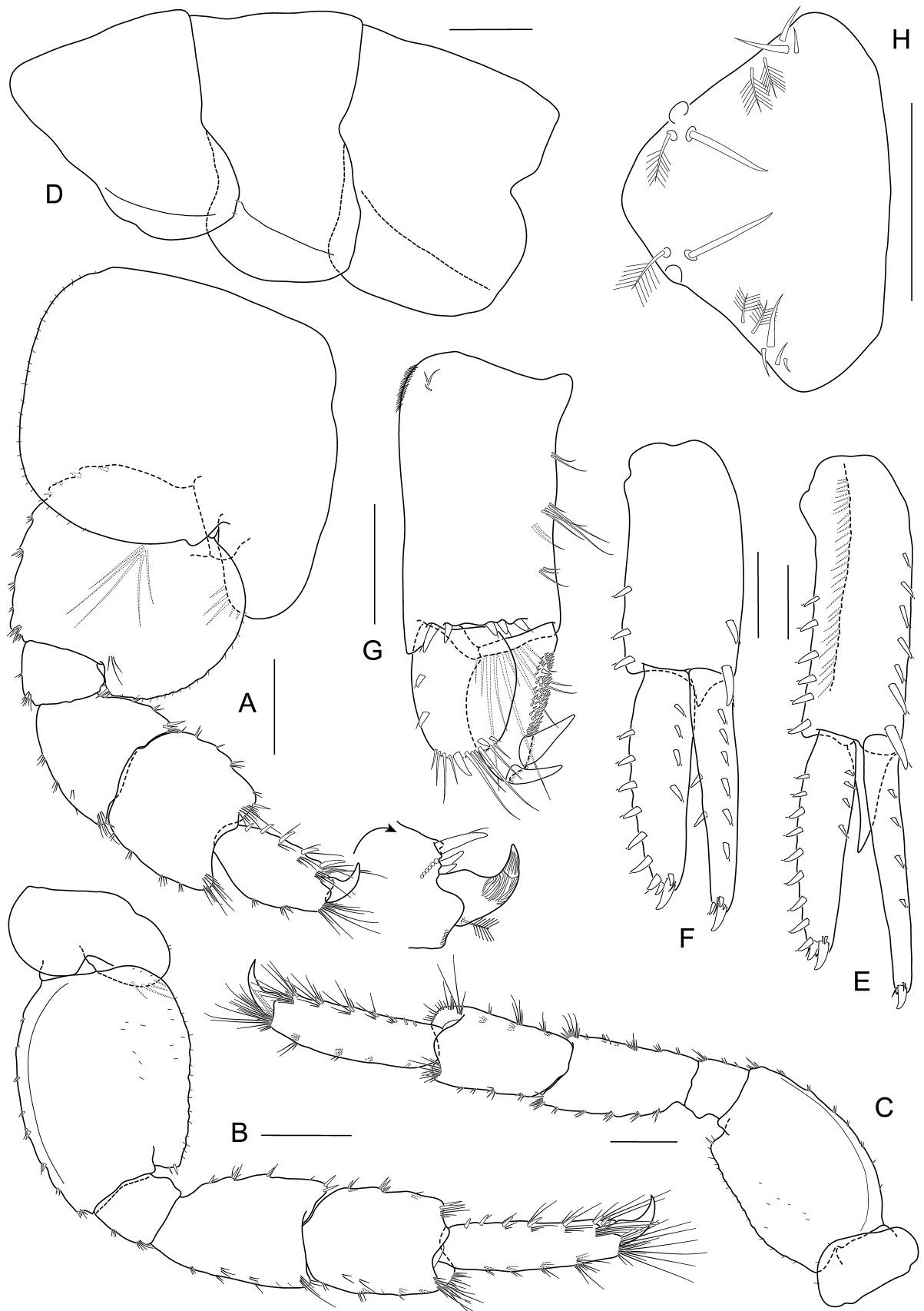


Fig. 5. *Peramphithoe guryongensis* n. sp., male holotype (KOSPI0000213405). A, pereiopod 5; B, pereiopod 6; C, pereiopod 7; D, epimeral plates 1-3; E, uropod 1; F, uropod 2; G, uropod 3; H, telson. Scale bars: A-D = 0.4 mm; E-H = 0.2 mm.

fringe, with large and acute distoventral spur; inner ramus longer than outer ramus, with 4 marginal robust setae, slender setae absent; outer ramus slender, about 5-6 times as long as broad, with 12 marginal robust setae, slender setae absent.

Uropod 2 (Fig. 5F) peduncle with 5 robust setae, slender setae fringe absent; rami subequal in length; inner ramus with 8 marginal robust setae; outer ramus with 10 marginal robust setae.

Uropod 3 (Fig. 5G) peduncle longer than broad (1.8 times width), 1.9 times as long as rami, without marginal robust setae, marginal slender setae present, with 5 peduncular distal robust setae, with 10 distal slender setae; rami short, less than twice as long as broad; outer ramus longer than inner ramus, with 2 large recurved distal robust setae, without apical accessory spines, with patch of small lateral denticles, with lateral setal fringe; inner ramus with 3 distal robust setae, with more than 5 distal slender setae, with 2 lateral robust setae.

Telson (Fig. 5H) subtriangular, apically subacute, with small apical cusps, apical and lateral slender setae present, with 3 pair slender and 2 pair plumose of lateral setae, and with 1 pair of apical setae and 1 pair of apical plumose setae, denticles absent.

Female.—Based on paratype ovigerous female, 8.9 mm.

Gnathopod 1 (Fig. 6A) subequal in size to gnathopod 2; anterodistal lobe of basis small and round, more rounded than that of male; carpus 0.8 times as long as propodus.

Gnathopod 2 (Fig. 6B) basis with sparse slender setae; carpus shorter than propodus (0.6 times propodus), subtriangular; propodus twice as long as width, subrectangular; palm transverse, entire, without crenulations or bumps, defined by subquadrate corner, with 1 robust seta; dactylus overreaching palm, tapering evenly, apically acute, inner margin crenate.

Pereiopods 5-7 distal articles broad.

Pereiopod 5 (Fig. 6C) basis rounded and broadened proximally, posterior lobe not overreaching ischium unlike that of male; distal articles slightly expanded distally; merus subtriangular.

Pereiopod 6 (Fig. 6D) basis posterior margin rounded proximally, straight distally, posterodistal lobe not reaching to ischium unlike that of male, without marginal robust setae, with medial slender setae; merus subrectangular.

Pereiopod 7 (Fig. 6E) similar to pereiopod 6; basis without marginal robust setae.

Other Specimen.—Body laterally compressed. The illustration was made based on the paratype male, 7.3 mm, smaller than holotype (Fig. 2).

Habitat.—Brown algae of shallow water.

Distribution.—East Sea of South Korea (only known from type locality).

Etymology.—Named for type locality Guryong-eup.

Remarks.—*Peramphithoe guryongensis* has enlarged pereiopods 5-7 like *P. chujaensis*, *P. falsa*, *P. parmerong*, and *P. spuria*. However, it differs from the other four species by the following characters: the palm of gnathopod 2 is concave near the basal part of propodus and minutely

crenulated in males, the palms of gnathopods 1-2 are straight in females, the basis of pereiopod 5 is extremely expanded posteriorly, and the posterior margin reaches to the end of ischium in males. In species with enlarged pereiopods 5-7, these appendages are less enlarged and weaker in females than in males. Nevertheless, *P. guryongensis* has distinct posterodistal lobes of the bases of pereiopods 5-7 in both males and females. Moreover, *P. guryongensis* can be distinguished from *P. chujaensis* by the shape of the telson: the *P. guryongensis* telson has a sub-pointed distal margin, while the *P. chujaensis* telson is slightly concave and truncated.

Key to the Male Species of *Peramphithoe* Conlan and Bousfield, 1982

1. Pereiopods 5-7 not enlarged 2
Pereiopods 5-7 enlarged 16
2. Gnathopod 2 similar to gnathopod 1; propodus not enlarged 3
Gnathopod 2 not similar to gnathopod 1; propodus enlarged 4
3. Antenna 2 slender, similar to antenna 1; gnathopod 2 propodus ovoid; palm convex *P. aorangi*
Antenna 2 robust, stouter than antenna 1; gnathopod 2 propodus subrectangular; palm weakly chelate *P. humeralis*
4. Gnathopod 2 propodus ovoid or subovoid 5
Gnathopod 2 propodus not ovoid 10
5. Gnathopod 2 palm clearly defined 6
Gnathopod 2 palm not defined 7
6. Gnathopod 1 carpus posterior margin straight; gnathopod 2 palm slight concave; antenna 2 flagellum longer than peduncular article 5 *P. mea*
Gnathopod 1 carpus posterior margin truncated; gnathopod 2 palm concave; antenna 2 flagellum shorter than peduncular article 5 *P. lindbergi*
7. Head dorsal margin bulbous; antenna 1 subequal in length to antenna 2; telson apically subacute *P. stypotrurpetes*
Head dorsal margin ordinary; antenna 1 longer than antenna 2; telson apically truncated or round 8
8. Epimera 1-3 posterodistal corner with acute tooth; antenna 2 slender *P. bungareei*
Epimera 1-3 posterodistal corner without tooth; antenna 2 stout 9
9. Antenna 2 flagellum densely setose; gnathopod 2 palm smoothly concave, without tubercle ... *P. lessoniophila*
Antenna 2 flagellum weakly setose; gnathopod 2 palm straight with shallow tubercle *P. femorata*
10. Gnathopod 2 dactylus reaching beyond carpus 11
Gnathopod 2 dactylus reaching to posterodistal angle of propodus 12
11. Gnathopod 2 palm with process near base of dactylus; pereiopod 5 basis with posterodistal lobe .. *P. orientalis*
Gnathopod 2 palm without process; pereiopod 5 basis without posterodistal lobe *P. eoa*
12. Gnathopod 2 palm without distinct protrusion 13
Gnathopod 2 palm with distinct protrusion 14

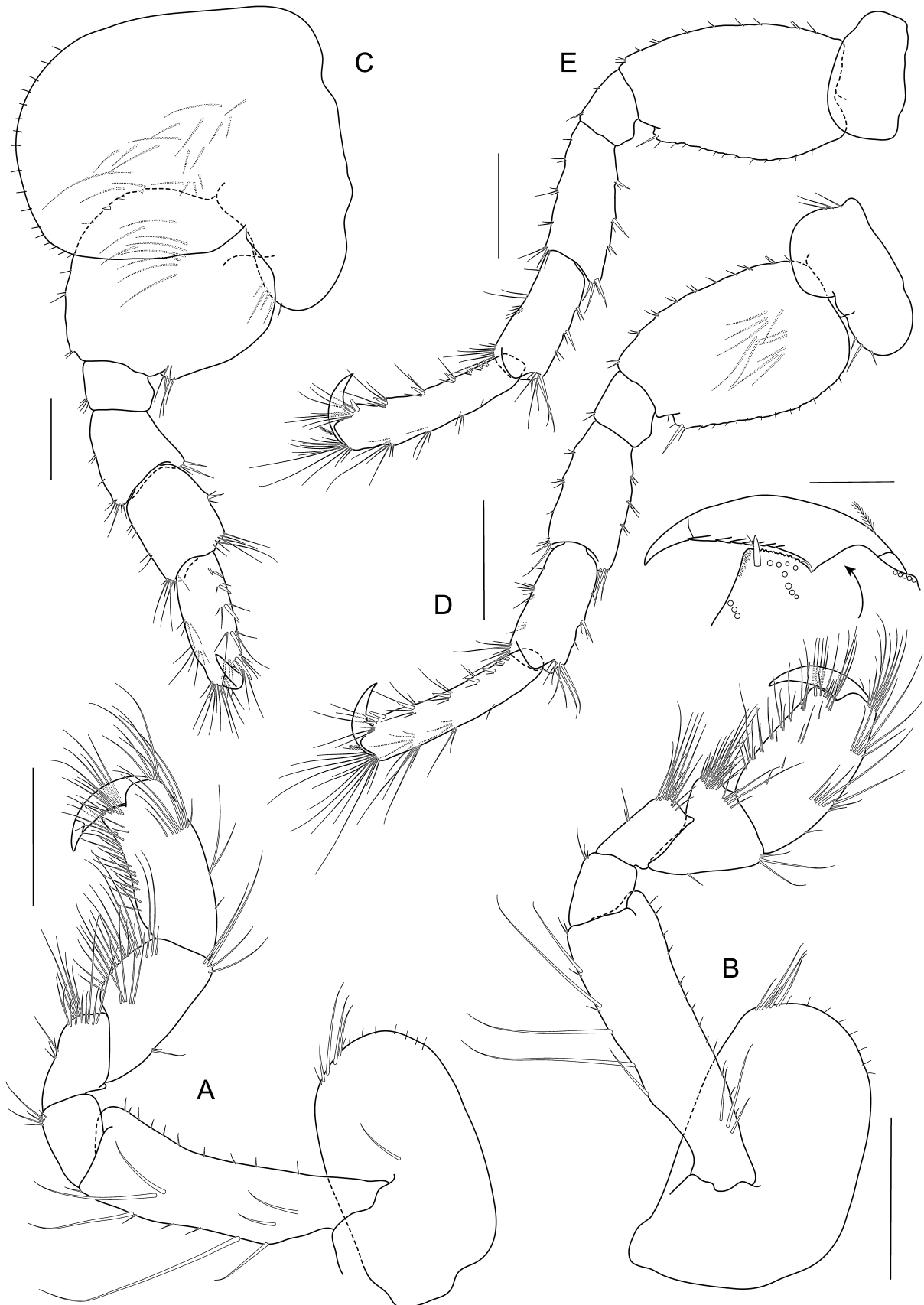


Fig. 6. *Peramphithoe guryongensis* n. sp., female paratype (MADBK220116_002). A, gnathopod 1; B, gnathopod 2; C, pereopod 5; D, pereopod 6; E, pereopod 7. Scale bars: A-E = 0.5 mm.

13. Gnathopod 2 propodus posterior margin straight; palmar border irregularly crenulate *P. annenkovae*
Gnathopod 2 propodus posterior margin deeply concave; palmar border smooth *P. baegryeongensis*
14. Gnathopod 2 ischium with anterior lobe; propodus subrectangular form; dactylus curved at apical half portion of length *P. plea*
Gnathopod 2 ischium without anterior lobe; propodus not subrectangular form; dactylus bent down at about quarter portion of length 15
15. Gnathopod 1 carpus with lobe, posterior margin truncated; gnathopod 2 palm straight, without distinct notch *P. tea*
Gnathopod 1 carpus without lobe, posterior margin straight; gnathopod 2 palm concave, with notches *P. namhaensis*
16. Pereiopod 5 basis posterodistal lobe present 17
Pereiopod 5 basis posterodistal lobe absent 19
17. Gnathopod 2 palm excavate, defined by lobe-like extension *P. chujaensis*
Gnathopod 2 palm extremely acute, not defined 18
18. Pereiopod 5 basis posterodistal lobe overreaching to ischium *P. guryongensis*
Pereiopod 5 basis posterodistal lobe not reaching to ischium *P. parmerong*
19. Gnathopod 2 propodus enlarged; palm sinuous, not defined *P. falsa*
Gnathopod 2 propodus weakly enlarged, and similar to gnathopod 1; palm defined *P. spuria*
- Key to the Females of *Peramphithoe* Conlan and Bousfield, 1982 (Except *P. bungareei*)
1. Pereiopods 5-7 distal articles not enlarged 2
Pereiopods 5-7 distal articles enlarged 15
2. Gnathopod 2 not or weakly sexually dimorphic 3
Gnathopod 2 sexually dimorphic 4
3. Gnathopod 2 palm transverse, convex; telson apically subacute *P. aorangi*
Gnathopod 2 palm slightly chelate; telson apically truncated *P. humeralis*
4. Gnathopod 2 propodus ovoid or subovoid 5
Gnathopod 2 propodus narrow and subrectangular ... 6
5. Gnathopod 2 palm deeply concave; antenna 2 slender; antenna 1 peduncular article longer than article 2 *P. annenkovae*
Gnathopod 2 palm concave without distinct edge; antenna 2 stout; antenna 1 peduncular article 1 subequal in length to article 2 *P. mea*
6. Antenna 1 longer than antenna 2, flagellum elongated 7
Antenna 1 subequal length of antenna 2, flagellum not elongated *P. stypotrumpetes*
7. Gnathopods 1-2 bases concave posteromedially, serrated with dense setae on posterodistal margin .. *P. plea*
Gnathopods 1-2 bases posterior margin ordinary and smooth 8
8. Telson apically subacute 9
- Telson apically truncated or subround 11
9. Gnathopod 1 carpus posterior margin truncated; gnathopod 2 palm convex *P. lindbergi*
Gnathopod 1 carpus posterior margin round; gnathopod 2 palm not convex 10
10. Gnathopod 1 carpus subequal in length to propodus; gnathopod 2 palm oblique *P. baegryeongensis*
Gnathopod 1 carpus longer than propodus; gnathopod 2 palm transverse *P. tea*
11. Gnathopod 2 basis anterodistal lobe round 12
Gnathopod 2 basis anterodistal lobe small and subacute 13
12. Gnathopod 2 palm transvers, straight; mandible palp article 1 longer than article 3 *P. orientalis*
Gnathopod 2 palm obliquely convex; mandible palp article 1 shorter than article 3 *P. namhaensis*
13. Gnathopods 1-2 and pereiopods 3-4 sparsely setose on posterior margin *P. eoa*
Gnathopods 1-2 and pereiopods 3-4 densely setose on posterior margin 14
14. Epimeron 3 posterodistal margin subquadrate; gnathopod 1 basis with setae on mid-surface and posterior margin *P. lessoniophila*
Epimeron 3 posterodistal margin round; gnathopod 1 basis with dense setae on posterior margin *P. femorata*
15. Pereiopod 5 basis posterodistal lobe present distinctly *P. guryongensis*
Pereiopod 5 basis posterodistal lobe absent or not clear 16
16. Gnathopods 1-2 bases anterodistal lobe present, round 17
Gnathopods 1-2 bases anterodistal lobe absent or vestigial 18
17. Telson apically subacute *P. parmerong*
Telson apically truncated *P. chujaensis*
18. Gnathopod 2 propodus longer than carpus; 2 palm convex *P. spuria*
Gnathopod 2 propodus subequal in length to carpus; palm straight *P. falsa*
- DIAGNOSES OF THE WORLD CONGENERIC SPECIES
- Peramphithoe annenkovae* (Gurjanova, 1938)
- Amphithoe annenkovae* Gurjanova, 1938: 349-351, 365 (key), 401, fig. 48. Gurjanova, 1951: 876 (key), 890-892, fig. 619. -J. L. Barnard, 1965: 2 (key). -Tzvetkova, 1967: 188.
- Type Locality.—Sea of Japan.
- Type Material.—Holotype, male, 8 mm.
- Diagnosis.—Antenna 2 similar to antenna 1. Gnathopod 2 propodus of male posterior margin straight; palm extremely acute, corresponding to posterior margin of propodus, saw-shape, irregularly crenulated with groups of setae; dactylus bent down at right angle at about one fourth of length. Gnathopod 1 carpus of female with round posterior lobe. Gnathopod 2 propodus of female subovoid; palm concave; dactylus overreaching palm. Uropod 3 outer ramus subequal

in length to inner ramus. Telson apically subacute. The diagnosis was made based on the description of Gurjanova (1938).

Habitat.—This species is collected from seagrass beds under strong surf, especially among *Laurencia* sp., and it sometimes occurs among algae such as *Gloiopeltis* sp., *Amphiroa* sp., and *Phyllospadix* sp. in the sublittoral zone.

Remarks.—This species has a distinctive palm of gnathopod 2 in males and females. The palm of male gnathopod 2 has serrated edge with groups of setae, and that of female gnathopod 2 is distinctly concave.

Distribution.—Sea of Japan (Gurjanova, 1938).

Peramphithoe aorangi (J. L. Barnard, 1972)

Amphithoe aorangi J. L. Barnard, 1972: 27 (key), 37, figs. 8-10a (not 10b-e).

Type Locality.—Eve Bay, Wellington, New Zealand.

Type Material.—New Zealand Oceanographic Institute: Holotype, male, 5.3 mm, NZOI No. 79.

Diagnosis.—Gnathopod 1 of male subequal in size to gnathopod 2. Gnathopods 1-2 ischia of male bilobated anteriorly. Gnathopod 2 propodus of male not enlarged; palm convex, defined by 1 robust seta; dactylus overreaching palm. Gnathopod 2 palm of female straight, transverse. Pereiopod 3 carpus about 1.5 times as long as width. Pereiopod 5 basis subovoid. Telson apically subacute. The diagnosis was made on the description of J. L. Barnard (1972), only the figures of 5.3 mm individual.

Habitat.—This species is collected from the wash of intertidal algae.

Remarks.—J. L. Barnard (1972) described and illustrated two types of male individuals of *P. aorangi*. The male specimen with a body length of 5.3 mm was designated as the holotype. The other type of male, with a body length of 7.8 mm, was described based on gnathopods 1-2.

According to the illustrations of J. L. Barnard (1972), the holotype specimen exhibits less sexual dimorphism in gnathopod 2. The gnathopod 2 is similar in form to gnathopod 1. The basis is 1.4 times longer than coxa 2. The propodus of gnathopod 2 is not enlarged, the palm is transverse, and the dactylus is the same as that in females and overlaps the palm. In the sample with 7.8 mm long body, the basis of gnathopod 2 is thin and 2.2 times longer than coxa 2. The propodus of gnathopod 2 is enlarged. The palm is evenly excavated distally 3/4 of the posterior margin in a semi-lunar form, and it is defined by a produced angle.

Recently, *P. aorangi* was reported from Australian waters by Hughes and Peart (2013). They illustrated a male individual with a 9 mm long body without providing a text description. Gnathopod 2 of this male individual is similar in shape to the J. L. Barnard's specimen, which has a 7.8 mm long body. However, the basis of gnathopod 2 is only 1.7 times longer than coxa 2, and the propodus is shorter and wider than that of the 7.8 mm long male described by J. L. Barnard. The length-to-width ratios of gnathopod 2 propodus (from the widest part to the angle) in the 7.8 mm and 9 mm long individuals are 1.6 and 1.4, respectively. In the 9 mm long

male, the length of gnathopod 1 propodus is three times its width, while it is only 2.2 times its width in the 7.8 mm long male.

The morphological differences between these two individuals, 9 mm long and 7.8 mm long, suggest a sexual dimorphism derived from the age of male individuals. Nevertheless, when the individual with 9 mm long body reported by Hughes and Peart (2013) and the holotype (5.3 mm body length) of J. L. Barnard (1972) are compared, other appendages that do not display sexual dimorphism such as palp of mandible, lower lip, maxilla 1, maxilla 2, uropods 1-3, and telson also exhibit morphological differences. Among these appendages, article 3 of the mandible palp in the 9 mm long individual is only 1/2 the length of article 1, and article 3 has only a single short apical seta. Such a difference in the mandible palp has never been observed among the species of *Peramphithoe*, and the size observed in the 9 mm long male indicates that the mandible palp might be in the process of regeneration.

Distribution.—New Zealand (J. L. Barnard, 1972).

Peramphithoe baegryeongensis Kim and Kim, 1988

Peramphithoe baegryeongensis Kim and Kim, 1988: 121-125, fig. 10. —Kim, 2011: 53 (key), 54-56, figs. 38, 39. —Kim et al., 2012, 4-5, 19 (key), fig. 2.

Type Locality.—Baengnyeong Island, South Korea.

Type Material.—Department of Zoology, Seoul National University, Seoul, South Korea: Holotype, male, 8 mm, SAH00004; allotype female, 9 mm, SAA00002; paratypes, SAP00014, SAP00015, SAP00016.

Diagnosis.—Antenna 2 peduncular article 4 subequal in length to article 5. Gnathopod 2 basis of male with anterodistal lobe large and round, reaching to ischium; propodus strongly tapering distally; palm excavation; dactylus falcate, strongly curved. Gnathopod 1 basis of female with anterodistal lobe, round; carpus with round posterior lobe; propodus transvers, slightly sinuous. Gnathopod 2 palm of female oblique. Telson broadly triangular. The diagnosis was made based on the description of Kim and Kim (1988).

Habitat.—This species is collected among algae in tidal pools.

Distribution.—South Korea (Kim and Kim, 1988).

Peramphithoe bungareei Hughes and Peart, 2013

Peramphithoe bungareei, Hughes and Peart, 2013: 95-97, figs. 62-63.

Type Locality.—North of Lion Island, Broken Bay, NSW, Australia.

Type Material.—Australian Museum: Holotype, male, 11.1 mm, AM P90120; paratypes 6 inds, AM P77125.

Diagnosis.—Gnathopod 1 propodus of male subrectangular, 3 times longer than width; palm transverse, straight, defined by subquadrate corner. Gnathopod 2 basis of male with anterodistal lobe large and rounded, almost reaching to ischium; propodus subrectangular, length about 2 times longer than width; palm acute, distally concave; dactylus

with depression part on distal half of outer curvature, and extending to 1/2 posterior margin of propodus length. Epimera 1-3 posterodistal corner with acute tooth. Telson subtrapezoidal, apically rounded. The diagnosis was made based on the description of Hughes and Peart (2013), and there was only male description.

Habitat.—Unknown.

Remarks.—This species has been very recently described by Hughes and Peart (2013). The illustration of the species' body shows relatively enlarged merus and carpus of the male pereopod 5. However, there are no descriptions and illustrations of pereopod 5, and pereopods 6-7 were damaged.

Distribution.—New South Wales, Australia (Hughes and Peart, 2013).

Peramphithoe chujaensis Kim, Hong, Conlan and Lee, 2012
Peramphithoe chujaensis Kim, Hong, Conlan and Lee, 2012: 6-11, 19 (key), fig. 3.

Type Locality.—Sangchujado Island, Jeju, South Korea.

Type Material.—National Institute of Biological Resources: Holotype, male, 10.9 mm, NIBRV0000246630; paratypes, female, 10.7 mm, NIBRV0000246631. Canadian Museum of Nature: allotype, female, 6.8 mm, CMNC2012-0012. Dankook University: paratypes, juveniles, 3.2-5.8 mm, DKU201204.

Diagnosis.—Antenna 1 flagellum elongate, more than 3 times length of peduncle. Antenna 2 peduncle of male, articles 3 to 5 with plumose setae on ventral margin; flagellum with plumose setae from article 1 to article 9, ventrally. Lower lip outer plates, medial and lateral lobes of subequal in size. Gnathopod 2 propodus of male with posteroproximal lobe-like extension; palm excavate with long setae, defined by lobe-like extension. Pereiopods 5-7 bases of male with posterodistal lobe; meri and carpi extremely enlarged. Uropod 3 peduncle more than 2 times length of rami. Telson apically truncated. The diagnosis was made based on the description of Kim et al. (2012).

Habitat.—This species is collected at 6 m depth.

Remarks.—This species has enlarged pereiopods 5-7, and the distal articles of the male pereopod 7 are enormously expanded.

Distribution.—South Korea (Kim et al., 2012).

Peramphithoe eoa (Brüggen, 1907)

Ampithoe eoa Brüggen, 1907: 481, figs. 4-5 (cited from Gurjanova, 1938).—Gurjanova, 1938: 345-347, 365 (key), 400, figs. 46-46a. —Gurjanova, 1951: 876 (key), 881-882, fig. 615. —J. L. Barnard, 1965: 3 (key). —Tzvetkova, 1967: 186-187. —Kudryaschov, 1979: 124.

Peramphithoe eoa.—Kim et al., 2012: 11-15, 19 (key), figs. 7-9.

Type Locality.—Original description was not available.

Type Material.—Original description was not available.

Diagnosis.—Antenna 1 flagellum elongate, more than 2 times length of peduncles. Mandible palp marginally setose. Maxilla 1 inner plate with 3 setae. Gnathopod 2 propodus of male elongated, subrectangular, posterior margin

straight; palm extremely acute; dactylus reaching to merus. Gnathopod 1 propodus of female slightly longer than carpus. Gnathopod 2 propodus of female, palm oblique, subequal in length to dactylus. Uropod 3 peduncle more than 2 times length of rami. The diagnosis was made based on the description of Gurjanova (1938) and Kim et al. (2012).

Habitat.—This species is collected from brown and red algae, *Zostera pacifica* and *Cysternus* sp., respectively, at a depth of 10-90 m.

Remarks.—According to J. L. Barnard (1954), the original description of *P. eoa* by Brüggen (1907) and J. L. Barnard's material show morphological differences in gnathopod 2. As noted by J. L. Barnard (1954), the dactylus of male gnathopod 2 is longer than the length of propodus in the specimen of Brüggen, while in the specimen of J. L. Barnard the dactylus of male gnathopod 2 is short, stout, and curved apically, and the distal edge of the palm has a large process with a smaller process. He further comments that these differences might have been caused by immaturity of the individuals of *P. eoa*. J. L. Barnard's material has a 10 mm long body, the anterodistal lobe of gnathopod 2 basis is subacute, and the basis of pereopod 5 has a distinct posterodistal lobe, reaching to the middle of the ischium.

Conlan and Bousfield (1982), however, suggested that J. L. Barnard's material might be another species, rather than just an immature individual.

After the original description of Brüggen (1907), *P. eoa* was again described by Gurjanova (1938) based on the material collected in the East Sea. Recently, *P. eoa* was also recorded by Kim et al. (2012) from the East Sea. The materials of Gurjanova (1938) and Kim et al. (2012) coincide with each other, and the body length is 35 mm and 19.3 mm, respectively.

Distribution.—Sea of Japan (Gurjanova, 1938; Kim et al., 2012); Oregon (J. L. Barnard, 1954).

Peramphithoe falsa (K. H. Barnard, 1932)

Ampithoe falsa K. H. Barnard, 1932: 240. —K. H. Barnard, 1937: 170-171, fig. 16. —Ruffo, 1969: 57-62, figs. xviii-xx. —J. L. Barnard, 1965: 2 (key). —Krapp-Schickel, 1969: 331, pls. 6-7. —Sivaprakasam, 1970: 71-74, figs. 3-4. —Griffiths, 1974: 274. —Griffiths, 1975: 105. —Griffiths, 1976: 25 (key), fig. 10e. *Ampithoe brevipes*. —K. H. Barnard, 1916: 255, pl. 28, fig. 34 (non Dana).

Type Locality.—False Bay, South Africa.

Type Material.—South African Museum: SAM A2537, SAM A3288 (cited from K. H. Barnard, 1916).

Diagnosis.—Maxilla 1 inner plate with 2 setae. Gnathopod 2 propodus of male 1.6 times as long as width; palm not defined, sinuous with long setae; dactylus strongly falcate. Gnathopod 2 propodus subequal in length to carpus; palm straight. Pereiopods 5-7 enlarged; bases without posterodistal lobe. Telson triangular, apically subacute. The diagnosis was made based on the description of Ruffo (1969), and morphology of pereiopods 5-7 of female were referred to Sivaprakasam (1970).

Habitat.—This species is found on seaweeds.

Remarks.—This species has enlarged pereopods 5-7.

Distribution.—South Africa, False Bay (K. H. Barnard, 1937); the Indian Ocean (Griffiths, 1975); Arabian Sea, Gulf of Aden, Red Sea; and Mediterranean Sea (Sivaprakasam, 1970).

Peramphithoe femorata (Krøyer, 1845)

Ampithoe femorata Krøyer, 1845: 335-402, Tab. 3, figs. 4a-i. —J. L. Barnard, 1965: 2 (key). —Alonso, 1980: 4-5, pl. 1.

Peramphithoe femorata. —Conlan and Bousfield, 1982: 60, 68-69, fig. 16. —Conlan and Chess, 1992: 415-418, 418 (key), figs. 1, 4. —Chiesa and Alonso, 2007: 106 (list).

Ampithoe brevipes Dana, 1852: 216-217.

Type Locality.—Valparaiso, Chile.

Type Material.—Universitets Zoologiske Museum København, Copenhagen, Denmark: Lectotype, female, 20.8 mm; paralectotypes, 3 juveniles.

Diagnosis.—Antenna 2 stouter than antenna 1. Lower lip outer plates, lateral lobe of distinctly longer than medial lobe. Gnathopod 2 propodus of male subovoid; palm extremely acute, with one shallow tubercle on proximal part of dactylus (with two shallow notches anterior and posterior to tubercle); dactylus subequal in length to palm. Gnathopods 1-2 bases of female moderately setose posteriorly. Gnathopod 1 carpus of female slightly shorter than propodus. Pereiopod 6-7 bases concave posterodistally. Uropods 1-2 rami slender and densely spinose. Telson subtrapezoidal, apically truncated. The diagnosis was made based on the description of Conlan and Chess (1992).

Habitat.—This species is found in self-built tubes among the fronds of kelp.

Remarks.—This species is the type species of the genus *Peramphithoe*. The lectotype of *P. femorata* was assigned by Conlan and Chess in 1992.

Distribution.—New Zealand, South Africa, Chile, Argentina, Brazil? (Conlan and Bousfield, 1982).

Peramphithoe humeralis (Stimpson, 1864)

Ampithoe humeralis Stimpson, 1864: 156. —Holmes, 1904: 241. —Stebbing, 1906: 636. —J. L. Barnard, 1954: 3 (key), 29. —J. L. Barnard, 1965: 2, 6 (key), 7-9, figs. 2-3. —J. L. Barnard, 1969a: 83. —Griffiths, 1979: 132-136, figs. 1-3.

Peramphithoe humeralis. —Conlan and Bousfield, 1982: 61 (key), 61-63, fig. 11. —Conlan and Chess, 1992: 418 (key).

Type Locality.—Puget Sound.

Type Material.—Information is not available in Stimpson (1864).

Diagnosis.—Antenna 2 peduncle article 4 longer than article 5. Gnathopods 1-2 of male identical with that of female. Gnathopod 1 carpus of male longer than propodus, posterior margin truncated. Gnathopod 2 of male subequal in size to gnathopod 1; propodus not enlarge; palm transverse, slightly chelate. Lower lip outer plates, lateral lobe of longer than medial lobe. Telson not subtriangular, apically truncated. The diagnosis was made based on the description of J. L. Barnard (1965).

Habitat.—This species is found in tubes made by curling fronds of eelgrasses and kelps in intertidal zone, at a depth of 70 m. This species is collected from kelps such as *Macrocystis* sp., *Egregia* sp., *Laminaria* sp., *Phyllospadix* sp., and *Ecklonia maxima*.

Remarks.—This species is distinguished from other species of *Peramphithoe* by the chelated palms on the propodi of gnathopods 1-2. The material of Griffiths (1979), collected from South Africa, is subtly different in morphology from the material of J. L. Barnard (1965). The body length of the male individual is 15 mm as per Griffiths' description, whereas it is 22 mm as per J. L. Barnard's description. Furthermore, compared to the description of the male individual by Griffiths, as per J. L. Barnard's description, the flagellum of antenna 1 is longer and the peduncles and the rami of uropods 1-2 are more spinose.

Distribution.—Manila, Philippines (Stebbing, 1906); Puget Sound to Guadalupe Is., Southern California (J. L. Barnard, 1965, 1969a); West coast of South Africa (Griffiths, 1979); Alaska, Baja California (Conlan and Bousfield, 1982).

Peramphithoe lessoniophila Conlan and Bousfield, 1982

Peramphithoe lessoniophila Conlan and Bousfield, 1982: 69, fig. 17. —Conlan and Chess, 1992: 418 (key).

Type Locality.—Adjoining to Coquimbo, Chile.

Type Material.—National Museum of Canada: Holotype, male, 9.5 mm, NMC-C-1981-964; allotype, female, 7 mm, NMC-C-1981-965; paratypes, NMC-C-1981-966.

Diagnosis.—Antenna 2 stout; flagellum slightly longer than peduncular article 5, with dense setae. Lower lip outer plates, lateral lobe of distinctly longer than medial lobe. Gnathopod 2 propodus of male enlarged, subovoid; palm slightly concave, reaching to 1/2 length of propodus. Gnathopod 1 carpus of female without lobe, posterior margin round. Gnathopod 2 carpus of female shorter than propodus. Pereiopod 5 basis concave posterodistally. Pereiopods 6-7 bases round proximally. Telson apically truncated. The diagnosis was made based on the description of Conlan and Bousfield (1982).

Habitat.—This species is found in small self-built chambers on kelps, *Lessonia* sp.

Distribution.—Coquimbo, Chile (Conlan and Bousfield, 1982).

Peramphithoe lindbergi (Gurjanova, 1938b)

Ampithoe lindbergi Gurjanova, 1938: 351-354, 365 (key), 401, fig. 49. —Gurjanova, 1951: 876 (key), 892-895, fig. 620. —Tzvetkova, 1967: 188-189. —J. L. Barnard, 1965: 2, 6 (key), 12-15, figs. 6-7. —J. L. Barnard, 1969a: 83-84. —Kudryaschov, 1979: 126.

Ampithoe femorata. —J. L. Barnard, 1952: 24-28, pls. 6-7.

Peramphithoe lindbergi. —Conlan and Bousfield, 1982: 61 (key), 64-65, fig. 13. —Conlan and Chess, 1992: 419 (key).

Type Locality.—Sea of Japan.

Type Material.—Holotype, male, 10.5 mm.

Diagnosis.—Antenna 2 stout; flagellum shorter than peduncular article 5, with dense setae. Lower lip outer plate, lateral lobe subequal in length to medial lobe. Gnathopod 1 basis of male with anterodistal lobe, round; carpus with truncated posterior lobe. Gnathopod 2 propodus of male subovoid; palm concave, with long and slender setae, defined by 1 stout seta and clear edge; dactylus longer than half of propodus length. Gnathopod 2 propodus of female about 2 times longer than carpus; palm convex, transvers; dactylus overreaching palm. Telson subtriangular, apically round. The diagnosis was made based on the description of Gurjanova (1938).

Habitat.—This species is found on the branches of brown algae such as *Cystophyllum* sp., *Sargassum* sp., *Pelvetia* sp., and *Coslaria* sp. in the littoral zone.

Remarks.—J. L. Barnard (1965) proposed that the material of *P. lindbergi* might be an immature individual of either *P. annenkovae* or *P. plea*. However, Conlan and Bousfield (1982) regarded this material as another species that is of similar maturity and body size. Morphological characters of antennae and gnathopods 1-2 of *P. lindbergi* distinctly separate this species from *P. annenkovae* and *P. mea*.

Distribution.—Sea of Japan (Gurjanova, 1938); California (J. L. Barnard, 1952); Alaska, Bering Sea, Okhotsk Sea, Japan Sea (Conlan and Bousfield, 1982).

Peramphithoe mea (Gurjanova, 1938)

Ampithoe mea Gurjanova, 1938: 361-364, 365 (key), 402, fig. 53. —Gurjanova, 1951: 876 (key), 882-885, fig. 616. —J. L. Barnard, 1965: 3 (key). —Tzvetkova, 1967: 187-188.

Peramphithoe mea. —Conlan and Bousfield, 1982: 61 (key), 63-64, fig. 12. —Conlan and Chess, 1992: 418 (key).

Ampithoe cf. *mea*. —J. L. Barnard, 1969a: 84.

Type Locality.—Sea of Japan.

Type Material.—Holotype, male, 22 mm.

Diagnosis.—Antenna 1 peduncular article 1 with 1 stout seta on posterodistal edge. Antenna 2 stout; flagellum with dense setae, longer than peduncular article 5. Mandible palp marginally setose. Lower lip outer plate, lateral lobe distinctly longer than medial lobe. Maxilla 1 inner plate with 2 setae. Gnathopods 1-2 bases of male with small and subacute anterodistal lobe. Gnathopod 2 propodus of male ovoid; palm slightly concave, defined by 1 stout seta; dactylus strongly curved, subequal in length to palm. Gnathopod 2 of female similar to that of male. Uropod 3 peduncle 2.7 times as long as rami. Telson apically subacute. The diagnosis was made based on the description of Gurjanova (1938).

Habitat.—This species is found from *Zostera* sp., *Desmarestia* sp., *Prilota* sp., and *Sargassum* sp. at a depth of 60 m.

Remarks.—Unlike all the other species the genus *Peramphithoe*, this species has a stout seta on the posterodistal of peduncular article 1 and a defining seta on the palm of male gnathopod 2.

Distribution.—Sea of Japan (Gurjanova, 1938); Alaska (Conlan and Bousfield, 1982).

Peramphithoe namhaensis Kim and Kim, 1988

Peramphithoe namhaensis Kim and Kim, 1988: 125-129, figs. 11-12. —Kim, 2011: 53 (key), 56-58, figs. 40, 41. —Kim et al., 2012: 16, 19 (key), fig. 10.

Type Locality.—Upper Chujado Island, South Korea.

Type Material.—Department of Zoology, Seoul National University, Seoul, South Korea: Holotype, male, 15.5 mm, SAH00005; allotype, female, 9.7 mm, SAA00003; paratypes, 6 females, SAP00017; 2 males and 2 females, SAP00018; 2 males, SAP00019.

Diagnosis.—Antenna 1 flagellum elongate, about three times as long as that of antenna 2. Gnathopod 1 basis of male with anterodistal lobe; carpus posterior margin straight. Gnathopod 2 basis of male with anterodistal lobe, large and round, reaching to ischium; propodus enlarged, massive, posterior margin straight; palm concave, corresponding to posterior margin of propodus, with one protrusion near base of dactylus and following notch, and with one midmedial process and behind depressed part; dactylus bent down at about one fourth of length, reaching to posterodistal angle of propodus. Gnathopods 1-2 bases of female with anterodistal lobe. Gnathopod 2 palm of female convex. Telson apically truncated. The diagnosis was made based on the description of Kim and Kim (1988).

Habitat.—This species is collected from among algae in tide pools.

Remarks.—This species is unique in that the palm of male gnathopod 2 has two dominant protrusions and clear notches are found between the two protrusions.

Peramphithoe namhaensis was recently recorded by Kim et al. (2012). However, the description of Kim et al. (2012) presents several discrepancies to the original description of Kim and Kim (1988). In Kim et al. (2012), the male material is 12.5 mm in body length, antenna 2 is stout, flagellum is setose, and telson is apically acute. Besides, the palm of male gnathopod 2 is irregularly crenulated without a distinct process, which is more similar to the palm of gnathopod 2 of *P. annenkovae*.

Distribution.—Korea (Kim and Kim, 1988; Kim et al., 2012).

Peramphithoe orientalis (Dana, 1853)

Ampithoe orientalis Dana, 1853: 937-939, pl. 64, fig. 2 (plate not available). —Bate, 1862: 246-247, pl. 40, fig. 9. —Stebbing, 1906: 641. —J. L. Barnard, 1955: 26-28, fig. 14. —J. L. Barnard, 1965: 2 (key). —J. L. Barnard, 1970: 50, fig. 17a-i.

Sunamphithoe orientalis. —K. H. Barnard, 1937: 172-173, fig. 17.

Peramphithoe orientalis. —Hirayama, 1983: 115 (key), 116, fig. 23. —Myers, 1985: 36, fig. 26. —Kim and Kim, 1988: 131-132, fig. 15. —Kim and Kim, 1991: 235. —Kim, 2011: 53 (key), 58-60, figs. 42-43. —Kim et al., 2012, 16, 19 (key).

Type Locality.—Manila, Philippines.

Type Material.—Information is not available.

Diagnosis.—Antenna 1 elongate. Antenna 2 flagellum as long as peduncular articles, without dense setae. Mandible palp, article 3 shorter than article 1. Gnathopod 1 basis of male with anterodistal lobe, round; propodus longer than

carpus. Gnathopod 2 basis of male with anterodistal lobe, subacute reaching to middle of ischium; propodus tapering distally, posterior margin slightly concave; palm extremely acute with one round process near base of dactylus; dactylus overreaching posterior lobe of carpus. Gnathopod 2 basis of female with anterodistal lobe, round; propodus about 2 times as long as carpus. Uropod 3 outer ramus longer than inner ramus. Telson apically rounded. The diagnosis was made based on the description of Myers (1985), and the length of male material was 8 mm.

Habitat.—This species is found on seaweeds and floating kelps.

Remarks.—This species has enlarged pereopods 5-7.

Distribution.—Manila, Philippines (Dana, 1853); Fijian Islands (Myers, 1985); Hawaii (J. L. Barnard, 1970); West Kyushu, Japan (Hirayama, 1983); Korea (Kim and Kim, 1988).

Peramphithoe parmerong Poore and Lowry, 1997

Peramphithoe parmerong Poore and Lowry, 1997: 927-932, figs. 22-25.

Type Locality.—Shark Bay, Port Jackson, NSW, Australia.

Type Material.—Australian Museum: Holotype, female, 12.9 mm, AM P50767; paratype, male, 14.5 mm, AM P50768; paratype, male, 8.5 mm, AM P50769; paratypes, male, 13.7 mm, and female, 14.5 mm, AM P50770; paratypes, 3 females and 3 males, AM P45092.

Diagnosis.—Antenna 1 flagellum elongate. Antenna 2 flagellum without dense setae on ventral margin. Gnathopod 2 propodus of male 1.5 times as long as width; palm extremely acute, with one slight distal bulge, without defining corner. Gnathopods 1-2 bases of female with anterodistal lobe, round; palms straight. Pereiopods 5-7 enlarged, and extremely broadened in male; bases of male with small posterodistal lobe. Telson apically subacute. The diagnosis was made based on the description of Poore and Lowry (1997).

Habitat.—This species lives on *Sargassum linearifolium*, at a depth of 1-2 m.

Distribution.—New South Wales, Australia (Poore and Lowry, 1997).

Peramphithoe plea (J. L. Barnard, 1965)

Ampithoe plea J. L. Barnard, 1965: 2, 6 (key), 15-20, figs. 9-10.

Peramphithoe plea.—Conlan and Bousfield, 1982: 61 (key), 67-68, fig. 15. —Conlan and Chess, 1992: 418 (key).

Type Locality.—Palos Verdes Headland, Los Angeles Coast, CA, USA.

Type Material.—Allan Hancock Foundation: Holotype, male, 8.5 mm, No. 5737.

Diagnosis.—Antenna 1 slightly longer than antenna 2. Antenna 2 peduncular articles 4-5 robust, long, flagellum stout, with plumose setae on ventral margin. Lower lip outer plate, lateral lobe longer than medial lobe. Gnathopod 1 carpus of male with lobe, posterior margin truncated; palm slightly oblique; dactylus scarcely overlapping palm. Gnathopod 2 basis of male anterodistal lobe round, not reaching to is-

chium; ischium with anterior lobe; propodus elongated, subrectangular, posterior margin straight; palm extremely acute, corresponding to posterior margin of propodus, with one protrusion near insertion of dactylus; dactylus straight proximally and apical half curved, reaching to posterodistal angle of propodus. Gnathopods 1-2 bases of female with serrated and strongly setose posterodistal edge. Pereiopods 5-7 bases with posterodistal lobe. Uropod 3 peduncle about 2.5 times as long as rami. The diagnosis was made based on the description of J. L. Barnard (1965).

Habitat.—This species lives among the holdfasts of kelp in the intertidal zone, at a depth of 17 m.

Distribution.—Santa Barbara, CA, USA (J. L. Barnard, 1965); Charlotte Islands (Conlan and Bousfield, 1982).

Peramphithoe spuria (Krapp-Schickel, 1978)

Ampithoe spuria Krapp-Schickel, 1978: 10-14, 14 (key), figs. 7-8.

Ampithoe cf. falsa.—Krapp-Schickel, 1969: 331-333, pls. 6-7.

Type Locality.—Rovinj (Istria), north Adriatic Sea.

Type Material.—Museo Civico di Storia Naturale, Verona and Zoologisch Museum Amsterdam [Naturalis, Leiden]: Holotype and paratypes, ZMA Amph 107.313.

Diagnosis.—Gnathopod 2 palm of male convex, defining corner with 1 robust seta, rounded. Gnathopod 1 coxa of female subacute on anterodistal margin; palm convex. Gnathopod 2 basis subequal in length to coxa; palm convex. Pereiopods 5-7 enlarged; bases without posterodistal lobe. Uropod 3 outer ramus subequal in length to inner ramus. Telson apically rounded. The diagnosis was made based on the description of Krapp-Schickel (1978).

Habitat.—This species lives on *Zostera* sp. and *Sargassum* sp. (Krapp-Schickel, 1982).

Remarks.—This species has enlarged pereopods 5-7. The male individual described in the original description, with 5 mm long body, might be a juvenile form of this species. However, the illustration of the male shows enlarged distal articles of pereopods 5 and 7.

Distribution.—Rovinj, Croatia (Krapp-Schickel, 1978).

Peramphithoe stypotruripes Conlan and Chess, 1992

Peramphithoe stypotruripes Conlan and Chess, 1992: 410-415, figs. 1-3, 418 (key).

Type Locality.—Whitesboro Cove, Mendocino County, CA, USA.

Type Material.—Canadian Museum of Nature: Holotype, female, 19.6 mm, NMC-C-1991-2120; paratypes, 102 juveniles, NMC-C-1991-2123; paratypes, 1 subadult female and 1 juvenile, NMCC1991-2122, paratypes 1 male, 1 adult female, and 156 juveniles, NMCC1991-2124; paratype, 1 male, NMCC1991-2125, paratypes, 1 male and 1 adult female, NMCC1991-2126.

Diagnosis.—Head bulbous dorsally. Antenna 1 short, subequal in length to antenna 2. Gnathopods 1-2 and pereopods 3-4 bases with dense setation on medial and posterior margin. Gnathopod 2 propodus of male subovoid; palm with

1 shallow tubercle at proximal part of dactylus, slightly depressed at distal third part; dactylus reaching to 1/2 length of propodus. Gnathopod 2 propodus of female larger than gnathopod 1 propodus; palm slightly concave. Pereiopod 5 basis with posterodistal lobe. Telson apically subacute. The diagnosis was made based on the description of Conlan and Chess (1992).

Remarks.—This species has a unique bulbous dorsal margin on the head. According to Conlan and Chess (1992), this species appears to have the less inflated bases of pereiopods 3 and 4 compared to other species in the genus.

Habitat.—This species, as a kelp-boring amphipod species, lives inside the stripes of *Laminaria dentigera*.

Distribution.—Alaska to California (Conlan and Chess, 1992).

Peramphithoe tea (J. L. Barnard, 1965)

Ampithoe tea J. L. Barnard, 1965: 3, 6 (key), 30-34, figs. 19-21. —J. L. Barnard, 1969a: 85. —J. L. Barnard, 1969b: 190.

Peramphithoe tea. —Conlan and Bousfield, 1982: 61 (key), 65-66, fig. 14. —Conlan and Chess, 1992: 419 (key). —Kim and Kim, 1988: 129-131, figs. 13-14. —Kim, 2011: 53 (key), 60-62, figs. 44-45. —Kim et al., 2012: 16-18, 19 (key), fig. 11.

Type Locality.—Northeast of Willow Cove, Santa Catalina Island, CA, USA.

Type Material.—Allan Hancock Foundation: Holotype, male, 12.0 mm, No. 4921.

Diagnosis.—Antenna 1 longer than antenna 2. Antenna 2 setose from peduncular article 5 to flagellum. Lower lip outer plate, lateral lobe distinctly longer than medial lobe. Gnathopod 1 carpus of male with lobe, posterior margin truncated. Gnathopod 2 basis of male anterodistal lobe large and subacute, reaching to middle of ischium; propodus elongated, tapering distally, posterior margin straight; palm extremely acute, corresponding to posterior margin of propodus, and with one protrusion on distal quarter portion of posterior margin, and palmar border minutely crenulated; dactylus reaching to posterodistal angle of propodus. Gnathopod 1 carpus of female with lobe. Pereiopods 5-7 bases with posterodistal lobe. Pereiopod 5 basis posterodistal lobe reaching to middle of ischium. The diagnosis was made based on the description of J. L. Barnard (1965).

Habitat.—This species is found in the intertidal zone, at a depth of 45 m.

Distribution.—Prince William Sound, Alaska to California (J. L. Barnard, 1965; Conlan and Bousfield, 1982); Korea, Japan (Kim et al., 2012).

DISCUSSION

In this study, morphological diagnoses, and other information for 19 species of *Peramphithoe* are reviewed along with a description of the new species, *P. guryongensis*. The original descriptions and other literature of the 19 species mainly describe and illustrate the species based on the morphology of gnathopods 1-2 and several appendages such as antennae, mandible, maxilla 1, lower lip, pereiopod 5, uropod 3, telson, etc. For six of the species, *P. annenkovae*, *P. humeralis*,

P. eoa, *P. lindbergi*, *P. mea*, and *P. orientalis*, information about the location of the type specimens is not cited in the original papers, and the original description of *P. eoa* is not available. As for *P. femorata*, the lectotype of the species was designated by Conlan and Bousfield in 1982. Although, the location of the lectotype and paralectotype specimens was mentioned, their registration numbers are not available.

Diagnostic characters of the genus were confirmed for all 20 species, including the new species described here. Morphological differences between the males and females were presented, especially the differences in gnathopod 2, and subtle differences in morphology were observed for antennae and pereiopods 5-7. All sexually dimorphic appendages are much stronger and larger in males than in females. Exceptionally, gnathopods 1 and 2 in *Peramphithoe humeralis* (Stimpson, 1864) are identical in males and females. The palms of this species are transverse and close to chelate form. Pereiopods 5-7 are enlarged in five species, *P. chujaensis*, *P. guryongensis*, *P. falsa*, *P. parmerong*, and *P. spuria*; they are less enlarged and weaker in females than in males.

In three species, *P. aorangi*, *P. eoa*, and *P. namhaensis*, inconsistencies in morphology were found between the original descriptions and later studies. As mentioned in the comments sections, these differences indicate that the collections may represent a separate species, discernible from the original species. To confirm the existence of potentially new species among the three species, the type specimens need to be compared in the future.

The male second gnathopod, one of the important appendages used for species discrimination, exhibited strong sexual dimorphism and variations depending on the age of individuals. The variations dependent on the maturity stage of individuals were shown in the illustrations of *P. orientalis* in J. L. Barnard (1965), who illustrated two types of male individuals, one with 5.0 mm long body, and the other one with body 7.0 mm long. As the individuals develop, the shape of propodus transforms from an ovoid form to a subrectangular form. The dactylus of the 7.0 mm long individual becomes longer and thinner, and the protrusion of the palm becomes clearer than those of the young 5.0 mm long individual. These two individuals displayed a dramatic variation in morphology of gnathopod 2, even though their body length differed by only 2 mm. Given the morphology, species discrimination and matching males and females among immature individuals might lead to misidentification or misconception of certain species. To resolve these taxonomic difficulties, further studies including morphological analyses based on age and life cycle, and molecular methods are needed.

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