

Copepods of Hatschekiidae (Copepoda, Siphonostomatoida) New to Korean Fauna, with Description of a New Species

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Abstract – Eight species of the Hatschekiidae are recorded as parasites of marine fishes from southern coast of Korea. One new species, *Hatschekia jejuensis*, parasitic on *Cheilodactylus zonatus* Cuvier is included. The remaining seven species are new to Korean fauna: *Hatschekia iridescens* Wilson, 1913, *H. japonica* Jones, 1985, *H. monacanthi* Yamaguti, 1939, *H. tenuis* (Heller, 1865) *H. pseudolabri* Yamaguti, 1953, *H. cylindrica* Shiino, 1957, and *Pseudocongericola chefoonsensis* Yü, 1933. *Hatschekia jejuensis* n. sp. has a combination of characteristics in the female where the trunk is 2.35 times as long as the cephalothorax and displays a pair of posterolateral bulges on both sides, the antennules is 5-segmented, the mandible bears six teeth, and the armature formulae of the legs are I-0; III (exopod) and 0-0; II (endopod) for leg 1 and I-0; I (exopod) and 0-0; II (endopod) for leg 2.

Key words – Copepoda, *Hatschekia*, *H. jejuensis* n. sp., fish parasites, Korea

1. Introduction

The copepod family Hatschekiidae Kabata, 1979 consists of eight genera known as gill parasites of marine teleost fishes (Boxshall and Halsey 2004). Of these, *Hatschekia* Poche, 1902 is the largest genus of the family, containing 97 valid species found on the gills of nearly 140 actinopterygian fish species (Uyeno and Nagasawa 2010). This group of copepod parasites has been very rarely reported in Korea. Kim (1998) recorded five species of the Hatschekiidae from Korean waters as follows: *Hatschekia branchiostegi* Yamaguti, 1939; *H. longibrachium* Yamaguti, 1939; *H. ostracii* Yamaguti, 1953; *H. pagrosomi* Yamaguti, 1939; and *Pseudohatschekia*

branchiostegi Yamaguti, 1939. The last species was transferred by Tang et al. (2010) to the family Pseudohatschekiidae which is established based on that species.

Recently the authors could find eight additional species of the Hatschekiidae from fish samples caught on southern coast of Korea. These eight species, including a new species, are reported in this paper.

2. Material and Methods

Marine fishes infected with parasitic copepods were caught from the coasts of Jeju Island and were fixed and preserved in 95% ethanol. Parasitic copepods were carefully removed from the gills of the hosts and preserved in 80% ethanol. Before microscopic observation and dissection, copepod specimens were immersed in lactic acid for at least 30 minutes. Dissection was done using the reversed slide method of Humes and Gooding (1964). The drawings were made with the aid of a drawing tube equipped on an Olympus BH-2 microscope. Type specimens have been deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea.

3. Systematic Accounts

Family **Hatschekiidae** Kabata, 1979

Genus ***Hatschekia*** Poche, 1902

Hatschekia cylindrica Shiino, 1957

(Fig. 1)

Hatschekia cylindrica Shiino, 1957b, p. 105, fig. 1.

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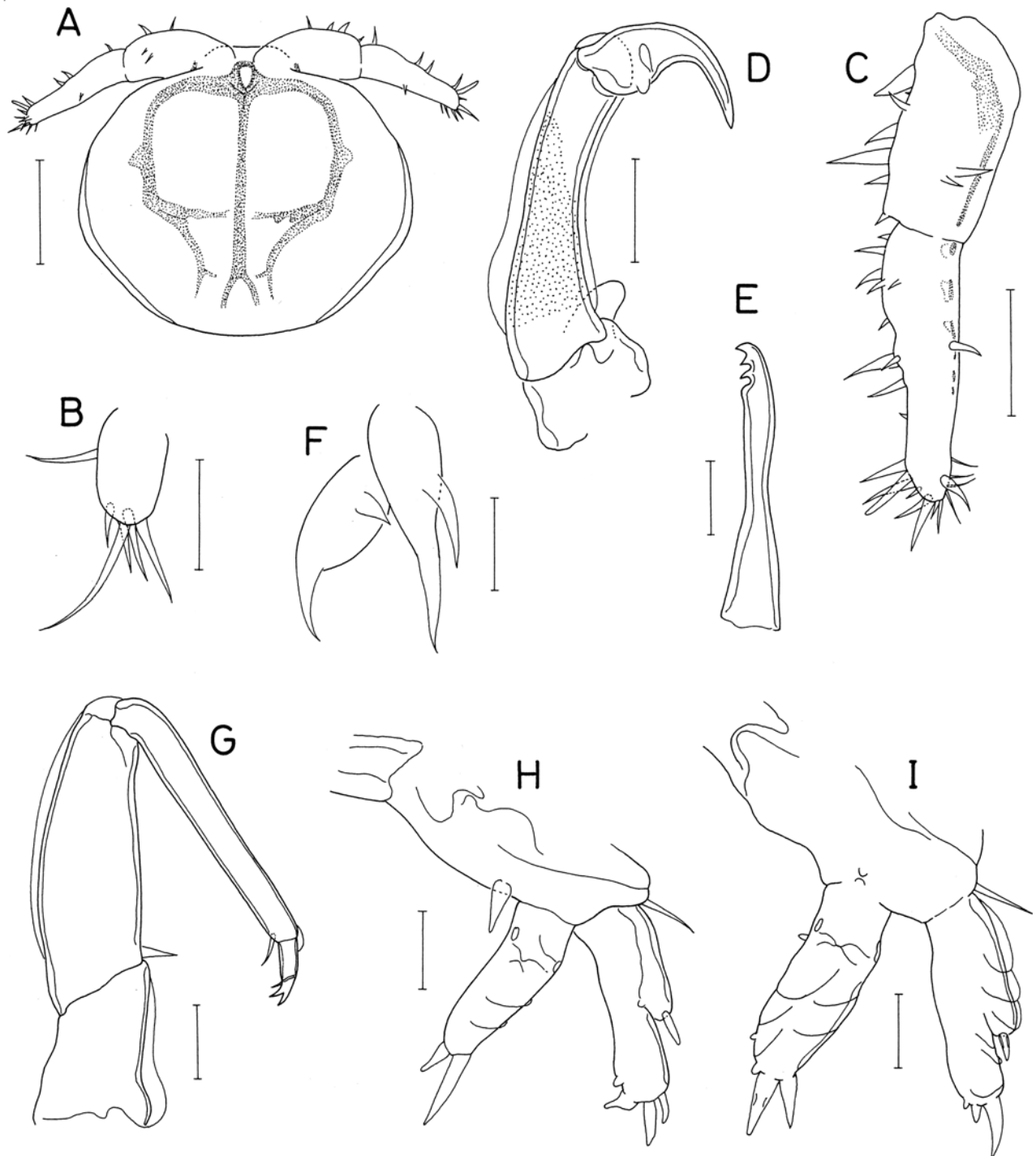


Fig. 1. *Hatschekia cylindrica* Shiino, female. A, cephalothorax, dorsal; B, caudal ramus; C, antennule; D, antenna; E, mandible; F, maxillule; G, maxilla; H, leg 1; I, leg 2. Scales: A, 0.1 mm; B, F-I, 0.02 mm; C, D, 0.05 mm; E, 0.01 mm

Material examined

1 ♀ (with broken trunk) from gills of *Parajulis poecilepterus* (Temminck and Schlegel), off Sagye, Andeok-myeon, Jeju Island, M.-K. Choe, 30 March 2011.

Description

Female. Cephalothorax (Fig. 1A) wider than long, $279 \times 321 \mu\text{m}$, with rounded lateral margins. Trunk not observed. Caudal ramus (Fig. 1B) $21 \times 13 \mu\text{m}$, 1.62 times as long as

wide, with 1 lateral and 5 distal setae.

Antennule (Fig. 1C) 195 μm long and 2-segmented; proximal segment with 9 setae (second proximal one minute); distal segment with 23 setae and 1 aesthetasc. Antenna (Fig. 1D) 3-segmented; proximal segment short and unarmed; middle segment longest, unarmed, with hyaline flange along outer margin and granules on surface; terminal segment forming strong claw, with 1 small knob proximally. Parabasal papilla small (Fig. 1D).

Mandible (Fig. 1E) 39 μm long, with 3 teeth. Maxillule (Fig. 1F) bilobate; each lobe with 2 setae or setiform processes. Maxilla (Fig. 1G) 5-segmented; proximal segment unarmed; second segment with inner seta near proximity and hyaline flange along outer margin; third segment slender, with inner seta at distal end; fourth segment with small distal seta; terminal segment forming bifurcate claw. Maxilliped absent.

Legs 1 (Fig. 1H) and 2 (Fig. 1I) biramous, with single-segmented rami. Some of setae on rami of both legs rudimentary, knob-like. Armature formula of these legs as follows:

Leg 1: protopod 1-1; exopod 5; endopod 2

Leg 2: protopod 1-0; exopod 4; endopod 5 (or 4)

Legs 3 and 4 represented by 2 and 1 setules, respectively.

Male. Unknown.

Remarks

Jones (1985) treated *Hatschekia cylindrica* as a synonym of *H. branchiostegi* Yamaguti, 1939. However, his treatment is not justifiable, because it rested on a misunderstanding derived from insufficient illustration in the original descriptions. The cephalothorax of *H. branchiostegi* is wide and triangular (Shiino, 1959; Kim, 1998), contrasting to the nearly circular form in *H. cylindrica*. The mandible of *H. branchiostegi* bears four teeth (three teeth in *H. cylindrica*). They are apparently different species. The major host of *H. branchiostegi* is *Branchiostegus japonicus* (Houttuyn) in Japan and Korea.

In the original description, Shiino (1957b) described *H. cylindrica* as having a 3-segmented antennules (2-segmented in our specimen), 3 setae on the caudal ramus (6 setae), only a single seta on the inner lobe of maxillule (2 setae), and a single terminal seta on the endopod of leg 2 (2 setae). However, in our observation, no species of *Hatschekia* has 3 setae on the caudal ramus. The 3-setae condition of Shiino's specimens is due to his error. We believe that other discrepancies are also due to errors in the original description. The presence in leg 2 of 2 setae and 1 process-like element terminally on

the exopod and 2 setae terminally on the endopod agrees well with our specimen. Both of the above Japanese and Korean specimens were found on the same species of host, *Parajulis poecilepterus*. *Hatschekia cylindrica* has been found only on fish species. These facts allow our specimen to be identified as *H. cylindrica*.

Hatschekia iridescens Wilson, 1913

(Fig. 2)

Hatschekia iridescens Wilson, 1913, p. 248, pl. 41, figs. 216-221, pl. 44, fig. 247, pl. 45; Jones, 1985, p. 244, figs. 10H, 11A-D; Uyeno & Nagasawa, 2009, p. 2, figs. 2-13.

Hatschekia diodontis Yamaguti, 1953, p. 225, pl. 4, figs. 29-34.

Material examined

7♀ from gills of *Diodon holocanthus* Linnaeus, off Sagye, Andeok-myeon, Jeju Island, M.-K. Choe, 2 May 2009.

Description

Female. Body (Fig. 2A) nearly fusiform, 1.15 mm long. Cephalothorax (Fig. 2B) much wider than long, 374×560 μm , with rounded lateral margins; dorsal surface with sclerotization sculpture. Trunk 1.09×0.52 mm, about 2.91 times as long as cephalothorax. Abdomen very small and wider than long. Caudal ramus (Fig. 2C) 26×18 μm , nearly rectangular, carrying one lateral and 5 distal, simple setae.

Antennule (Fig. 2D) 283 μm long and 4-segmented, but articulations obscure among distal 3 segments; armature formula: 10, 5, 4, 12+aesthetasc. Antenna (Fig. 2E) 3-segmented; proximal segment (coxobasis) becoming broader distally and unarmed; middle segment (endopod) gradually narrowed distally and unarmed; terminal segment forming claw, abruptly narrowed in distal quarter, with 1 small inner seta proximally; parabasal papilla absent.

Mandible (Fig. 2F) 52 μm long, with 6 small teeth of similar sizes. Maxillule (Fig. 2G) bilobate; each lobe consisting with 1 pair of setae. Maxilla (Fig. 2H) 5-segmented; proximal segment small and unarmed; second segment (lacertus) largest, with 1 inner seta proximally; third segment (brachium) slender, with inner seta at distal end; fourth segment with 1 small distal seta; terminal segment forming bifurcate claw. Maxilliped absent.

Legs 1 (Fig. 2I) and 2 (Fig. 2J) biramous, with 1-segmented rami, but exopods divided by deep notch into original

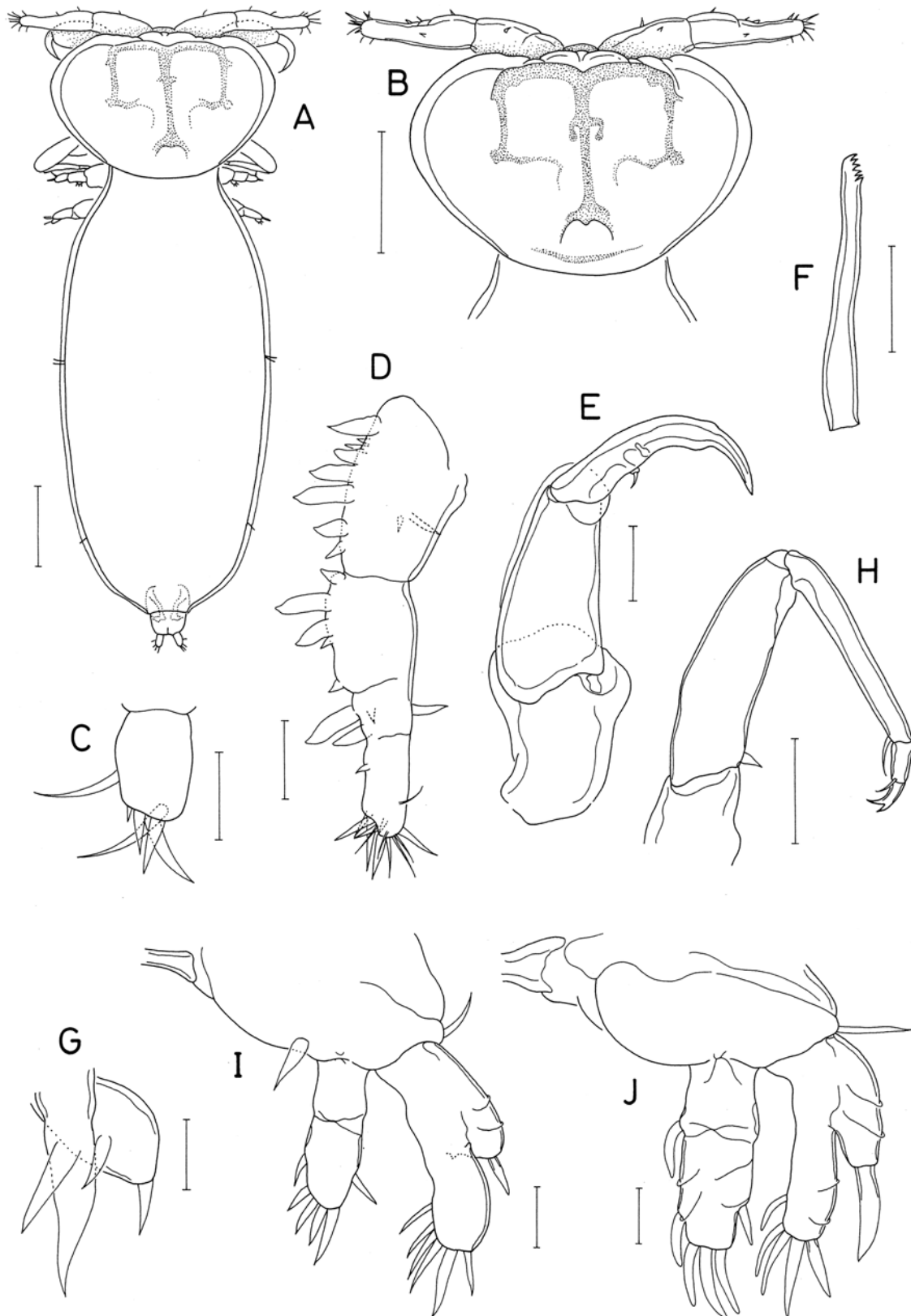


Fig. 2. *Hatschekia iridescens* Wilson, female. A, habitus, dorsal; B, cephalothorax, dorsal; C, caudal ramus; D, antennule; E, antenna; F, mandible; G, maxillule; H, Maxilla; I, leg 1; J, leg 2. Scales: A, B, 0.2 mm; C, F, G, I, J, 0.02 mm; D, E, H, 0.05 mm

proximal and distal segments. Armature of legs 1 and 2 as follows:

Leg 1: protopod 1-1; exopod 7; endopod 0-0; 6

Leg 2: protopod 1-0; exopod 6; endopod 0-1; 5

Leg 3 represented by 2 small lateral setules located on 44% region of trunk. Leg 4 represented by 1 small setule on 84% region of trunk.

Male. Unknown.

Remarks

The type locality of this species is Jamaica in the West Indies. The type host of this copepod, the porcupinefish *Diodon hystrix* Linnaeus, occurs in tropical waters worldwide. Jones (1985) and Uyeno and Nagasawa (2009) redescribed this species, the former based on type specimens and the latter based on specimens from the Far East. Uyeno and Nagasawa (2009) recorded three species of tetraodontiform fishes as hosts of *H. iridescens*, including *D. holocanthus* caught in the West Pacific.

Our specimens from Korea share with specimens from Japan recorded by Uyeno and Nagasawa (2009) the same structure of the same setal formulae of legs, except for 6 teeth of mandible.

Hatschekia japonica Jones, 1985

(Fig. 3)

Hatschekia japonica Jones, 1985, p. 246.

Hatschekia labracis: Yamaguti, 1939, p. 462, pl. 22, figs. 88-90, pl. 23, figs. 91-92.

Material examined

About 100 from gills of 1 *Choerodon azurio* (Jordan and Snyder), at Donggwi, Bukjeju-gun, Jeju Island, M.-K. Choe, 5 July 2009.

Description

Female. Body (Fig. 3A) rather elongate, 1.40 mm long. Cephalothorax (Fig. 3B) wider than long, 230×281 µm, with prominent bulge on each lateral margin; dorsal surface with sclerotization. Trunk about 4.9 times as long as cephalothorax, 1.13×0.31 mm, with posterior part strongly tapering. Abdomen wider than long, incompletely divided from trunk. Caudal ramus (Fig. 3C) 27×15 µm, with 1 middle and 5 distal setae.

Antennule (Fig. 3D) 153 µm long, 4-segmented, but distal

3 segments indistinctly articulated; armature formula: 10, 6, 4, and 13+aesthetasc. Antenna (Fig. 3E) 3-segmented; proximal segment much wider than long and unarmed; middle segment longest, unarmed with membranous flange along outer margin; terminal segment rather short claw, its distal half abruptly slender; fleshy parbasal papilla present (Fig. 3E).

Mandible (Fig. 3F) 37 µm long, with pointed tip bearing no tooth. Maxillule (Fig. 3G) bilobate; each lobe with 2 setae or setiform processes. Maxilla (Fig. 3H) 5-segmented; proximal segment unarmed; second segment largest, with inner seta near proximity; third segment slender, with inner seta at distal end; fourth segment with small distal seta; terminal segment forming bifurcate claw. Maxilliped absent.

Legs 1 (Fig. 3I) and 2 (Fig. 3J) biramous, with 2-segmented rami. Exopodal segments and distal segment of endopod of leg 2 each with 2 membranes. Armature formula of these legs as follows:

Leg 1: protopod 1-1; exopod 1-0; 6; endopod 0-0; 5

Leg 2: protopod 1-0; exopod 1-0; 5; endopod 0-1; 4

Leg 3 represented by 2 small setules located at 42% region of lateral margin of trunk. Leg 4 represented by single seta located at 77% region of lateral margin.

Male. Unknown.

Remarks

The present report is the second description of *H. japonica* Jones, 1985, following Yamaguti's (1939) original description under the name of *H. labracis* (van Beneden, 1871). Jones (1985) renamed *Hatschekia labracis* sensu Yamaguti (1939) as *H. japonica*. Although Yamaguti illustrated this species insufficiently, his illustrations for the body which is rather elongate and distinctly tapered distally and of leg setation generally agree with our observation for Korean specimens. The structure of mandible, which is quite distinct in having a terminal point (or tooth) without any additional teeth, is reported for the first time in the present paper as an important feature of this species. This copepod has been known only from the type host *Choerodon azurio* (Jordan and Snyder) and seems to be not rare on this fish.

Hatschekia monacanthi Yamaguti, 1939

(Fig. 4)

Hatschekia monacanthi Yamaguti, 1939, p. 468, pl. 26; Jones, 1985, p. 250, fig. 13a-g, Uyeno & Nagasawa, 2009, p. 13, figs. 38-64.

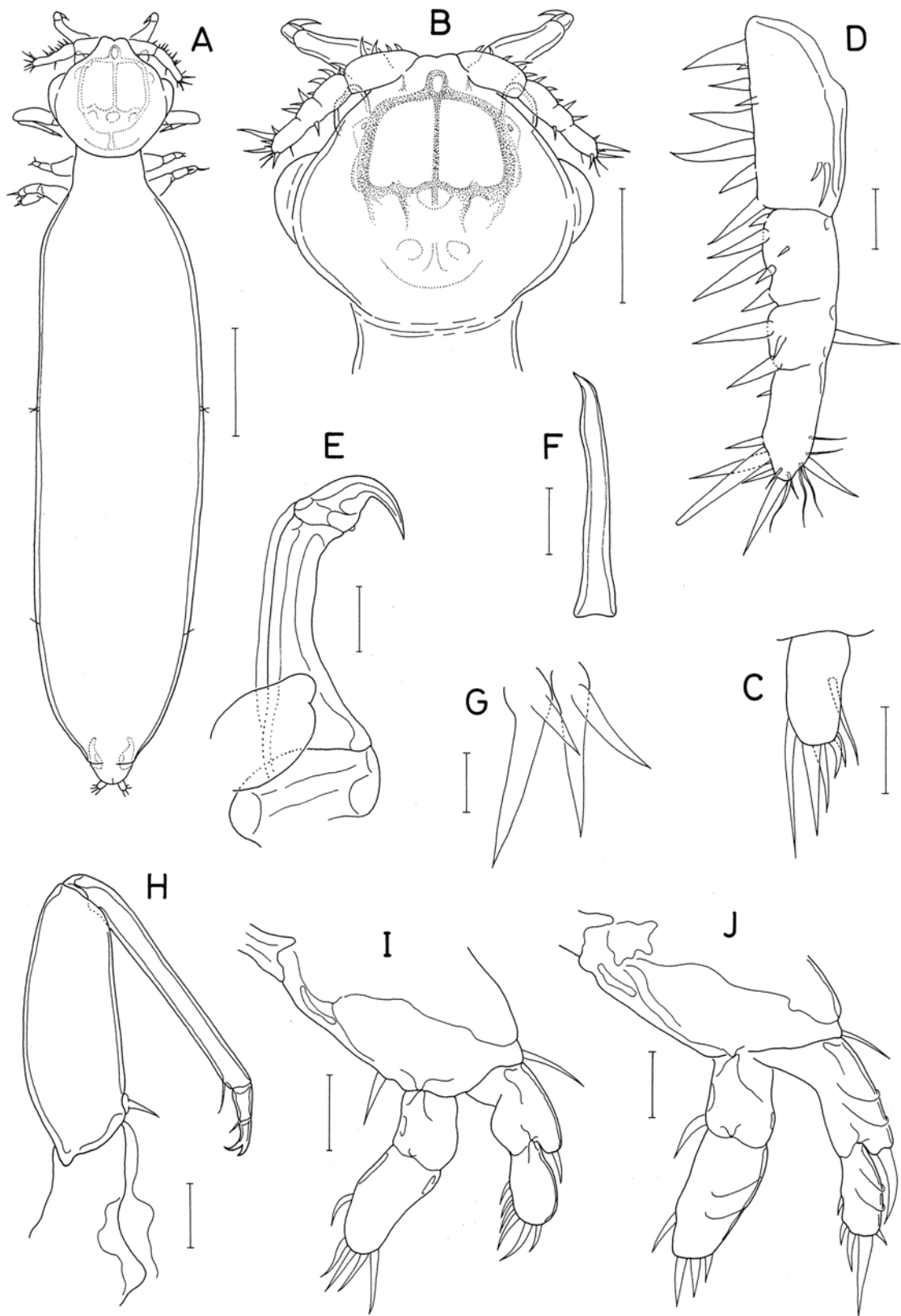


Fig. 3. *Hatschekia japonica* Jones, female. A, habitus, dorsal; B, cephalothorax, dorsal; C, caudal ramus; D, antennule; E, antenna; F, mandible; G, maxillule; H, maxilla; I, leg 1; J, leg 2. Scales: A, 0.2 mm; B, 0.1 mm; C-E, H-J, 0.02 mm; F, G, 0.01 mm

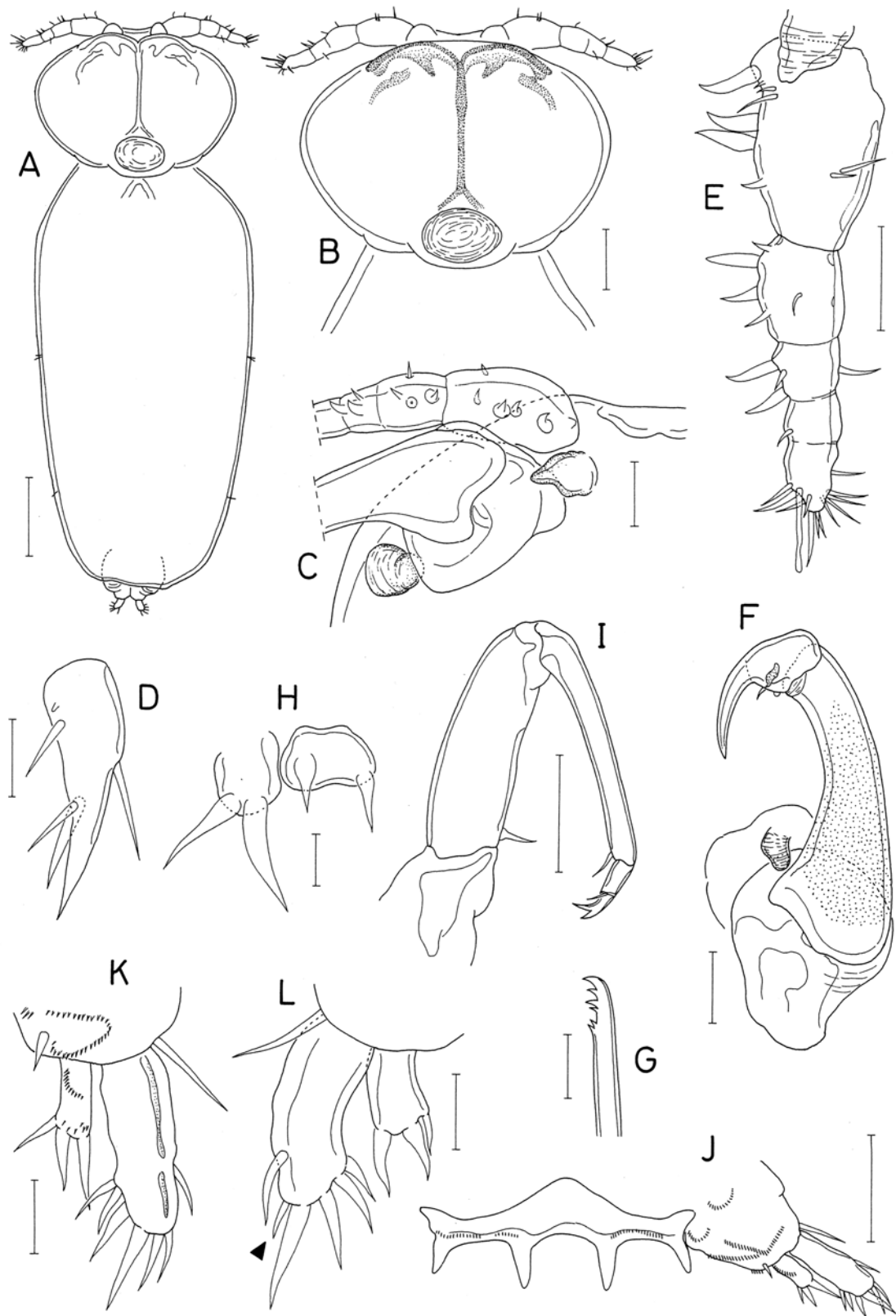


Fig. 4. *Hatschekia monacanthi* Yamaguti, female. A, habitus, dorsal; B, cephalothorax, dorsal; C, right antennal area, ventral; D, caudal ramus; E, antennule; F, antenna; G, distal part of mandible; H, maxillule; I, maxilla; J, leg 1 and intercoxal sclerite; K, rami of leg 1; L, rami of leg 2. Scales: A, 0.2 mm; B, 0.1 mm; C, E, F, I, J, 0.05 mm; D, H, K, L, 0.02 mm; G, 0.01 mm

Material examined

4♀ from gills of 4 *Thamnaconus modestus* Günther, off Sagye, Andeok-myeon, in Jeju Island, M.-K. Choe, 30 November 2010.

Description

Female. Body (Fig. 4A) stout, 1.48 mm long. Cephalothorax (Fig. 4B) distinctly wider than long, 385×519 µm, with large bulge on posterodorsal surface. Trunk about 2.7 times as long as cephalothorax, 1.05×0.56 mm, gradually narrowed posteriorly. Abdomen wider than long, mostly inserted in trunk. Caudal ramus (Fig. 4D) 68 µm long, with sharply pointed distal process and 4 large setae and 1 small, knob-like seta proximally.

Antennule (Fig. 4E) 228 µm long and 5-segmented; armature formula: 9, 5, 4, 1, and 12+aesthetasc; fleshy, tapering papilla present near base of antennule (Fig. 4C, E). Antenna (Fig. 4F) 3-segmented; proximal segment much wider than long and unarmed; middle segment longest, unarmed, with granule-like ornamentation; terminal segment forming claw, with 1 small inner seta, distal half slender; fleshy parbasal papilla present (Fig. 4C, F).

Mandible (Fig. 4G) 69 µm long, with 6 unequal teeth. Maxillule (Fig. 4H) bilobate; each lobe with 2 setae; setae on outer lobe larger than those of inner lobe. Maxilla (Fig. 4I) 5-segmented; proximal segment unarmed; second segment largest, with inner seta near proximity; third segment slender, slightly longer than second segment, with inner seta at distal end; fourth segment with small distal seta; terminal segment forming bifurcate claw. Maxilliped absent.

Legs 1 (Fig. 4J, K) and 2 (Fig. 4L) biramous, with 1-segmented rami. Intercoxal sclerite of legs 1 and 2 well developed, with 4 digitiform posterior processes (Fig. 4J). Armature formula of these legs as follows:

Leg 1: protopod 1-1; exopod 7; endopod 3

Leg 2: protopod 1-0; exopod 5 or 6; endopod 3

Exopod of leg 2 armed with 5 or 6 setae; small outer distal seta (indicated by an arrowhead) present or absent.

Leg 3 represented by 2 small setules located at 46% region of lateral margin of trunk. Leg 4 represented by single seta located at 79% region of lateral margin.

Male. Unknown.

Remarks

The most detailed description of *H. monacanthi* has been provided by Uyeno and Nagasawa (2009) and is based on

specimens from Japanese waters. Their illustration for the mandible, showing only four teeth, differs from our observation of Korean specimens of the same species. Nevertheless, their specimens and Korean ones are not considered to be different species, because the specimens from Japan and Korea reveal, as diagnostic characters of this species, the presence of a papilla near the base of antennule, the unsegmented rami of legs 1 and 2 with identical setations, the caudal ramus which is terminated by a tapering process, and the same host species as the host of *Thamnaconus modestus* Günther.

Hatschekia pseudolabri Yamaguti, 1953

(Fig. 5)

Hatschekia pseudolabri Yamaguti, 1953, p. 227, pl. 5, figs. 40-44; Jones, 1985, p. 261, fig. 16j.

Material examined

2♀ from gills of *Pseudolabrus sieboldi* Mabuchi and Nakabo, off Sagye, Andeok-myeon, Jeju Island, M.-K. Choe, 2 May 2009.

Description

Female. Body (Fig. 5A) elongate, fusiform, 1.93 mm long. Cephalothorax (Fig. 5B) nearly rhomboidal, wider than long, 270×325 µm, with obscure posterior margin. Trunk 1.67×0.39 mm, more than 4 times as long as wide, about 6 times as long as cephalothorax, its anterior third anteriorly tapering and its posterior third posteriorly tapering, with truncate posterior end. Abdomen mostly imbedded in trunk. Caudal ramus (Fig. 5C) 19×11 µm, 1.73 times as long as wide, with 1 lateral and 5 distal, unequal setae.

Antennule (Fig. 5D) 150 µm long and 2-segmented; armature formula: 9 and 22+aesthetasc; 5 of distal setae setule-like. Antenna (Fig. 5E) 3-segmented; proximal segment short and unarmed; middle segment longest, unarmed, with hyaline flange along outer margin; terminal segment forming strong claw, with 2 knob-like elements. Parbasal papilla absent.

Mandible (Fig. 5F) 35 µm long, with 5 teeth. Maxillule (Fig. 5G) bilobate; each lobe with 2 setae. Maxilla (Fig. 5H) 5-segmented; first segment unarmed; second segment largest, with inner seta near proximity; third segment slender, with inner seta at distal end; fourth segment with small distal seta; terminal segment forming bifurcate claw; inner margin of

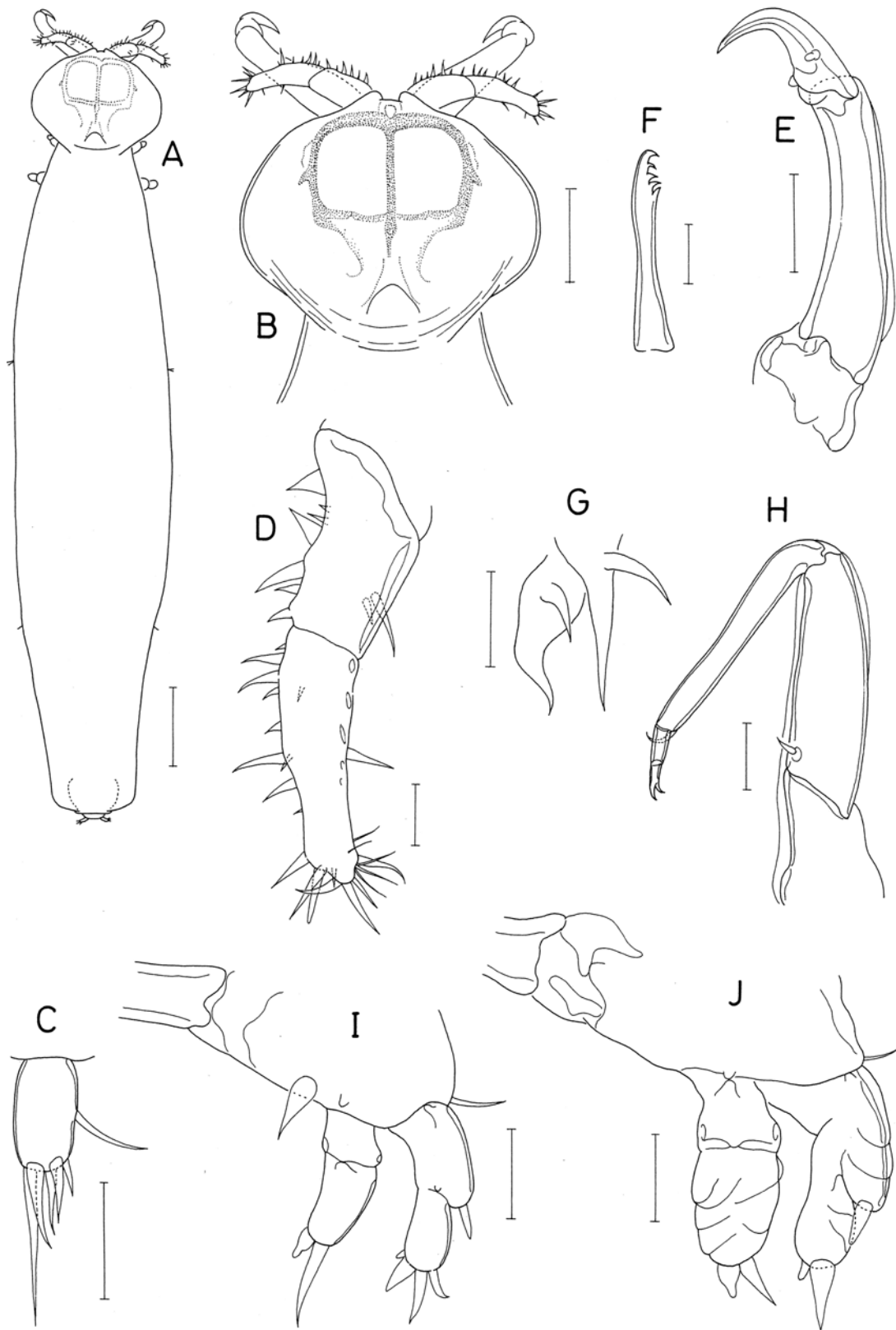


Fig. 5. *Hatschekia pseudolabri* Yamaguti, female. A, habitus, dorsal; B, cephalothorax, dorsal; C, caudal ramus; D, antennule; E, antenna; F, mandible; G, maxillule; H, maxilla; I, leg 1; J, leg 2. Scales: A, 0.2 mm; B, 0.1 mm; C, D, G–J, 0.02 mm; E, 0.05 mm; F, 0.01 mm

first 2 segments and distal half of outer margin of second segment with hyaline flange. Maxilliped absent.

Legs 1 (Fig. 5I) and 2 (Fig. 5J) biramous, with 2-segmented rami. Exopods incompletely segmented. Armature formula of these legs as follows:

Leg 1: protopod 1-1; exopod 1-0; 4; endopod 0-0; 2

Leg 2: protopod 1-0; exopod 1-0; 2; endopod 0-0; 2

Leg 3 represented by 2 setules located at 33% region of trunk. Leg 4 represented by single setule located at 72% region of trunk.

Male. Unknown.

Remarks

Yamaguti (1953) described this species as a parasite of *Pseudolabrus japonicus* (Houttuyn) and *Verreo oxycephalus* (Bleeker) (as *Bodianus oxycephalus*) from Japan. The illustration by Yamaguti (1953) reveals the attenuated posterior part of trunk and the cephalothorax which is longer than wide. He also described that its mandible bears four teeth. The discrepancies in the characteristics above between Korean and Japanese specimens are thought to be either intraspecific variations or errors. The setation on the rami of legs 1 and 2 in both Japanese and Korean specimens is identical and considered one of the more important traits of this species. Jone (1985) separated this species from *H. gracilis*, *H. elongata*, *H. leptoscari*, and *H. tenuis* by having 3 setae and 1 minute seta on the distal exopodal segment of leg 1. The fish *Pseudolabrus sieboldi* Mabuchi and Nakabo from which our specimens of *H. pseudolabri* were derived is a new host record.

Hatschekia tenuis (Heller, 1865)

(Fig. 6)

Clavella tenuis Heller, 1865 (*sensu* Jones, 1985)

Hatschekia monocentris Yamaguti & Yamasu, 1959, p. 129, pl. 13, figs. 266-271.

Material examined

14♀ from gills of *Monocentris japonica* Houttuyn, off Hupo, Uljin-gun, Gyeongsangbuk-do, I.-H. Kim, 14 August 2010.

Description

Female. Body (Fig. 6A) extremely elongate, cylindrical, 5.15 mm long. Cephalothorax (Fig. 6B) nearly circular,

slightly wider than long, 277×323 µm, with hyaline flanges along lateral margins. Trunk more than 15 times as long as cephalothorax, more than 10 times as long as its maximum width (330 µm), gradually broadened posteriorly, but slightly tapering near distal end. Abdomen slightly longer than wide, mostly inserted in trunk. Caudal ramus (Fig. 6C) 20×18 µm, with 1 conical terminal process and 6 setae.

Antennule (Fig. 6D) inserted on fleshy anterior expansion of cephalothorax (Fig. 6B, D), 240 µm long and 5-segmented, but segmentation obscure between 2 distal segments; armature formula: 10, 6, 4, 1, and 13+aesthetasc. Antenna (Fig. 6E) 3-segmented; proximal segment unarmed; middle segment longest, unarmed, and covered with fine granules; terminal segment forming claw, rather large and strongly curved, with 1 small inner seta proximally; parabasal papilla small and rounded (Fig. 6E).

Mandible (Fig. 6F) 37 µm long, with 3 (occasionally 2) teeth distally. Maxillule (Fig. 6G) bilobate; each lobe with 2 setae; setae on outer lobe larger than those of inner lobe. Maxilla (Fig. 6H) 5-segmented; first segment unarmed; second segment largest, with inner seta mounted on papilliform process near proximity; third segment slender, with inner seta at distal end; fourth segment with small distal seta; terminal segment forming bifurcate claw. Maxilliped absent.

Legs 1 (Fig. 6I) and 2 (Fig. 6J) biramous, with 2-segmented rami. Both segments of exopod and distal segment of endopod of these legs with membraneous flanges. Inner seta on basis of leg 1 spiniform. Armature formula of legs 1 and 2 as follows:

Leg 1: protopod 1-1; exopod 1-0; 6; endopod 0-0; 6

Leg 2: protopod 1-0; exopod 1-0; 5; endopod 0-1; 5

Leg 3 represented by 2 setules and 1 rod-shaped element located at 14% region of trunk. Leg 4 represented by single setule located at 64% region of trunk.

Male. Unknown.

Remarks

The most characteristic feature of *Hatschekia tenuis* seems to be the elongated body: the trunk is more than 15 times as long as the cephalothorax. When Yamaguti and Yamasu (1959) described *H. monocentris*, which was later synonymized with *H. tenuis* by Jones (1985), they mentioned that this species was similar to *H. pagrosomi* Yamaguti, 1939 which also has an elongated body. *H. pagrosomi* exhibits, as major differences from *H. tenuis*, that the mandible has no teeth, the caudal ramus bears no distal

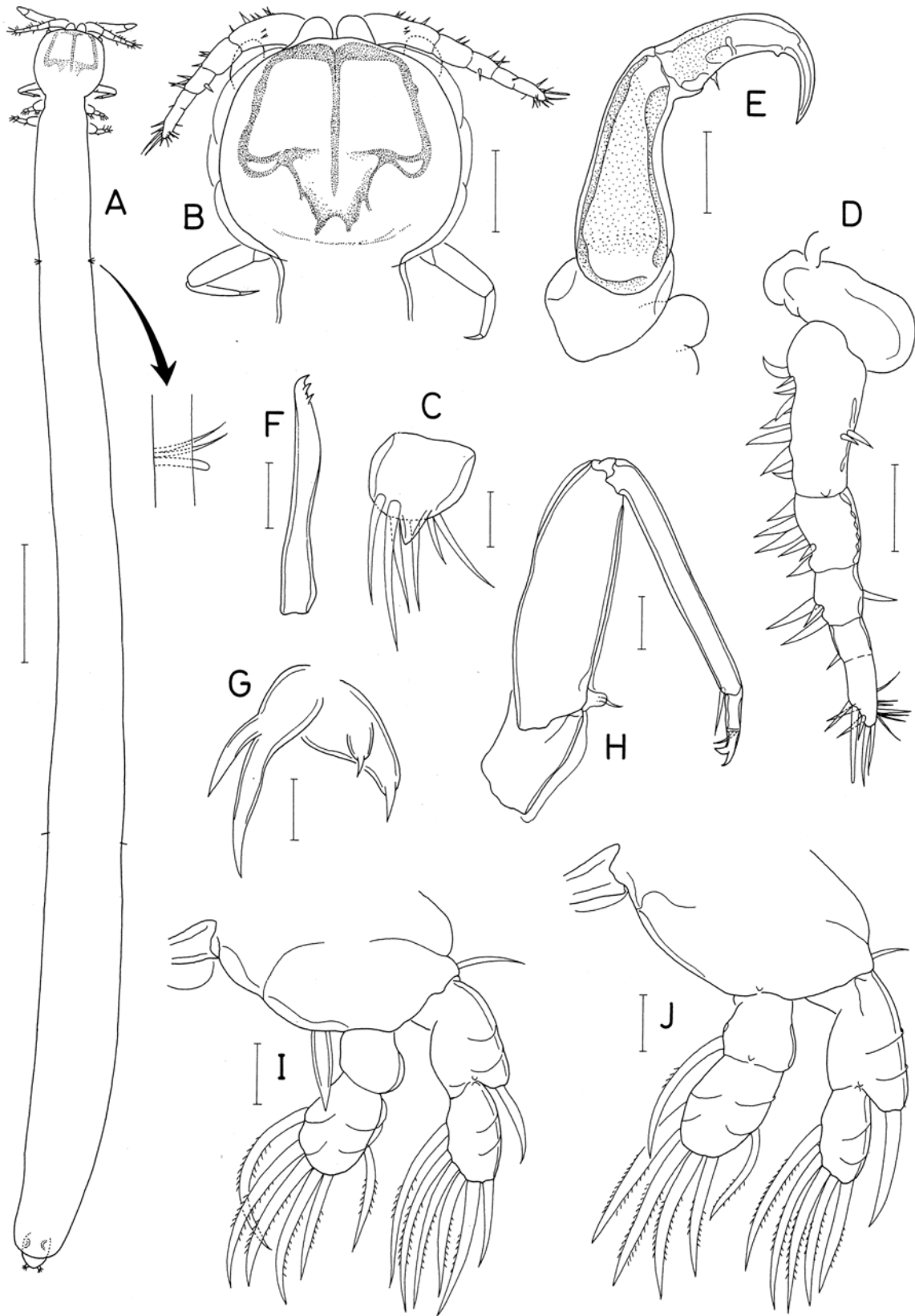


Fig. 6. *Hatschekia tenuis* (Heller), female. A, habitus, dorsal; B, cephalothorax, dorsal; C, caudal ramus; D, antennule; E, antenna; F, mandible; G, maxillule; H, maxilla; I, leg 1; J, leg 2. Scales: A, 0.5 mm; B, 0.1 mm; C, F, 0.01 mm; D, E, 0.05 mm; G-J, 0.02 mm

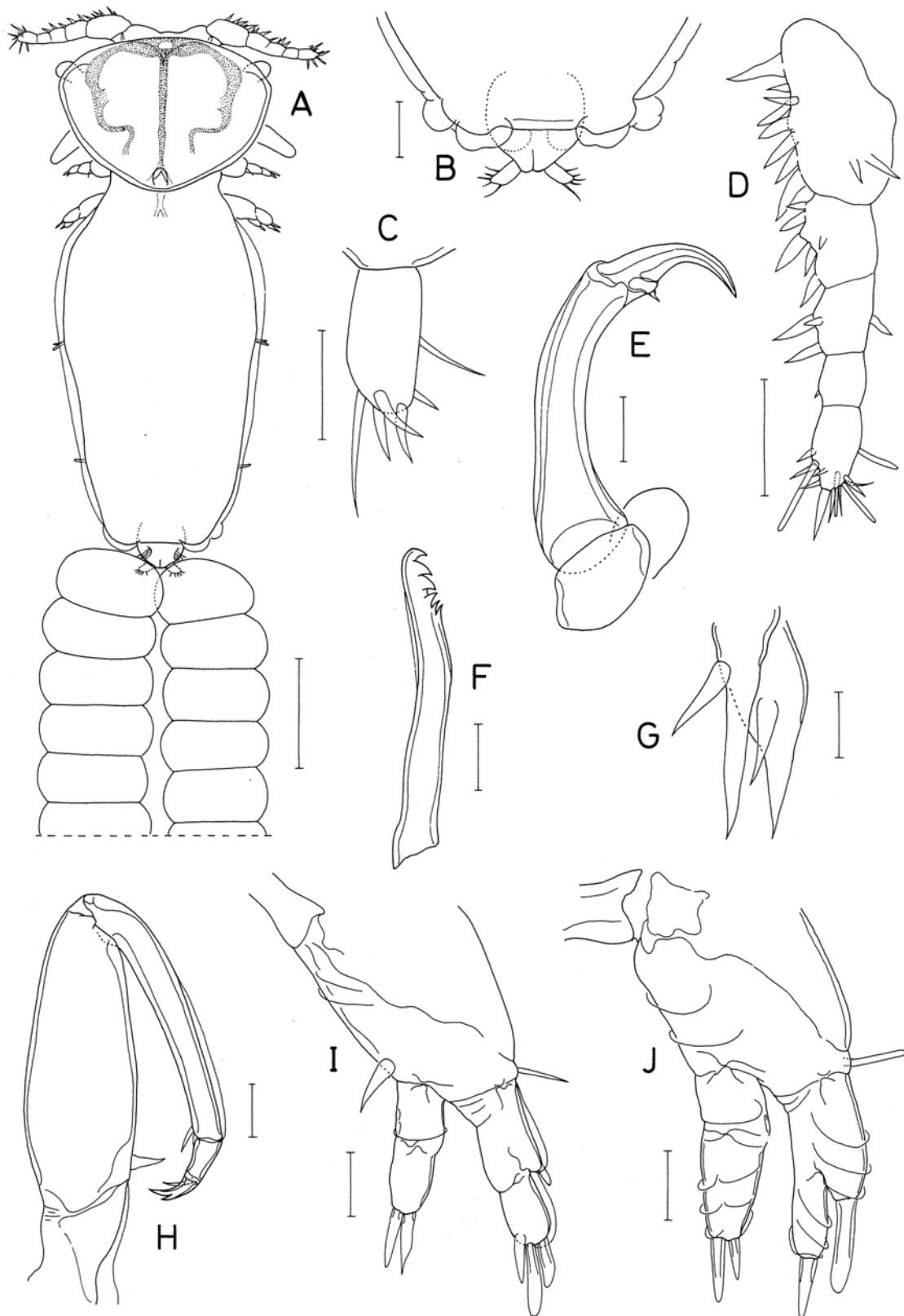


Fig. 7. *Hatschekia jejuensis* n. sp., female. A, habitus, dorsal; B, posterior part of trunk, dorsal; C, caudal ramus; D, antennule; E, antenna; F, mandible; G, maxillule; H, maxilla; I, leg 1; J, leg 2. Scales: A, 0.2 mm; B, D, E, 0.05 mm; C, H-J, 0.02 mm; F, G, 0.01 mm

process, the rami of legs 1 and 2 have fewer setae, and the cephalothorax is trapezoidal (see Kim, 1998). Body length of *H. pagrosomi* is much shorter (2.31 mm in Kim, 1998), compared to that of *H. tenuis* (4.0 mm in Yamaguti and Yamasu's specimen, and 5.25 mm in Korean specimen).

***Hatschekia jejuensis* n. sp.**

(Fig. 7)

Material examined

15♀ from gills of 2 *Cheilodactylus zonatus* Cuvier, at Donggwi, Bukjeju-gun, Jeju Island, M.-K. Choe, 5 July 2009. Holotype (♀, NIBRIV0000209145) and paratypes (5♀, NIBRIV0000216922) have been deposited in the National Institute of Biological Resources, Incheon. Other specimens are retained in the collection of the second author.

Description

Female. Body (Fig. 7A) rather stout, 971 µm long. Cephalothorax much wider than long, 275×379 µm, with strongly tapering posterior three-fourths. Trunk 646×379 µm, about 2.4 times as long as cephalothorax, widest at anterior third and gradually narrowed posteriorly from this area, with pair of posterolateral bulges on each side (Fig. 7B). Caudal ramus (Fig. 7C) 28×14 µm, twice as long as wide, with 1 lateral and 5 distal setae. Egg Sac usually longer than body and uniserial.

Antennule (Fig. 7D) 205 µm long and 5-segmented; armature formula: 10, 6, 4, 1, and 9+4 aesthetascs. Antenna (Fig. 7E) 3-segmented; proximal segment short and unarmed; middle segment longest, unarmed, with hyaline flange along outer margin; terminal segment forming strong claw, with 1 small inner seta proximally. Parabasal papilla rather small (Fig. 7A, E).

Mandible (Fig. 7F) 47 µm long, with 6 teeth, consisting of 4 larger distal and 2 smaller proximal ones. Maxillule (Fig. 7G) bilobate; each lobe with 2 setae. Maxilla (Fig. 7H) 5-segmented; proximal segment unarmed; second segment largest, with inner seta near proximity; third segment slender, with inner seta at distal end; fourth segment with small distal seta; terminal segment forming bifurcate claw. Maxilliped absent.

Legs 1 (Fig. 7I) and 2 (Fig. 7J) biramous, with 2-segmented rami. Exopod of leg 2 indistinctly segmented. Setae on rami usually blunt. Outer seta on first exopodal segment of leg 2 large and rod-shaped. Armature formula of these legs as

follows:

Leg 1: protopod 1-1; exopod 1-0; 3; endopod 0-0; 2

Leg 2: protopod 1-0; exopod 1-0; 1; endopod 0-0; 2

Leg 3 represented by 2 rod-shaped setules located at 48% region of trunk. Leg 4 represented by single, rod-shaped setule located at 81% region of trunk.

Male. Unknown.

Etymology

The specific name *jejuensis* is derived from Jeju Island where this type is located.

Remarks

Twenty species of *Hatschekia* have posterolateral bulges (processes or knobs) on the trunk. Of these, only five species have a similar proportional length of cephalothorax and trunk, where the trunk is 2-3.5 times as long as the cephalothorax, as in *H. jejuensis* n. sp. They are *H. bicaudata* Kabata, 1991, *H. monacanthi* Yamaguti, 1939; *H. napoleoni* Jones and Cabral, 1990, *H. parva* Pearse, 1951; and *H. quadrabdominalis* Yü, 1933. However, none of these five species shares an armature formula of legs 1 and 2 same with *H. jejuensis*. Only *H. quadrabdominalis* approaches the new species in having the setation of the legs similar to that of the new species, although it carries three setae on the exopod of leg 2 (two setae in *H. jejuensis*). *H. quadrabdominalis* has a pair of "horn-like processes" on the intercoxal sclerite of legs 1 and 2 (Yamaguti and Yamasu, 1959; Jones, 1985), 3-segmented antennules (Jones, 1985), a curved trunk (Yü, 1933; Yamaguti and Yamasu, 1959; Jones, 1985), and no teeth in the mandible (Yamaguti and Yamasu, 1959). These features of *H. quadrabdominalis* are not observable in *H. jejuensis*.

Genus *Pseudocongericola* Yü, 1933

Pseudocongericola chefoonensis Yü, 1933

(Fig. 8)

Pseudocongericola chefoonensis Yü, 1933, p. 130, pl. 7; Yamaguti, 1939: p. 473, pl. 28, fig. 138; Shiino, 1957a, p. 407, fig. 7; Redkar, Rangnekar & Murti, 1951, p. 58, figs. 1-8.

Material examined

4♀ from gills of 2 *Muraenesox cinereus* (Forsskal), at Tongyeong on the southern coast of Korea, I.-H. Kim, 14 August 2009.

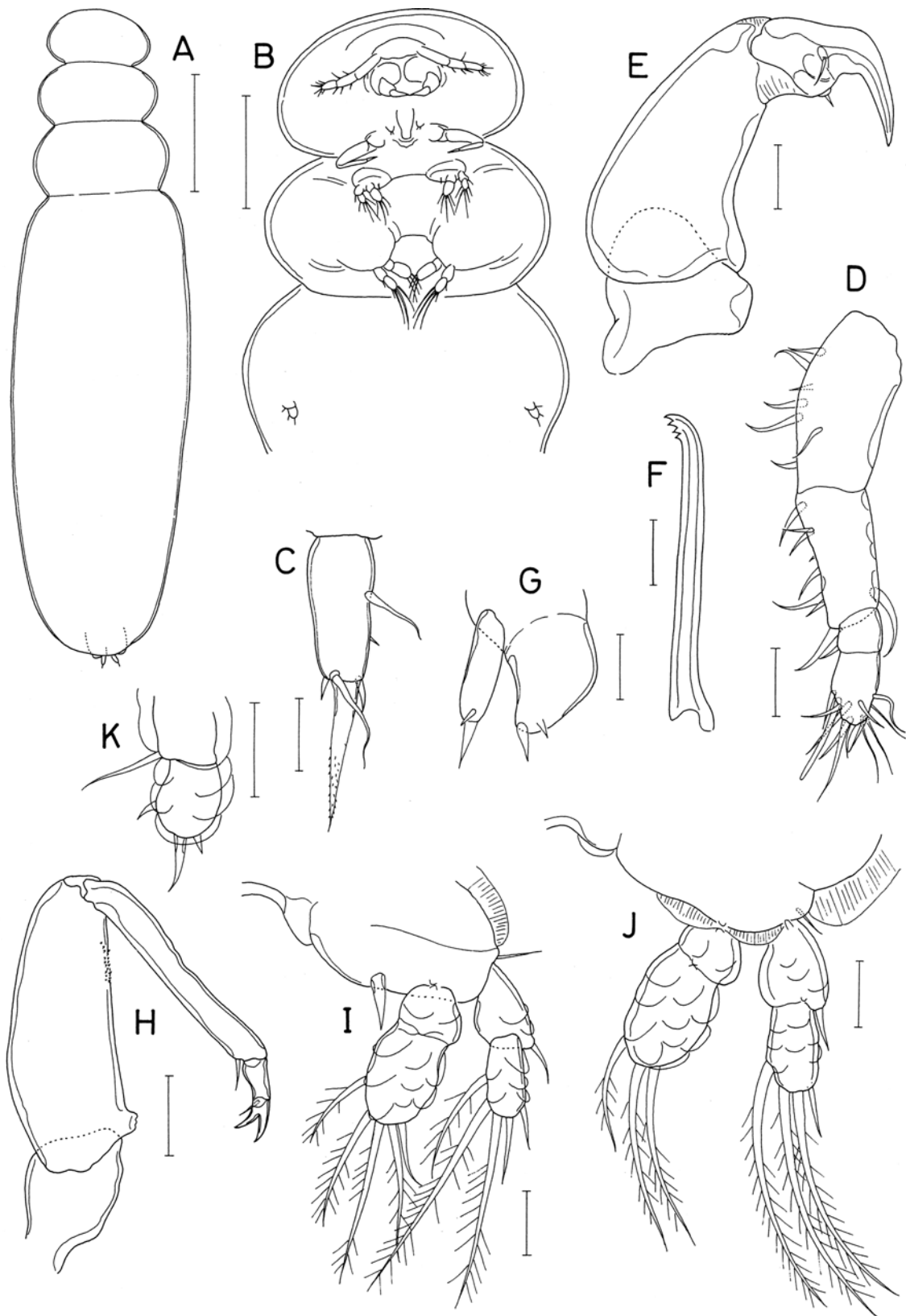


Fig. 8. *Pseudocongericola chefoonensis* Yü, female. A, habitus, dorsal; B, anterior part of body, ventral; C, caudal ramus; D, antennule; E, antenna; F, mandible; G, maxillule; H, maxilla; I, leg 1; J, leg 2. Scales: A, 0.5 mm; B, 0.2 mm; C-E, H-K, 0.02 mm; F, G, 0.01 mm

Description

Female. Body (Fig. 8A) cylindrical, 2.80 mm long, consisting of 4 parts: cephalosome (228×436 µm), first metasomite (248×505 µm) incorporating first and second pedigerous somites (Fig. 8B), second metasomite (307×574 µm) corresponding to third pedigerous somite, and large posterior trunk (1,970×762 µm). Abdomen imbedded in trunk. Caudal ramus (Fig. 8C) 40×18 µm, with 2 lateral (including minute distal one) and 4 distal setae (one of them large and spinulated). Egg sac large, multiseriate, 3178×347 µm, much longer than body.

Antennule (Fig. 8D) 121 µm long and 4-segmented; armature formula: 7, 9 (1 being minute), 1, and 12+aesthetasc. Antenna (Fig. 8E) 3-segmented; first segment short and unarmed; second segment large but unarmed; third segment forming strong claw, with 2 small setae in proximal region.

Mandible (Fig. 8F) 49 µm long, with 4 teeth distally. Maxillule (Fig. 8G) bilobed with broad outer lobe and narrower inner lobe; each lobe with 2 small setae. Maxilla (Fig. 8H) 5-segmented; first segment unarmed; large second segment also unarmed but bearing truncated inner protrusion proximally and patch of minute spinules subdistally on inner margin; elongate third segment with 1 distal seta; fourth segment with 1 small distal seta; terminal segment forming bifurcate claw. Maxilliped absent.

Legs 1 (Fig. 8I) and 2 (Fig. 8J) biramous, with 2-segmented rami; segments of rami of both legs with membranes; distal setae on rami rather developed and pinnate. Armature formula of legs 1 and 2 as follows:

Leg 1: protopod 1-1; exopod 1-0; 5; endopod 0-0; 5

Leg 2: protopod 1-0; exopod 1-0; 4; endopod 0-0; 3

Leg 3 (Fig. 8K) uniramous, 2-segmented, with 1 seta on proximal segment (protopod) and 3 small setae on distal segment (1-segmented exopod). Leg 4 not seen.

Male. Unknown.

Remarks

The monotypic genus *Pseudocongericola* may be characterized by the possession of the 4-segmented body, multiseriate eggs, 2-segmented rami of legs 1 and 2 and 2-segmented uniramous leg 3, without leg 4. Its sole species, *Pseudocongericola chefoonensis*, has been rarely found and only on a conger eel *Muraenesox cinereus* (Forsskal) which is distributed in the Indo-West Pacific. The structure of leg 3 has never been adequately described. In the original description by Yü (1933) leg 3 was not mentioned and Shiino (1957a) described

as it is unsegmented. In our observation, it is 2-segmented, with a single seta on the proximal segment and 3 on the distal segment. The antennule of our specimens of this species is apparently 4-segmented, compared to the previous records that described as it is 3-segmented. The mandible and maxillule are illustrated for the first time in the present record.

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References

- Boxshall GA, Halsey SH (2004) An Introduction to Copepod Diversity, Part II. The Ray Society, London, pp 422-966
- Humes AG, Gooding RU (1964) A method for studying the external anatomy of copepods. *Crustaceana* 6:238-240
- Jones JB (1985) A revision of *Hatschekia* Poche, 1902 (Copepoda: Hatschekiidae), parasitic on marine fishes. *NZ J Zool* 12:213-271
- Kim I-H (1998) Illustrated Encyclopedia of Fauna & Flora of Korea. Vol. 38. Cirripedia, Symbiotic Copepoda, Pycnogonida. Ministry of Education, Korea, 1038 p
- Redkar MV, Rangnekar FG, Murti NN (1951) Notes on a *Trebius* male and a few females of *Pseudocongericola chefoonensis* Yü. *J Univ Bombay* B20(3):51-61
- Shiino SM (1957a) Copepods parasitic on Japanese fishes. 15. Eudactylinidae and Dichelesthiidae. *Rep Fac Fish Pref Univ Mie* 2:392-410
- Shiino SM (1957b) On a new species of *Hatschekia* (Crustacea, Copepoda) from *Halichoeres poecilopterus* (T. & S.). *J Fac Sci Hokkaido Univ Ser 6 Zool* 13:105-108
- Shiino SM (1959) Sammlung der parasitischen Copepoden in der Präfekturuniversität von Mie. *Rep Fac Fish Pref Univ Mie* 3:334-374
- Tang D, Izawa K, Uyeno D, Nagasawa K (2010) Pseudohatschekiidae, a new family for *Pseudohatschekia branchiostegi* Yamaguti, 1939 (Crustacea: Copepoda: Siphonostomatoida) from *Branchiostegus* spp. (Teleostei: Perciformes: Malacanthidae) in Japanese waters, with descriptions of the early developmental stages of *P. branchiostegi*. *Syst Parasitol* 77:215-231
- Uyeno D, Nagasawa K (2009) Redescription of four species of *Hatschekia* (Copepoda: Siphonostomatoida: Hatschekiidae)

- parasitic on tetraodontiform fishes from Japan. *Zootaxa* **2110**: 1-21
- Uyeno D, Nagasawa K (2010) The copepod genus *Hatschekia* Poche, 1902 (Siphonostomatoida: Hatschekiidae) from triggerfishes (Pisces: Tetraodontiformes: Balistidae) from off the Ryukyu Islands, Japan, with descriptions of eleven new species. *Zootaxa* **2478**:1-40
- Wilson CB (1913) Crustacean parasites of West Indian fishes and land crabs, with descriptions of new genera and species. *Proc US Nat Mus* **44**:189-277
- Yamaguti S (1939) Parasitic copepods from fishes of Japan. Part 5. Caligoida, III. Vol Jubil Prof Sadao Yoshida **2**:443-487
- Yamaguti S (1953) Parasitic copepods from fishes of Japan. Part 7. Cyclopoida III and Caligoida IV. *Publ Seto Mar Biol Lab* **3**:221-231
- Yamaguti S, Yamasu T (1959) Parasitic copepods from fishes of Japan with descriptions of 26 new species and remarks on two known species. *J Biol Okayama Univ* **5**:89-165
- Yü SC (1933) Chinese parasitic coepods collected by H. W. Wu, with descriptions of new genera and species. *Bull Fan Mem Inst Biol* **4**:117-139