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Haplostoma kimi, a new species and a redescription of *Haplostomella halocynthiae* (Fukui) from Korea (Copepoda: Cyclopoida: Ascidicolidae)

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Abstract.—A new species of the genus *Haplostoma* associated with the ascidians *Styela clava clava* Herdman and *Amaroucium pliciferum* Redikorzev is described. The new species can be differentiated from its 13 congeners in having 4 simple spines on second segment of antenna, 3 spines and 1 seta on the exopod of legs 3 and 4, and 6 distinct projections on the posterior margin of labrum. In addition, *Haplostomella halocynthiae* (Fukui), a new record in Korean fauna is redescribed, based on the specimens collected from the ascidians, *Styela clava clava* and *Halocynthia roretzi* (von Drasche).

The subfamily Haplostomatinae, one of the eight subfamilies in the family Ascidicolidae (Illg & Dudley 1980), consists of four genera (*Haplostoma, Haplostemella, Haplostomides,* and *Haplosaccus*). Most species are known to inhabit the common test of compound ascidians, but some species have been described from the branchial sac and/or intestine of solitary ascidians (Ooishi & Illg 1977).

During the course of a survey of the Korean ascidicolid copepods, two species of Haplostomatinae from Korean waters were found, one is a new species and the other a species known only from Japan. This paper describes both species.

The specimens were cleared in lactic acid for approximately one day before taking measurements and dissecting. Drawings were made with the aid of a camera lucida.

Description

Family Ascidicolidae Thorell, 1859

Subfamily Haplostomatinae Chatton and Harant, 1924

Genus *Haplostoma* (Canu, 1886)

Haplostoma kimi, new species

Figs. 1, 2

Type material.—20 ♀ ♀ found inside intestine of solitary ascidian, *Styela clava clava* at Gangneung (approximately 37°45′N, 128°50′E) in Sea of Japan, Aug 1992. Holotype ♀ (EWNHM60258) and paratypes 14 ♀ ♀ (EWNHM60259) deposited in Natural History Museum, Ewha Womens University, Seoul, Korea. Remaining specimens (dissected) in the collection of the author.

Other material examined.—20 ♀ ♀ on common test of compound ascidian, *Amaroucium pliciferum,* collected at Hupo in Sea of Japan, on 3 Aug 1987; 5 females collected from *A. pliciferum* at Seongsanpo in Jeju Island, on 27 Jun 1987.

Female: Body (Fig. 1A–C) columnar, vermiform and grub-like. Full grown adult 2.04 mm long (holotype, from tip of cephalosome to end of caudal rami excluding setae), with slightly tapering cephalosome (Fig. 1A, B) but in dorsal view becoming gradually broadened posteriorly (Fig. 1A). Young adult with evenly rounded cephalosome and evenly wide metasome (Fig. 1C, E). Cephalosome with distinct rostrum, bearing antennule, antenna, mandible, and

maxilliped. Dorsal cephalic plaque represented by 2 large sclerotized areas (Fig. 1D). Pedigerous somites demarcated from each other by moderately prominent constrictions. Each pedigerous somite bearing 1 pair of minute protrusions on dorsolateral surface. Each protrusion prominent in adults, with minute seta. Anal segment (Fig. 1F) about $1/10$ length of whole body, directed posteroventraly (Fig. 1B, G), consisting of rounded, broad anterior part and narrower, laterally parallel posterior part. Proximal section of anal segment with genital apparatus consisting a pair of oviducal apertures on dorsolateral sides. Oviducal aperture at each side with 3 spines (Fig. 1F). Caudal rami divergent. Each ramus as long as wide, strongly tapering, triangular, inconspicuously demarcated from anal segment, and armed with 1 lateral, 1 disterodorsal, and 1 terminal spine. Terminal spine extremely thick, triangular and claw-like.

Rostrum with a row of minute spinules on both sides (Fig. 1E). Antennule (Fig. 1H) indistinctly segmented and tapering terminally. Proximal part with 3 broad setae and 2 or 3 thin setules. Distal part incompletely divided on posterior margin into 3 segments, with 2 broad proximal setae mounted on a large elevation, 5 broad (1 being distinctly larger) and 1 slender setae in medial part, and 8 slender setae terminally. Antenna (Fig. 1I) 2-segmented. First segment broad and slightly longer than distal segment. Second segment with sclerotized margins, and bearing 3 lateral and 1 terminal spines. All spines thick and claw-like.

Labrum with 6 rounded, distinct projections on posterior margin (Fig. 2A). Mandible a lobe bearing 2 terminal setae (Fig. 2A). Maxillule and maxilla absent. Maxilliped (Fig. 2B) 5-segmented. First segment nearly as long as wide, much wider than distal segments but unarmed. Second segment as long as wide, with 1 distal and 1 subdistal setae on inner margin; location of subdistal seta varied, occasionally located in middle portion of inner margin. Third and fourth segments indistinctly segmented (sometimes fused), short and unarmed. Fifth segment a small claw, with 1 subterminal, claw-like process on inner side.

Legs 1–4 alike in general shape and becoming gradually larger from anterior to posterior. Protopod non-segmented, with thick sclerotization along posterior margin. Endopod fused with protopod and represented by large, conical protrusion. Exopods unsegmented. Exopod of leg 1 (Fig. 2C) with a trace of segmentation, armed with 1 proximal seta, 4 claw-like spines, and 1 small dentiform process. Exopod of leg 2 similar to that of leg 1, but 1 spine less (Fig. 2D). Leg 3 (Fig. 2E) and 4 (Fig. 2F) alike, protruded in the middle portion of outer margin near insertion of seta, and armed with 1 proximal seta and 3 spines. Bases of these spines with rows of minute spinules.

Leg 5 (Fig. 2G) a small tapering lobe located on dorsolateral side of last metasomal somite, bearing 1 basal and 2 terminal setae.

Male: Unknown.

Etymology.—The specific name, *kimi,* is given after Dr. Il-Hoi Kim who provided specimens of the new species.

Remarks.—There are 13 species of *Haplostoma,* with five of them bearing processes on the posterior margin of labrum. The new species has 6 processes, similar to the following three species: *H. banyulensis* (Brément, 1909), *H. eruca* (Norman, 1869), and *H. minutum* Ooishi & Illg, 1977. These three species are easily differentiated from *H. kimi,* by the armature on the exopod of legs 3 and 4, armed with either 2 (in *H. eruca* and *H. minutum*) or 4 spines (in *H. banyulensis*), instead of 3 spines and 1 seta as in *H. kimi.*

According to Ooishi (1998), *Haplostoma mizoulei* Monniot, 1962 is synonymous with *H. brevicauda* (Canu, 1886). *H. mizoulei* Monniot, 1962 is the only species that carries the same number of spines on the exopod of legs 3 and 4 as the new species (Monniot, 1962). However, *H. mizoulei*

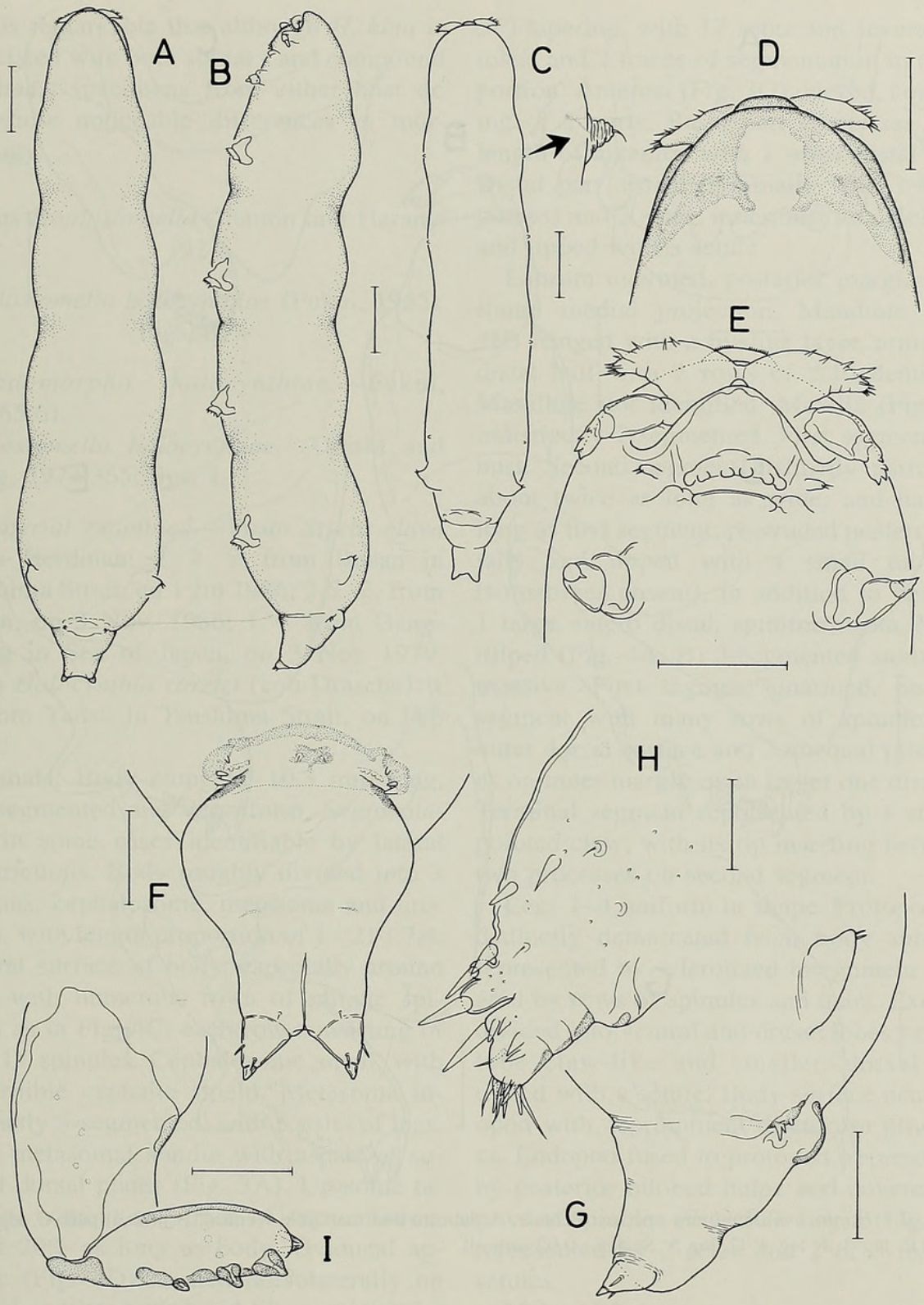

Fig. 1. *Haplostoma kimi* new species. Female. A, habitus, dorsal; B, habitus, lateral; C, habitus, protrusion of dorsal, D, cephalic plaque; E, oral area, ventral; F, anal segment and caudal rami; G, leg 5, anal segment and caudal rami. lateral; H, antennule; I, antenna. Scales : A–C = 0.2; D–G = 0.1; H, I = 0.02mm.

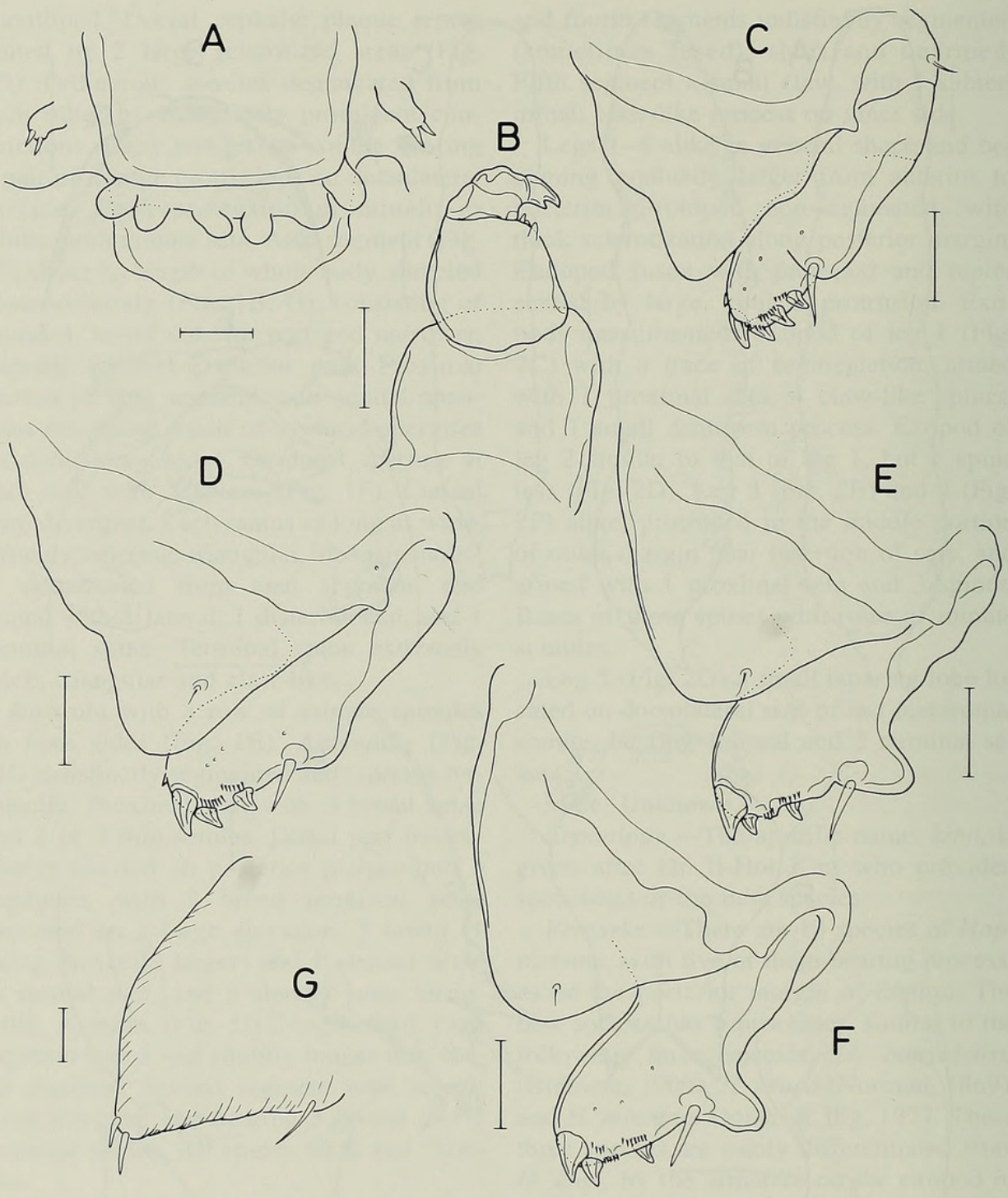

Fig. 2. *Haplostoma kimi* new species. Female. A, labrum and mandible, ventral; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scales : 0.02 mm all.

differs from *H. kimi,* in having 2 spines and 2 setae instead of 1 spine and 2 setae on the caudal ramus, 3 setae instead of 2 setae on the apex of leg 5, and no subterminal process on the terminal claw of maxilliped.

Haplostoma gibberum (Schellenberg, 1922) is incompletely known but not comparable with the new species on the basis of morphology of the labrum and legs. According to Ooishi and Illg (1977), *H. gibberum* has 3 spines on the terminal segment of the antenna. This character differs from that of the new species which has 4 simple spines.

It is remarkable that although *H. kimi* is associated with both solitary and compound ascidians, specimens from either host do not show noticeable differences in morphology.

Genus *Haplostomella* Chatton and Harant, 1924

Haplostomella halocynthiae (Fukui, 1965) Figs. 3, 4

Rhabdomorpha halocynthiae.—Fukui, 1965:61.

Haplostomella halocynthiae.—Ooishi and Illg, 1974:365, figs. 1–3.

Material examined.—From *Styela clava clava* Herdman: 2 ♀ ♀ from Busan in Tsushima Strait, on 1 Jul 1986; 2 ♀ ♀, from Busan, on 3 Nov. 1986; 1 ♀ from Gangneung in Sea of Japan, on 3 Nov 1979. From *Halocynthia roretzi* (von Drasche): 1 ♀ from Yeosu in Tsushima Strait, on Feb 1993.

Female: Body elongate, 10.3 mm long, non-segmented and vermiform. Segmentation in some cases identifiable by lateral constrictions. Body roughly divided into 3 sections: cephalosome, metasome and urosome, with length proportion of 1 : 21 : 7.4. Ventral surface of body, especially around legs, with numerous rows of minute spinules as in Fig. 4C; each row consisting of 4 to 15 spinules. Cephalosome small, with discernible cephalic shield. Metasome indistinctly 5-segmented, with 5 pairs of legs. Each metasomal somite with a pair of suboval dorsal plates (Fig. 3A). Urosome tapering, without any trace of segmentation, about 20% as long as body. Oviducal aperture (Fig. 4D) located dorsolaterally on genital somite, with hood-like semicircular projection armed with 4 dorsal denticles, outermost denticle 3 or 4 small points. Caudal rami widely separated from each other (Fig. 3C), 167 × 81 μm, 2.06 times as long as wide, armed with 5 setae (Fig. 3D). Egg sac elongate, 5.0 mm long.

Rostrum not discernible. Antennule (Fig. 3F) tapering, with 17 setae and several setules, and 2 traces of segmentation in distal portion. Antenna (Fig. 3G) curved, consisting of 2 parts. Basal part comprises 75% length of antenna, with 1 inner distal seta. Distal part armed terminally with 1 blunt process and 3 setae; innermost seta globular and tipped with a setule.

Labrum unarmed, posterior margin with round medial projection. Mandible (Fig. 3H) fringed with a hyaline layer, armed in distal half with 2 rows of ±10 denticles. Maxillule not identified. Maxilla (Fig. 3I) indistinctly 2-segmented. First segment robust. Second segment distinctly narrower, about twice as long as wide, and half as long as first segment; protruded postero distally and tipped with a small tubercle (sometimes absent), in addition to bearing 1 large antero distal, spiniform seta. Maxilliped (Fig. 4A, B) 3-segmented stout and massive. First segment unarmed. Second segment with many rows of spinules on outer dorsal surface and 2 unequal processes on inner margin, with larger one distally. Terminal segment represented by a strong pointed claw, with its tip inserting between two processes on second segment.

Legs 1–4 uniform in shape. Protopod indistinctly demarcated from body surface, represented by sclerotized integument covered by rows of spinules and hairs. Exopod divided into ventral and dorsal lobes ventral lobe claw-like and smaller, dorsal one tipped with a setule. Body surface near exopod with 4 prominent digitiform processes. Endopod fused to protopod, represented by posterior bilobed bulge and covered by rows of spinules (Fig. 4C). Leg 5 (Fig. 4F) represented by 2 setae and 2 or 3 minute setules.

Male: Unknown.

Remarks.—*Haplostomella halocynthiae* has so far been known only from *Halocynthia roretzi* in Japan. The Korean specimens of *H. halocynthiae* are very similar in morphology to the Japanese specimens. Therefore, the present record adds another ascidian host, (*Styela clava clava*) from another

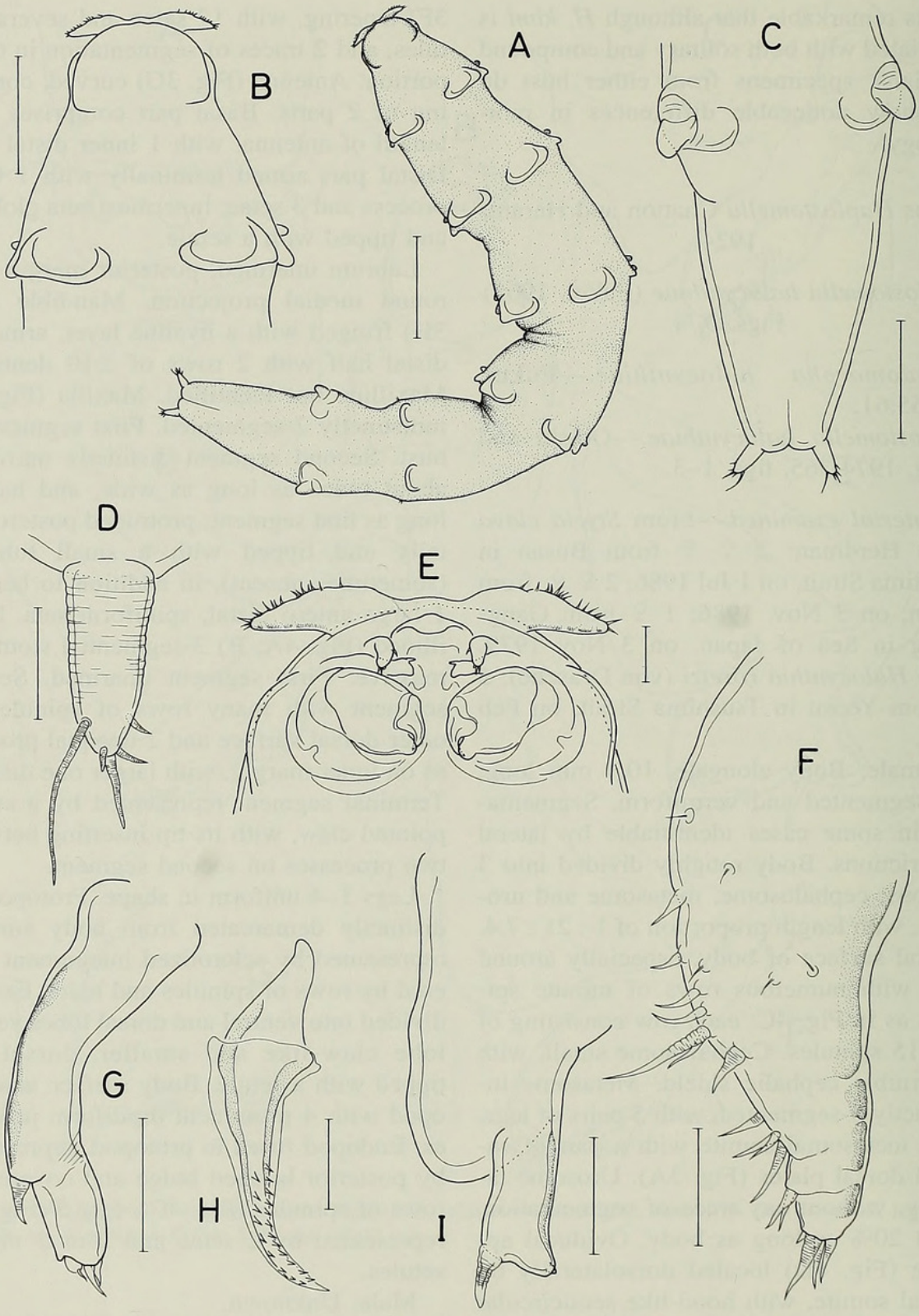

Fig. 3. *Haplostomella halocynthiae* (Fukui). Female. A, habitus, dorsal; B, cephlosome, dorsal; C, urosome, dorsal; D, caudal ramus; E, oral area, ventral; F, antennule; G, antenna; H, mandible; I, maxilla. Scales : A = 1; B, C = 0.5; D, E = 0.1; F, G, I = 0.05; H = 0.02mm.

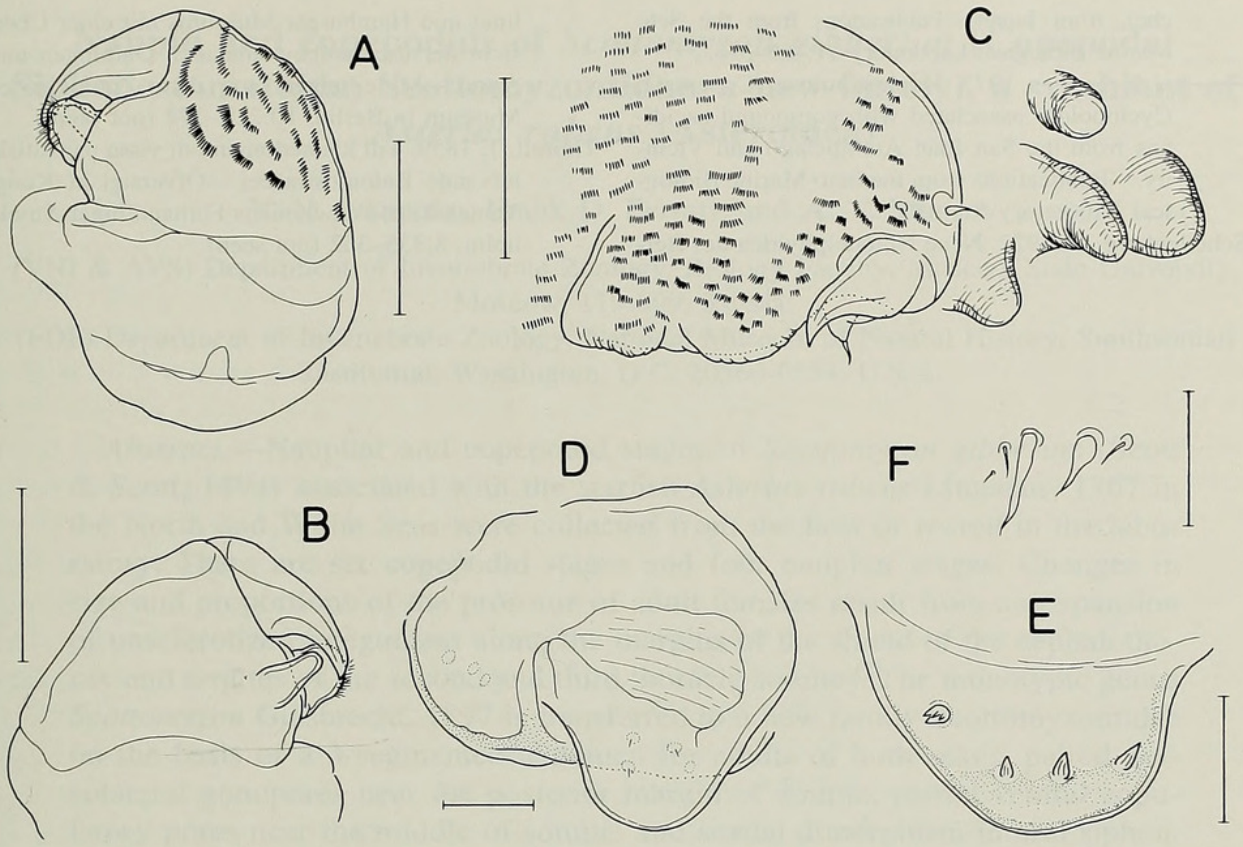

Fig. 4. *Haplostomella halocynthiae* (Fukui), Female. A, maxilliped, outer; B, maxilliped, inner; C, leg 1; D, oviducal aperture, dorsal; E, oviducal aperture, ventral; F, leg 5. Scales : A–E = 0.1; F = 0.05 mm.

country. This species was thoroughly redescribed by Ooishi and Illg (1974); it is redescribed herein as one of its hosts, *H. roretzi,* is the most important ascidian cultured along the Korean coast.

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