한국동물분류학회지 제20권 제1호
The Korean Journal of Systematic Zoology
Vol. 20, No. 1: 55-62 (April 2004)

Marine Chaetonotid Gastrotrichs of Genus *Halichaetonotus* (Chaetonotida: Chaetonotidae) from Korea

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ABSTRACT

Two marine gastrotrich species belonging to the genus *Halichaetonotus*, which were collected from intertidal or sublittoral sand bottom of Korea, are reported: *H. aculifer* (Gerlach, 1953) and *H. atlanticus* Kisielewski, 1988. Both of them are newly reported from Korea as well as the Pacific. This paper deals with the systematic accounts on them with redescriptions and illustrations.

Key words: marine, Gastrotricha, Chaetonotidae, *Halichaetonotus*, Korea

INTRODUCTION

In the western Pacific, especially in East Asia, the taxonomic studies on marine gastrotrichs are still scanty. The studies on the marine gastrotrich fauna of East Asia were referred to our previous paper (Lee and Chang, 2003). So far, ten marine gastrotrich species have been recorded from Korea: *Thaumastoderma appendiculatum* Chang, Lee and Clausen, 1998, *Th. coronarium* Chang, Lee and Clausen, 1998, *Th. copiophorum* Chang, Lee and Clausen, 1998, *Tetranchyroderma gracilium* Chang, Lee and Clausen, 1998, *T. heterotentaculatum* Chang and Lee, 2001, *T. hoonsooi* Chang and Lee, 2001, *Pseudostomella longifurca* Lee and Chang, 2002, *Ps. koreana* Lee and Chang, 2002, *Ptychostomella orientalis* Lee and Chang, 2003 and *Pt. papillata* Lee and Chang, 2003 (Chang et al., 1998a, b; Chang and Lee, 2001; Lee and Chang, 2002, 2003).

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However, they are all macrodasyid gastrotrichs belonging to the family Thaumastodermatidae, so the report on marine chaetonotids from Korea is still entirely lacking.

Members of the family Chaetonotidae are known to be the representative group of freshwater gastrotrichs. They are ubiquitous and abundant in nearly all aquatic habitats, especially inhabit the interstitial spaces of bottom sediments and the surfaces of submerged plant materials (Lee and Chang, 2000). This family comprises about 400 species of 16 genera of which only the genus *Halichaetonotus* is exclusively marine.

As a provisional result of the faunal study on the marine gastrotrichs from Korea since 1997, we identified two *Halichaetonotus* species. Although total 26 species have been known in the genus up to the present, they are recorded mostly from European coasts and not reported from the Pacific. This paper deals with the systematic accounts of two *Halichaetonotus* species from Korea with redescriptions and illustrations.

MATERIALS AND METHODS

The specimens were collected from the intertidal or shallow sublittoral sand bottom at several stations along sea coasts of Korea by scooping the top sediments into polyethylene vinyl bag or 700 ml volume plastic bottles with SCUBA or skin diving. In the laboratory the gastrotrichs were extracted by the anesthetization-decantation technique using 7% $MgCl_2$, and fixed in 5% buffered formalin.

Specimens were mounted in glycerin on H-S slide (Shirayama et al., 1993) after the treatment in a solution of 5% glycerin-95% ethyl alcohol for one or two days, and photographed using a differential interference contrast microscope (Olympus BX-50) equipped with Nomarski optics. All drawings and measurements were made with the aid of a camera lucida. Minute morphological characters like sensory hairs and inner genital organs were examined and video-recorded in living worms using a CCD camera (Olympus DP-11).

SYSTEMATIC ACCOUNTS

Order Chaetonotida Remane, 1924

Family Chaetonotidae Zelinka, 1889

Genus **Halichaetonotus* Remane, 1936

****Halichaetonotus aculifer* (Gerlach, 1953) (Fig. 1)**

Chaetonotus aculifer Gerlach, 1953, p. 208, figs. 4-5; Schrom, 1966, p. 39, Abb. 3; Schrom, 1972, p. 330, Abb. 18; Luporini and Tongiorgi, 1972, p. 300, fig. 1, pls. 1-2.

Halichaetonotus aculifer: Kisielewski, 1988, p. 197, fig. 4; Balsamo et al., 1995, p. 281; Todaro et al., 2000, p. 108, fig. 4E.

Material examined. One ind., Biando Is., Gunsan, 25 Nov. 2000; 2 inds., Yangjeong, Uljin, 9

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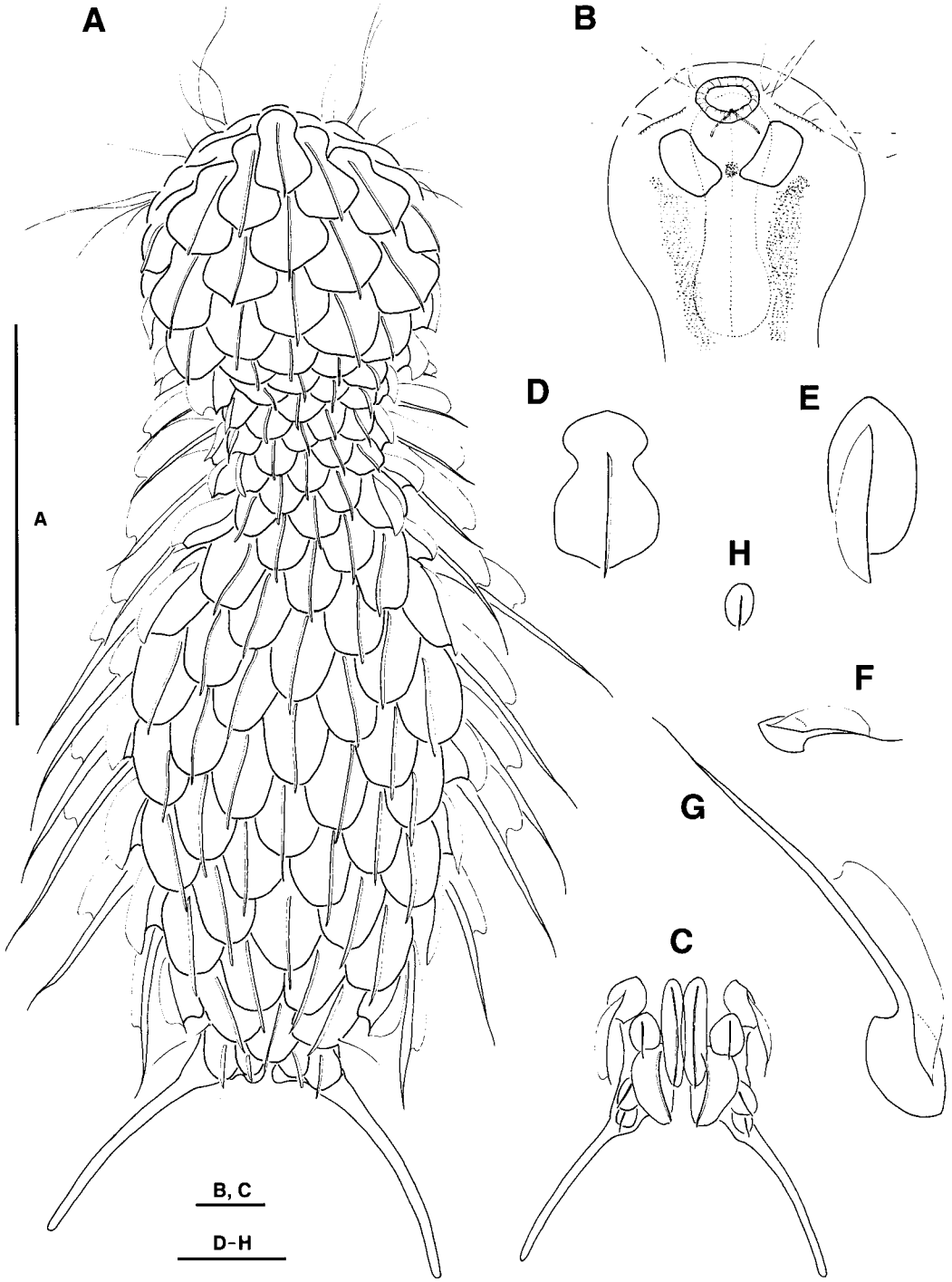

Fig. 1. *Halichaetonotus aculifer*. A, habitus, dorsal; B, head, ventral; C, posterior part of trunk, ventral; D, scale on head; E, scale on trunk; F-G, ventrolateral hydrofoil scales; H, ventral scale. Scale bars = 10 μm (B-H), 50 μm (A).

May 2001; 3 inds., Jongdal-ri, Jejudo Is., 24 Jan. 2003.

Description. Body (Fig. 1A) slender, 156 μm long including posterior adhesive appendage, distinctly divided into head, neck, and trunk. Head a little protruding and its anterior margin rounded, 39 μm wide. Cephalion not clear. Four cephalic ciliary tufts, each comprising 3-7 cilia, scattered along anterior margin of head. A pair of sensory bristle located at distolateral corner of trunk. Pharynx (Fig. 1B), 36 μm long, rather swollen at both anterior and posterior ends. A pair of cuticular rods forming inverted V-shape, and located inside anterior portion of pharynx (Fig. 1B). Hypostomion (Fig. 1B) large, forming paired oblong plates ventrolaterally.

Dorsal surface of whole body covered with cuticular scales keeled along its midline; scales arranged in 7-9 columns, each consisting of 13-15 scales, overlapping each other; scale size slightly increasing posteriorly.

Two types of dorsal scales distributed mid- and subdorsally: one (Fig. 1D) situating in head region, pyriform with posterior end bluntly projected and its anterior third constricted; the other (Fig. 1E) in neck and trunk region, elliptical.

Two columns of hydrofoil scales per side located ventrolaterally, extending from middle of head to posterior trunk region, each column consisting of 12-14 scales; hydrofoil scales (Fig. 1F, G) hemi-elliptical with concave posterior edge and an elongated hyaline membrane as a mid-dorsal keel, posteriorly prolonged to a long, simple spine, then ended into a fine hair; hyaline membrane situated between anterior part of the scale to about half of its spine; scale size and spine length slightly increasing posteriorly.

Ventral locomotory ciliary bands running parallel with each other along whole body length, except unpaired tuft of ventral cilia occurring between 2 plates of hypostomion; 6-9 columns of small elliptical ventral scales present between ventral ciliary zone, each scale (Fig. 1H) with a median keel, ending into a short projection posteriorly.

Posterior adhesive appendage forming a furca, taking up adhesive tubes, slender and somewhat elongate, its surface smooth without any ornamentation, about 40 μm in length.

Remarks. *Halichaetonotus* was separated from the genus *Chaetonotus*, and ranked up to the genus by Schrom (1972), based upon the character combination of ventrolateral hydrofoil scales and dorsal scales with a keel of hyaline membrane. Until now, total 26 species have been recognized in the genus.

As Luporini and Tongiorgi (1972) mentioned by the scanning electron microscopy, *H. aculifer* most closely resembles *H. batillifer* (Luporini and Tongiorgi, 1972) among the known congeners. According to them, the former species is distinguished from the latter by the different shapes of scales on head and trunk in *H. aculifer*, while similar in *H. batillifer*. Furthermore, *H. aculifer* has long-spiny ventrolateral hydrofoil scales with a short hyaline membrane, while *H. batillifer* has short-spiny ones with a relatively long hyaline membrane.

Schrom (1972) proposed a new forma of '*H. aculifer* f. *adriatica*', which had the same type of scales on head and trunk, and two anteriormost hydrofoil scales without hyaline membrane. However, considering the characteristics above, the 'forma' deserves to be regarded as a distinct species or subspecies, although that cannot be decisively determined on the basis of his paper only, because his description was insufficient and somewhat inadequate.

Kisielewski (1988) reported *H. aculifer* from the French coast of the Atlantic, and enumerated a

few morphological discrepancies between the type specimens from the Mediterranean and his Atlantic specimens: (1) unusually large hypostomion as polygonal plate, (2) a pair of cuticular rods which obliquely located inside the anterior pharynx, and (3) bilobed X-organ developed in one specimen were shown in Kisielewski's (1988).

Considering that the discrepancies above were not observed in our Korean specimens, the present specimens were better coincided with the original description (Gerlach, 1953) rather than Kisielewski's (1988), except for the paired cuticular rods. Moreover, the spine on ventrolateral hydrofoil scales ending into a fine hair examined by Luporini and Tongiorgi's (1972) SEM study was also confirmed in the Korean specimens. We could observe a pair of sensory bristles at distolateral corner of trunk in the Korean specimens, however, not shown apparently in the references above mentioned.

Distribution. Italy, Roscoff (English Channel) and Arcachon of France, Korea.

**Halichaetonotus atlanticus* Kisielewski, 1988 (Fig. 2)

Halichaetonotus atlanticus Kisielewski, 1988, p. 200, fig. 6; Balsamo et al., 1995, p. 281.

Material examined. One ind., Gwakji, Jejudo Is., 19 Apr. 1995 (C. Y. Chang, J. M. Lee and H. S. Rho); 2 inds., Sangju-ri, Namhaedo Is., 24 Jun. 1995 (C. Y. Chang, J. M. Lee and H. S. Rho); 2 inds., Bongpo, Sokcho, 25 Aug. 1996 (H. S. Rho).

Description. Body (Fig. 2A) tenpin-shaped, slender, 164 μm long including posterior adhesive appendage, distinctly divided into head, neck, and trunk. Widths of head/neck/trunk 30/19/36 μm, respectively. Head a little protruding anteriorly, with indistinct cephalion; 2 pairs of cephalic ciliary tufts, each of 3-6 cilia along anterior margin of head, of which anterior tuft shorter than posterior one. A pair of sensory bristles originating from small pentagonal scale with obliquely double-keeled, situated at distolateral corner of trunk. Pharynx (Fig. 2B) 40 μm long, narrowest at its middle, and becoming wider toward both ends. Hypostomion (Fig. 2B) comprising a pair of rhomboic plate, and as large as anteroventral field on head.

Dorsal surface covered with 11-13 scale columns, each composed of 18-20 pentagonal scales; scale (Fig. 2D, E) with rather flat posterior edge and a relatively high hyaline membrane as a keel; both scale surface and hyaline membrane of all dorsal scales ornamented with irregular furrows; anteriormost scales of head region and scales on neck relatively smaller than those in other regions; scales in trunk region slightly increasing in their sizes posteriorly, shown eminently at mid-trunk region; every scale overlapped by preceding scales.

Two columns of hydrofoil scales running along nearly all body side ventrolaterally (ranging from middle of head to posterior trunk region), each consisting of 16-17 scales. Hydrofoil scales (Fig. 2F, G) covered with a well-developed hyaline membrane as a mid-dorsal keel on scale; one spine present along posteroventral margin of every hyaline membrane as a rim, so posteroventral margin shown rather straight and thicker; hyaline membrane blades of hydrofoil scales becoming much swollen in posterior trunk region.

Ventral interciliary zone covered with small elliptical ventral scales (Fig. 2H), each with a median keel, arranged in 5-7 columns. Two pairs of elongate ventral scales (Fig. 2C), with a simple and

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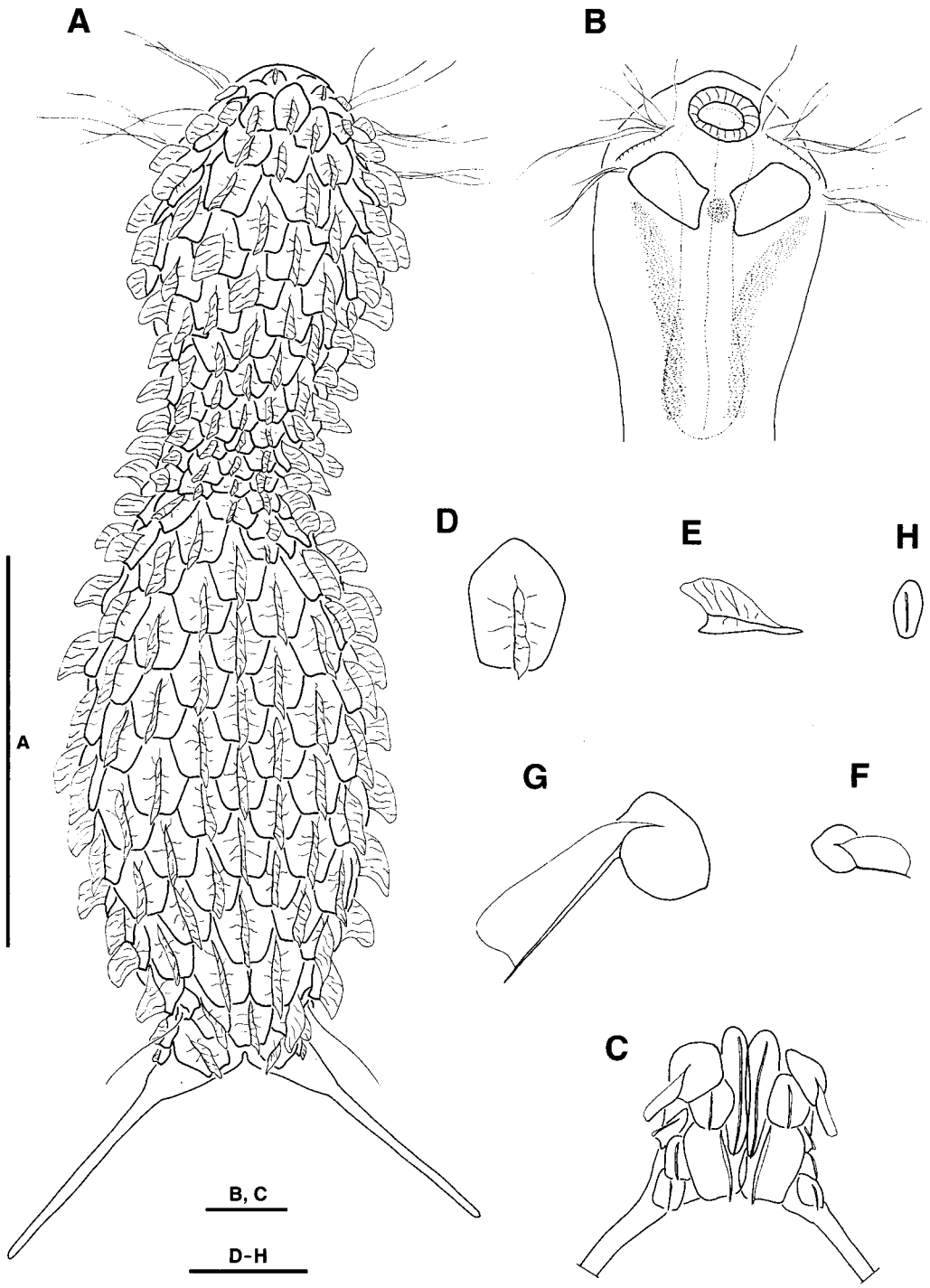

Fig. 2. *Halichaetonotus atlanticus*. A, habitus, dorsal; B, head, ventral; C, posterior part of trunk, ventral; D, scale on trunk, dorsal view; E, scale on trunk, lateral view; F-G, ventrolateral hydrofoil scale; H, ventral scale. Scale bars = 10 μm (B-H), 50 μm (A).

much lower keel lacking furrows, present near posterior margin of trunk.

Caudal appendages forming a furca, strongly divergent outward, consisting of paired straight and smooth posterior adhesive tubes, 40 μm long.

Remarks. Among the currently known congeners, the present species is most characteristic in having the furrowy surface both on pentagonal dorsal scales and on their high hyaline membrane keels. The Korean specimens of *H. atlanticus* were well fitted with the original description (Kisielewski, 1988) from French coast of the North Atlantic, except the following discrepancies: (1) body was a little narrower in the Korean specimens (the ratio of body length to width is 4.8 in Korean specimens, while 3.3-3.6 in the original description), (2) the number of dorsal scale columns was smaller than that of French specimens (11-13 vs. 13-15), (3) a pair of sensory bristles at the distolateral corner of trunk situated on the double-keeled, pentagonal dorsal scales in Korean specimens, while the bristles and the double-keeled scales were not apparently shown in the original description, (4) Hypostomion consisted of a pair of rhomboic plate in Korean specimens, while a wide plate in the original description, and (5) Korean specimens had the distoventral scales without furrows, while European ones had furrowy ones.

Distribution. Roscoff (English Channel) and Arcachon, Italian coast of the Mediterranean, Korea.

ACKNOWLEDGEMENTS

This work was supported by Korea Research Foundation Grant (KRF-2002-070-C00080).

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RECEIVED: 26 February 2004
ACCEPTED: 25 March 2004

짠물새앙쥐벌레속(카이토노티드목: 카이토노티드과)의 해양 복모류

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한국 연안의 조간대와 조하대 모래틈에 서식하는 짠물새앙쥐벌레속(*Halichaetonotus*)의 2종, 바늘짠물새앙쥐벌레(*H. aculifer*)와 아틀란타짠물새앙쥐벌레(*H. atlanticus*)를 보고한다. 2종 모두 한국미기록종일 뿐 아니라 태평양 해역에서는 처음으로 보고된다. 본 논문에서는 이들 2종에 대한 도판을 작성하고 재기재하는 한편 분류학적으로 고찰하였다.