Reconsideration on Two Acanthodasys Species (Gastrotricha: Macrodasyida: Thaumastodermatidae) from Korea, with Nomenclatural Note on Korean Marine Gastrotrichs

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ABSTRACT

Two marine gastrotrich species of the genus Acanthodasys, A. ericinus Lee, 2012 and A. comtus Lee, 2012, are taxonomically reconsidered. Both of them were originally described based on the specimens from intertidal or sublittoral sandy bottom of the Yellow Sea and Jeju Island, South Korea, and included in a monographical publication of <Flora and Fauna in Korea> in 2012. However, the description of them was quite insufficient, and designations of type specimens were entirely lacking. In this study, we make a subsequent designation of type specimens for the two Acanthodasys species, and carry out a full redescription of them with additional remarks on their morphological micro-characteristics by scanning electronic microscopy. Some brief nomenclatural notes on Korean marine gastrotrichs are also provided.

Keywords: subsequent designation, type, redescription, Acanthodasys ericinus, Acanthodasys comtus, Korean fauna

INTRODUCTION

Authors have conducted serial taxonomic studies on marine gastrotrichs in Korea since 1998 (Chang et al., 1998a, 1998b; Chang and Lee, 2001; Lee and Chang, 2002, 2003, 2004, 2006, 2007, 2012a, 2012b, 2014; Lee et al., 2009, 2013, 2014; Lee, 2012). In 2011, when the senior author (JL) took part in a joint program for the monographical studies of <Flora and Fauna in Korea> sponsored by the National Institute of Biological Resources, Korea, a total of 31 species of 11 genera of 5 families belonging to orders Macrodasyida and Chaetonotida were listed, including several taxa due to publication in 2013.

Following the original schedule of ‘publication-within-2013,’ she prepared a concise description for the 31 species, including two Acanthodasys species dealt herein, and figure plates as well as keys to species and genera in Korea according to the general style of the series of booklets. However, the booklet was printed in late 2013 under the nominal date of issue dated back to 24 December 2012 by reason of the end of fiscal year of the program.

As a result, the booklet became a nominally preceding publication prior to the three articles for five new species published in 2013 or in the beginning of 2014 (Lee et al., 2013, 2014; Lee and Chang, 2014). Otherwise, two Acanthodasys species in the booklet, which were under preparation of submission to a journal in 2013 and later failed, are in need of an adequate full-redescription with subsequent designation according to the Article 69.1 of the International Code of Zoological Nomenclature (ICZN, 1999). The present paper deals with a full redescription of the two Acanthodasys species, with additional remarks on their morphological micro-characters by scanning electronic microscopy.

Notwithstanding the author’s good will of providing a more comprehensive monograph within the range of original publication plan, the proper authorities and publication dates of the seven species in the booklet may probably be a highly controversial, which might cause long-lasting confusions. We provide a table for the emendation of the authorities of the seven species described in Korea in the last section of
this paper, according to the Article 21.4 of ICZN.

MATERIALS AND METHODS

Gastrotrichs were collected from intertidal sandy bottoms at Sambong and Baegripo in the Yellow Sea, and from sublittoral ones at 10 m depth at Seongsan in Jeju Island. Samplings were conducted using a long-handled bowl in the lower intertidal zone or by SCUBA divers in the sublittoral zone. Sediments were taken by scooping the top few centimeters and placed in 700 mL bottles or plastic bags. In the field, at the former two stations, samples were filtered through a 63 μm mesh sieve after being treated with the anesthetization-decantation method with 7% MgCl2; for 5–10 minutes, however, at Seongsan, they were sieved after freshwater rinsing for 10–30 minutes. Sieved materials were all fixed in 15% buffered formalin immediately. Specimens were measured when glycerin mounted on slide. The general methods, including preparation of whole mount, observation and scanning electron microscopy, were carried out according to our previous papers (Lee and Chang, 2003; Lee et al., 2009).

Type specimens were deposited in the National Biological Resources Center (NIBR), Incheon, Korea, and in the Korea Institute of Ocean Science & Technology (KIOST), Korea.

Terminology mostly follows Hummon et al. (1992) and Clausen (2000). Abbreviations used in the text and figures are as follows: Lt, total length, from anterior end of head to posterior tip of pedicles excluding adhesive tubes; PhJIn, junction between pharynx and intestine; TbA, anterior adhesive tubes; TbD, dorsal adhesive tubes; TbL, lateral adhesive tubes; TbP, posterior adhesive tubes; TbVL, ventrolateral adhesive tubes; U, percentage unit of Lt, used for the location (U–) from anterior to posterior, or for the relative length (–U).

SYSTEMATIC ACCOUNTS

Order Macrodasysida Remane, 1925 [Rao and Clausen, 1970]
Family Thaumastodermatidae Remane, 1927
Subfamily Diplodasyinae Ruppert, 1978
Genus Acanthodasys Remane, 1927

Acanthodasys ericinaus Lee, 2012 (non Lee and Chang, 2013) (Figs. 1, 2)
Acanthodasys ericinaus Lee, 2012, p. 18, fig. 5.

Type locality. Sambong beach, Taean, Korea (36°48’43”N, 126°09’14”E; 1–2 m deep).

Type specimens. Holotype (NIBRIV0000779141) and 11 paratypes, all adult specimens (KIOST01G01-10, NIBRIV 0000779142), mounted in glycerin on H-S slides, 18 Jul 2006, leg. J. Lee.


Etymology. The proposed specific name, ericinaus (L. ‘of hedgehog’) refers to body covered with cuticular armature of ancre.

Diagnosis. An elongate Acanthodasys, 550–750 μm in adult body length; both sides of body nearly parallel, except for a body constriction at the level of the reproductive organs in posterior trunk region; anterior margin of head truncated; cuticular armature with both spiny scales (uniancretes) and spineless scales (ellipsoidal scales), densely covering whole body surface; 2–4 TbA per side; 3–7 TbD forming 1 median column in intestinal region; 7–11 TbL per side, asymmetrically arranged, comprising foremost tube near pharyngeal pore and others along whole intestinal region anterior to the constricted posterior trunk region; 6–9 TbVL per side, distributed between PhJIn and anteriorly to the base of caudum, asymmetrically; each bifid caudal pedicle with 3–4 TbP per side, forming 2 distal and 1–2 medial TbP.

Description of the holotype. Body (Figs. 1A, 2A) elongate and strap-shaped, Lt 573 μm; both lateral sides nearly parallel, constricted near posterior part of frontal organ in posterior trunk region (U89), a little widened at the level of caudal organ and again narrowing toward caudal lobes at U97. Widths of head/pharyngeal pores/trunk/base of caudal lobes 33/38/44/11 μm at U02/U23/U55/U97, respectively.

Anterior margin of head truncated, with a terminal mouth opening, 30 μm wide, and a narrow ciliary band surrounding the whole anciromost part of mouth opening, where cuticular armature is absent (Fig. 2C). Pharynx 152 μm long, with paired pharyngeal pores which obliquely opened at 10° from level of PhJIn at U23. Intestine gradually narrowing toward posterior end. Anus at U91.

Epidermal glands 22–29 per side, arranged asymmetrical, distributed along whole body length from U05 to U93, except for anterior part of head and base of caudal region; generally oval-shaped, ranging 4–8 μm in diameter.

Cuticular armature extremely densely covered with both spiny scales (uniancretes) and spineless scales, irregularly arranged on the whole body surface except for the anterior-most mouth region where a ciliary band is present (Fig. 2C); dorsal and lateral surface more densely covered with uni-
ancres than ventral surface (Fig. 2B, D); uniancres straight, ranging 2–6 μm long, arising from a suboval base and with a tapering apex crisscross-shaped in transverse section; dorsal and lateral uniancres longer than ventral ones; ellipsoidal spineless scales with a large central depression and a little thick rim, ranging 1–3 μm in diameter; both suboval base of uniancres and ellipsoidal scales can be observed and distinguished only with scanning electron microscope, unclear at high magnification (1,000×) of differential interference contrast microscopy.

Adhesive tubes: TbA consisting of 3 tubes per side, comprising 1 mid-ventral tube at U02 and 2 ventral tubes obliquely arranged at U03; TbD (Fig. 2B) a single median column of 3 tubes, located at anterior intestinal region (U31–U57); TbL, 7–8 tubes per side, asymmetrical, the foremost one located near pharyngeal pore at U21 and the others distributed along whole intestinal region, anterior to the constriction of the posterior trunk region at U34–U80; TbVL, 8–9 tubes per side, asymmetrical, from the level of PhJIn to the base of caudum at U31–U95; anterior 4 tubes at anterior part of intestinal region, 2–3 tubes scattered in middle intestinal region, and the others at swollen posterior trunk region; TbP (Fig. 2D), 3 tubes per side, each forming a bifid pedicle, consisting of 2 distal tubes, 1 sensory hair between them, 1 short proximomedial tube.

Ventral ciliation arranged in a single column at mid-ventral surface, intermingling with both spineless ellipsoidal scales and uniancres; extending from just posteriorly to TbA to caudal base (U02–U96).

Hermaphrodite; paired testes not reaching PhJIn at U40. Rosette organ 23 μm in diameter, located at anterior intestinal region (U32–U34) on mid-dorsal surface. Caudal organ inverse-pyriform, situated at swollen posterior trunk region (U88–U94). Frontal organ ellipsoidal, located in front of caudal organ. Seven ova located dorsally to the posterior half of intestine at U58–U80; the foremost one largest, the other decreasing in size posteriorly (Fig. 1A).

*Acanthodasys comtus* Lee, 2012 (non Lee and Chang, 2013) (Figs. 3, 4)

*Acanthodasys comtus* Lee, 2012, p. 20, fig. 6.

Type locality. Seongsan, Jeju Island, Korea (33°27′52.71″N, 126°56′35.83″E; 10 m deep).

Type specimens. Holotype (NIBRIV0000779139) and six paratypes (KJOST02G01-05, NIBRIV0000779140), mounted in glycerin on H-S slides, 15 Jun 2010, leg. S.H. Kim.

Additional material examined. Four specimens, with same collection data, mounted on aluminum stub for scanning electron microscopy.

Etymology. The specific name, *comtus* (L. ‘ornamented,’...
‘adorned’) alludes to the cuticular armature ornamented with uniancres and spineless scales, covering whole body.

**Diagnosis.** *Acanthodasys* with thick cuticular armature both dorsally and ventrally, Lt 500–600 μm; dorsal surface covered with a single median column of spiny scales (uniancres), 4–6 columns of large sculptured rhombic plates, and numerous small elliptical scales between them; lateral sides each with 2 columns of uniancres; ventrolateral sides each covered with 2–5 columns of uniancres, increasing in size toward lateral side; ventral surface with various spineless scales in size and in shape; 10–12 TbA per side; 4 TbL per in mid-trunk region; 62–69 TbVL per side; 20–30 TbP along round caudal lobe.

**Description of the holotype.** Description based on fixed specimen after freshwater rinsing not *in vivo*. Body large, thickly covered with cuticular armature both dorsally and ventrally, Lt 582 μm. Anterior margin of head broad, slightly convex; body a little widened in mid-trunk region and gradually narrowing towards caudal lobe. Widths of anterior part of head/trunk/caudum 95/149/55 μm at U09/U55/U95, respectively (Figs. 3A, B, 4A).

Anterior margin of head slightly truncated, without ciliary band surrounding anteromost part of head. Mouth opening subterminal, 61 μm wide, surrounded with a double row of about 40 small uniancres, except on mid-ventral side; ancres on innermost edge of lip smaller than those on outer edge (Fig. 4E).

Cuticular armature composed of both spiny scales (uniancres) and two kinds of spineless scales on dorsal and lateral surfaces of body, while only spineless scales with various in size and shape on ventral surface.

Spiny scales (Figs. 3D, 4D), cone-shaped uniancres, each with 4 keels showing cruciform shape in transversal cutting plane, arising from a rhomboidal base with a little thickening on the edge of each keel base; spiny scales arranged in 1 single medial column, 2 lateral columns per side, and 2–5 ventrolateral ones per side. The single medial column consists of 39 spiny ancre, arranged from anterior head (U02)
Two Acanthodasys Species from Korea

Fig. 3. *Acanthodasys comtus* Lee, 2012. A, Habitus, dorsal; B, Habitus, ventral; C, Caudal lobe with posterior adhesive tubes, ventral, paratype; D, Uniancre with small spineless scales on its base; E, Large sculptured rhombic scale. Scale bars: A–E = 50 μm (modified from Lee, 2012).
to caudum, with uniancre largest in mid-trunk region (U59), 54 μm long, gradually decreasing in length toward both head (25 μm long, at U08) and caudum (33 μm long, at U95); arrangement from the 11th uniancre to 29th one (U33–U66) in the medial column, shown as 2 alternative columns due to shrinking body, however, in the others specimens, shown a single column. Lateral uniancre arranged in 2 columns per side, except for anterior part of head and posterior part of trunk, where single column; largest in mid-trunk region, 52 μm long at U67. Ventrolateral uniancre 4–5 columns

Fig. 4. Acanthodasys comtus Lee, 2012. Scanning electron microscope photographs. A, Habitus, dorsal; B, Head, dorsal; C, Caudum, dorsal; D, Dorsal cuticular armature on the head; E, Mouth opening and cuticular armature on ventral side; F, Lateral adhesive tubes and ventrolateral adhesive tubes on the trunk, ventral. Scale bars: A = 50 μm, B, C, E, F = 20 μm, D = 10 μm.
per side in mid-trunk region while 2–3 columns on anterior part of head and posterior part of trunk region, respectively; clearly increasing in size toward lateral sides, ranging 4–39 μm in length.

Spineless scales on dorsal surface (Figs. 3E, 4D) of 2 kinds: large, sculptured, rhombic plates, similar to cuticular plates of Diplodasys, and small elliptical scales; large rhombic plates, 13–37 μm in diameter, sculptured with central depression where embossed in criss-cross shape with its terminal end split up (Fig. 3E); a few rhombic plates among large sculptured plates incompletely sculptured without criss-cross; arranged in 4–6 columns on dorsal surface; median column composed of 21–22 plates; the first anterior 10 rows of plates overlap each other posteriorly; the 11th scale of the median column not overlapped; next 10–11 rows overlap each other anteriorly. Other numerous small scales, irregularly shaped, from triangular to rhombic or elliptical, ranging 2–12 μm in length, with only central depression without sculpture and thickly rimmed; piled up around bases of dorsal and lateral uniancres and extending over plates between them.

Ventral ciliation distributed in the bare area between large ones (Figs. 3C, 4E, F); a few rhombic plates among large sculptured plates incompletely sculptured without criss-cross; arranged in 4–6 columns on dorsal surface; median column composed of 21–22 plates; the first anterior 10 rows of plates overlap each other posteriorly; the 11th scale of the median column not overlapped; next 10–11 rows overlap each other anteriorly. Other numerous small scales, irregularly shaped, from triangular to rhombic or elliptical, ranging 2–12 μm in length, with only central depression without sculpture and thickly rimmed; piled up around bases of dorsal and lateral uniancres and extending over plates between them.

Remarks on taxonomy affinities. The genus Acanthodasys Remane, 1927 is characterized by cuticular armatures of both uniancres and spineless scales: A. aculeatus, A. arccassonensis, A. caribbeanensis and A. paurocactus. Acanthodasys ericinus from Yellow Sea is easily distinguished from the four species above by the elongate, strap-shaped body with constriction of the posterior trunk at the level of the reproductive organs and by 3–7 dorsal adhesive tubes arranged in a column. Those features are unique in the genus. In particular, the former character of strap-shaped body with constriction near reproductive organs is reminiscent of that of Lepidodasys castoroides Clausen, 2004, which shows the caudal portion ‘like a beaver tail or a flounder’ where copulatory organ exists (see Clausen, 2004, p. 431, figs. 8–10). It does not shrink when the specimens are fixed after the anesthetization-decantation with 7% MgCl₂, although it could not be observed in vivo. Moreover, A. ericinus evidently differs from the four congeners in having dorsal adhesive tubes (ThD) body.

Acanthodasys comtus from Jeju Island most resembles A. caribbeanensis in having large uniancres in distinguishable columns on the dorsal and lateral surfaces, as well as the large, sculptured, spineless plates, similar to the cuticular plates of Diplodasys. However, A. comtus differs from it by 4–5 columns of large uniancres on each ventrolateral side (against lacking in A. caribbeanensis) and by the unique shape of spineless scales ornamented with criss-cross sculptured central depression (against with unadorned central depression in A. caribbeanensis). Furthermore, it is definitely discernible from A. caribbeanensis by presenting four lateral adhesive tubes per side in the mid-trunk region (against without lateral adhesive tubes in A. caribbeanensis) and 24 posterior adhesive tubes on round caudum (against bifid pedicle forming four posterior adhesive tubes in A. caribbeanensis).

Nomenclatural note on Korean marine gastrotrichs

As above mentioned in the Introduction chapter, an article for three species of the genus Tetranchyroderma, was published in 2013 (Lee et al., 2013) substantially before the booklet of <Flora and Fauna of Korea> (Lee, 2012), and was immediately followed by a description of another Tetranchyroderma species (Lee and Chang, 2014) and one of Dendrodasys (Lee et al., 2014) at the beginning of 2014. Otherwise, an article for two Acanthodasys species due for publication in late 2013 was aborted just ahead of publica-
tion of the booklet. To avoid the authority problem for the seven species above, we adopt the Article 24.1 of the ICZN, and emendate the authorities of them as shown in the Table 1.

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