

Freshwater Chaetonotid Gastrotrichs in Korea

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ABSTRACT

Ten gastrotrich species belonging to family Chaetonotidae are recorded on the basis of the material from various freshwater bodies at 65 localities in South Korea: *Polymerurus rhomboides* (Stokes), *P. nodicaudus* (Voigt), *Lepidodermella squamata* (Dujardin), *Chaetonotus (Zonochaeta) succinctus* Voigt, *C. (Z.) bisacer* Greuter, *C. (Euchaetonotus) polypinosus* Greuter, *C. (E.) heterospinosus* Balsamo, *C. (E.) heideri* Brehm, *C. (E.) zelinkai* Grünspan, and *C. (Hystricochaetonotus) persetosus* Zelinka. All the species are illustrated and briefly commented on their affinities and habitats, with a key to the ten species of Chaetonotidae from Korea. This is the first record on the freshwater gastrotrichs from Korea.

Key words: Taxonomy, Gastrotricha, Chaetonotoida, Chaetonotidae, freshwater, Korea.

INTRODUCTION

Family Chaetonotidae Gosse, 1864 comprises 376 species of 16 genera including 61 marine species, the freshwater ones of which amount to about 87.9% of total 358 freshwater species currently recorded. Members of the family, as the representative group of freshwater gastrotrichs, are ubiquitous and abundant in nearly all aquatic habitats, especially inhabit the interstitial spaces of bottom sediments and the surfaces of submerged plant materials. Although they have been so familiar to limnologists or taxonomists studying freshwater invertebrates as early as 1800's, the

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accurate classification of this diversified family is often regarded as absolutely difficult even to specialists by reasons of their minute body size, the subtle differences among species, and the intraspecific variations frequently occurred according to habitats, seasons and geographical distribution.

As a provisional result of the faunal research on the freshwater gastrotrichs, of which the taxonomic study is entirely lacking in Korea, the authors confirmed ten species belonging to family Chaetonotidae. This report deals with the redescrptions of the species with the illustrations of them and the brief comments on their habitats, in addition to a key to the species of family Chaetonotidae from Korea.

MATERIALS AND METHODS

Samplings were made mostly by scooping up bottom debris or rinsing the aquatic vegetables of the various freshwater bodies, and filtering through nylon gauze with 64 μm mesh from total 178 stations since May, 1994, of which the material used for this paper were obtained from 65 localities.

Samples were extracted using micropipette under the stereomicroscope, anaesthetized in 1% MgCl_2 solution for 5-10 minutes, and then fixed one night in 10% formalin.

Specimens were mounted and measured in lactophenol medium on Cobb's hole slide. Observation and drawings were made under differential interference contrast microscope furnished with Normaski optics and camera lucida.

Percentage unit (U) used in redescrptions herein means the relative length (-U) or location (U-) to total body length measured from frontal margin of head to the posterior tip of adhesive appendage. Basic scheme of classification adopted in this paper follows that of Schwank (1990).

All specimens examined are deposited in the Department of Biology, Taegu University.

TAXONOMIC ACCOUNTS

Order Chaetonotida Remane, 1924

Suborder Multitubulatina D'Hondt, 1971

Family Chaetonotidae Gosse, 1864

Genus *Polymerurus* Remane, 1927

1. *Polymerurus rhomboides* (Stokes, 1887) (Fig. 1A-D)

Chaetonotus rhomboides Stokes, 1887, p. 561, tab. 2, figs. 31-35 (cited from Rudescu, 1967); Rudescu, 1967, p. 124, fig. 61.

Polymerurus rhomboides: Kisielewski, 1981, p. 96; Kisielewski, 1991, p. 85; Schwank, 1990, p. 63, fig. 22.

Material examined. 8 inds., Aejiho pond, Taegu Univ., 9 Aug. 1999; 12 inds., same locality, 11 Aug. 1999.

Description. Body slender and elongated; body length ranging about 261.9-270.0 μm . Head

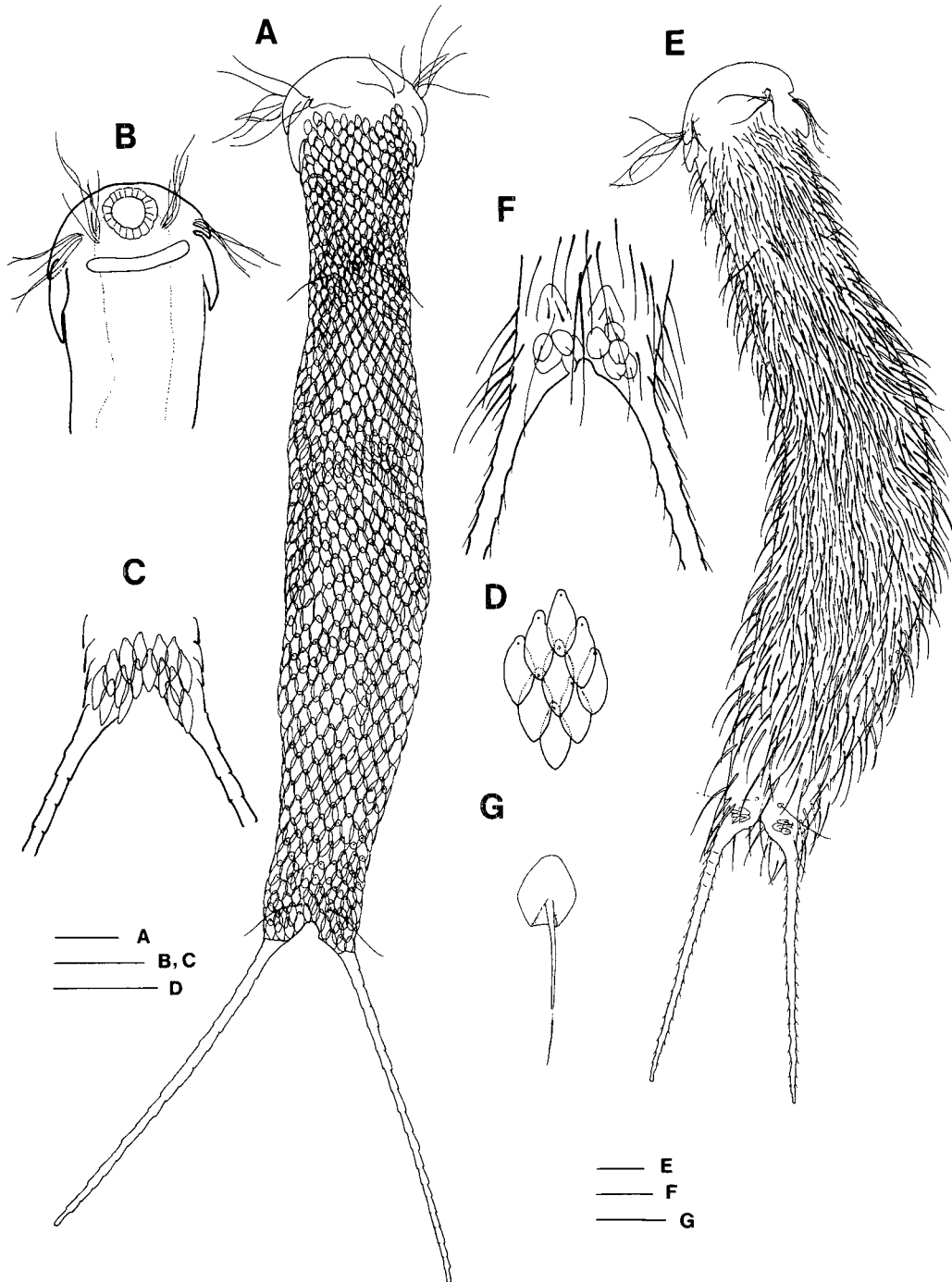


Fig. 1. A-D, *Polymerurus rhomboides* (Stokes): A, habitus, dorsal; B, head, ventral; C, caudal appendage and adhesive tube segments, ventral; D, dorsal scales. E-G, *Polymerurus nodicaudus* (Voigt): E, habitus, dorsal; F, caudal appendage and adhesive tube segments, dorsal; G, dorsal scale. Scale bars = 20 μm (A, E) and 10 μm (B-D, F, G).

distinctly three-lobed with well-developed cephalion (27.0-30.3 μm wide), bearing one pair of extensional pleurae (12.3-15.5 μm long), two long lateral cephalic cilia, and 3-4 dorso-anterior cilia. Two pairs of dorsal bristles inserted on the neck and posterior end. Mouth ring reaching 5.8-6.4 μm in diameter. A pair of ciliary tufts lateral to mouth. Ventral hypostomion bent posteriorly. Neck constricted, 17.4-20.7 μm wide. Pharynx pear-formed, and comparatively short (41.0-43.2 μm long, 16U). Cuticular scales in 20-22 longitudinal rows, each composed of 45-48 scales; all the dorsal, lateral and ventrolateral scales in the form of oblong pear furnished with short peduncle anteriorly; surface of each scale rather smooth; scales gradually increasing posteriorly (3.2-3.9/6.1-7.7 μm long in head/trunk). Pair of ventral locomotory cilia bands running parallel along whole body; interciliary area arranged with 10-11 longitudinal rows of scales, similar to dorsal scales about a little smaller. Trunk 27.7-31.6 μm wide (11-12U), narrowing at its rear. Adhesive appendage (toe) extremely elongated, 76.5-80.0 μm long (28-31U), less than one third to a quarter of total body length; each appendage equipped with 20-22 simple adhesive tube segments as a series of knots, not bearing any spine or hair, however, when observed under scanning electron microscope, each tube bearing 4 longitudinal ridges forming a pointed protrusion.

Remarks. Up to the present, 15 species have been known in the genus *Polymerurus*. *P. rhomboides* is readily separated from its congeners by the following combination of characteristics: (1) furca length ranging between a third to a fourth of whole body, (2) the shape of scales, (3) adhesive tube consisting of 20-22 simple tube segments. Our specimens fitted well with the redescription of Schwank' (1990) except that the edges of cephalion and pleurae were a little produced than those of Schwank's. This is the first report in East Asia, although *P. rhomboides* is known as cosmopolitan.

Korean specimens were collected from the saprobic, stagnant, and marshy pond in summer.

Distribution. Italy, England, Bulgaria, Poland, Rumania, Russia, Canada, U.S.A., Argentina, Korea.

2. *Polymerurus nodicaudus* (Voigt, 1901) (Fig. 1E-G)

Chaetonotus nodicaudus Voigt, 1901, p. 193; Grünspan, 1910, p. 285, fig. 32; Saito, 1937 p. 247, fig. 1.

Polymerurus nodicaudus var. *comatus* Greuter, 1917, p. 53, t. 3, fig. 5; Rudescu, 1967, p. 121, fig. 59; Balsamo, 1978, p. 97, fig. 1.

Polymerurus nodicaudus: Rudescu, 1967, p. 120, fig. 58; Kisielewski, 1981, p. 96; Kisielewski, 1991, p. 84; Schwank, 1990, p. 66, fig. 24; Sudzuki, 1992, p. 44, 68, Pl. VII, figs. 8, 9.

Material examined. 1 ind., Kumho R., Hayang, Kyungsan, 4 Sep. 1995; 1 ind., Munchonji reservoir, Taegu Univ., 13 Sep. 1995; 1 ind., Joman bridge, West-Naktong R., 21 Aug. 1997; 1 ind., streamlet of Okchunsa temple, 5 June 1999; 1 ind., marsh of Oksansowon, Angang, Pohang, 1 Dec. 1999.

Description. Body elongate, about 315.5-462.0 μm long including posterior adhesive appendage. Head, 32.3-48.6 μm wide, clearly three-lobed with well-developed cephalion protruding dorsoposteriorly, paired elongate pleurae and two pairs of ciliary tufts, one of which located on anterodorsal part of head, another between cephalic lobe and cephalion. Two pairs of dorsal

bristles, 1.7–14.8 μm long, inserted on neck and posterior end of trunk. Hypostomium forming a weak transverse furrow. Mouth ring 8.4–12.6.0 μm in diameter. Neck very short, slightly constricted, 20.6–38.6 μm wide. Pharynx narrow, 52.3–82.5 μm in length (17–18U), about 1/6 of whole body. Trunk parallel along whole body, 29.7–67.0 μm wide. Dorsal surface covered with pentagonal cuticular scales in 18–23 longitudinal rows, each consisting of up to 30–38 scales; posterior edge of each scale concave, bearing a spine. Spines of scales gradually increasing posteriorly and mesially at hind part of trunk. 4–5 small keeled scales without spine, assembled at basis of caudal appendage. Adhesive appendage much elongated, 78.7–114.4 μm long (25U) with 16–19 complete tube segments, furnished with short seta at every notch of both inner and outer edges.

Remarks. No remarkable difference was found between European and our specimens except (1) the concave posterior edge of dorsal scales shown as splitted owing to their extreme concavity, (2) fewer scales consisting of every longitudinal row (30–38 scales in our specimens while 50–60 in Europeans), and (3) bearing 4–5 keeled scales without spine at the basis of caudal appendage.

Korean specimens were collected from the marshy debris of streamside or swamp.

Distribution. Germany, England, Italy, Hungary, Poland, Rumania, Russia, India, Canada, U.S.A., Brazil, Japan, Korea.

Genus *Lepidodermella* Blake, 1933

3. *Lepidodermella squamata* (Dujardin, 1841) (Fig. 2)

Chaetonotus squammatus Dujardin, 1841, p. 569, fig. 8 (cited from Schwank, 1990).

Lepidoderma squammatum: Zelinka, 1889, p. 300.

Lepidoderma squamatum: Saito, 1937 p. 257; Beauchamp, 1965, p. 1400, fig. 1125b; D'Hondt, 1967, p. 383; Grünspan, 1910, p. 248, fig. 10; Remane, 1936, p. 93, figs. 93, 202.

Lepidodermella squamatum: Rudescu, 1967, p. 243, fig. 132; Balsamo, 1978, p. 141, fig. 13; Balsamo, 1980, p. 567; Kisielewski, 1981, p. 79.

Lepidodermella squamata: Weiss and Levy, 1979, p. 302; Amato and Weiss, 1982, p. 229, figs. 1–6; Hummon, 1984, p. 619.

Lepidodermella squamata: Weiss, 1988, p. 369; Bertolani and Balsamo, 1989, p. 91; Schwank, 1990, p. 85, fig. 33; Kisielewski, 1991, p. 69, tab. 30.

Material examined. 2 inds., Munchonji reservoir, Taegu Univ., 29 Apr. 1994; 1 ind., same locality, 31 May 1994; 1 ind., bog in Taegu Univ., 31 May 1994; 1 ind., submerged mosses at Wachon, Kyungsan, 18 July 1994; 1 ind., bog under Tamra Bridge, Kwanumsa temple, Cheju I., 16 June 1999; 9 inds., Chonjeyon fall, Cheju I., 16 June 1999; 1 ind., stream and bog of Wunmoonsa valley, 10 July 1999; 1 ind., Yongso valley, Hongchun, 27 July 1999; 4 inds., Ssangsaeng fall, Mt. Naeyon, Youngduk, 11 Aug. 1999; 1 ind., ditch, Mt. Cheundung, Wanju, 14 Sep. 1999; 1 ind., bog at Gomgol valley, Jangsu, 4 Sep. 1999; 1 ind., Yukmojung valley, Namwon, 4 Sep. 1999; 3 inds., stream near Hwansun cave, Samchok, 9 Oct. 1999; 1 ind., spring at Chiljangsa temple, Ansong, 15 Oct. 1999; 2 inds., Okjung spring, Hadong, 26 Oct. 1999; 4 inds., Oeo reservoir, Pohang, 28 Nov. 1999; 1 ind., Jangchuck reservoir, Changnyong, 13 Jan. 2000; 2 inds., pond, Haeje, Muan, 14 Jan. 2000.

Description. Body slender, 153.0–161.3 μm in length, divided into head, neck and trunk, 23.0–

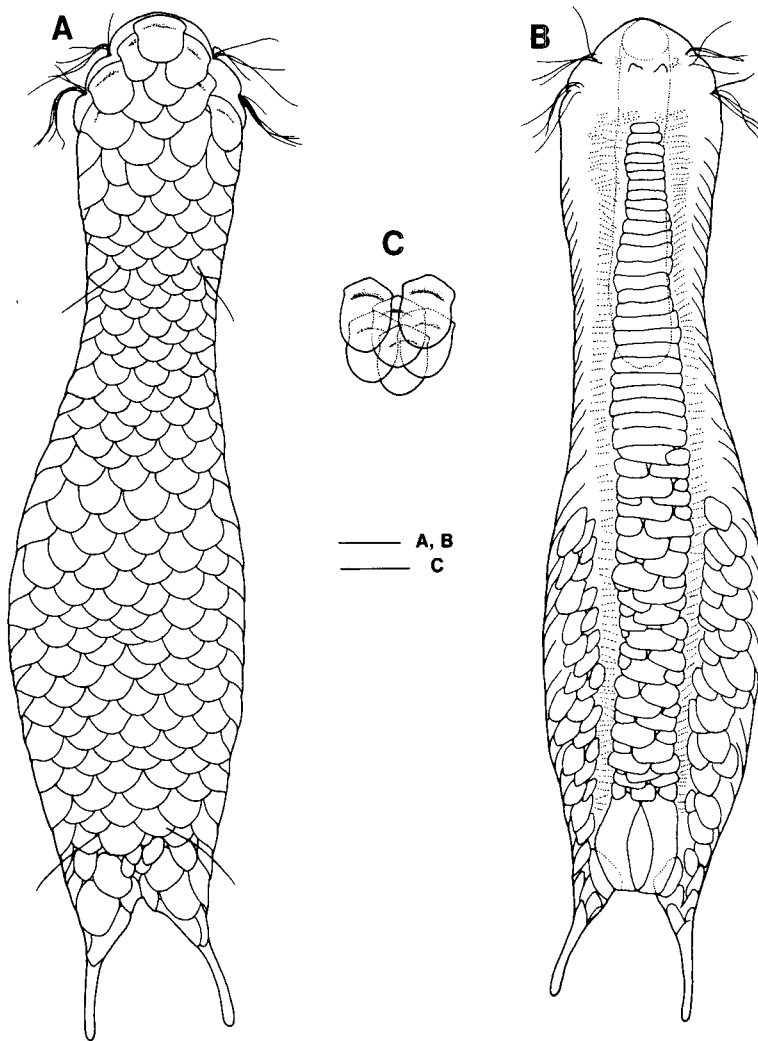


Fig. 2. A-C, *Lepidodermella squamata* (Dujardin): A, habitus, dorsal; B, habitus, ventral; C, dorsal scales. Scale bars = 10 μ m.

26.5 μ m/18.0-21.3 μ m/29.0-35.5 μ m in width. Head roundish, five-lobed with two pairs of cephalic cilia tufts. Two pairs of sensory dorsal bristles inserted on eighth scale and posterior end. Hypostomion represented by weakly paired teeth without transverse furrow. Mouth ring, 7.7 μ m in diameter. Pharynx narrow, 33.0-50.3 μ m in length (22-32U). Covered with cuticular scales devoid of spine or keel, and distributed in 7-8 longitudinal rows, each consisting of 27-29 scales; scales oblong oval, anterior edges of dorsal ones convexed, and strongly overlapped each other. Ventral band of locomotory cilia extending along whole body. Pharyngeal region of ventral field between ciliary bands stacked by a series of 26 plates; at intestinal region, arranged with 2-3 longitudinal rows of rectangular plates narrower than those in pharyngeal region; terminating with a pair of big, elliptical scales. Adhesive appendage straight, 15.5-16.0 μ m in length (10U), covered with scales

excluding adhesive tubes.

Remarks. The genus *Lepidodermella*, characteristic in the five-lobed head and the oval or roundish pentagonal dorsal scales flattened without keel and spine, was displaced from *Lepidoderma*, for the latter had been already used for an eurypterid name of *Lepidoderma* Reuss, 1856. The specific name of this species, which had been spelled as *squamatus*, *squamatus*, *squamatum*, *squamata* and *squamata*, was settled as *squamata* by Weiss (1988).

This species was known as ubiquitous in the various freshwater bodies like bogs, swamps, springs, and streams.

Distribution. Italy, England, Norway, Switzerland, Sweden, Bulgaria, Hungary, Poland, Rumania, Russia, Africa, India, North America, Brazil, Uruguay, Japan, Korea.

Genus *Chaetonotus* Ehrenberg, 1831

Subgenus *Zonochaeta* Remane, 1927

4. *Chaetonotus (Zonochaeta) succinctus* Voigt, 1902 (Fig. 3A-I)

Chaetonotus succinctus Voigt, 1902, p. 117; Voigt, 1904, p. 141, figs. 46, 50; Saito, 1937, p. 4, fig. 2; Rudescu, 1967, p. 152, fig. 79; Nesteruk, 1986, p. 220; Kisielewski and Kisieleska, 1986, p. 271.

Chaetonotus (Zonochaeta) succinctus: Remane, 1936, p. 189, fig. 177; Kisielewski, 1981, p. 63; Schwank, 1990, p. 118, fig. 48; Kisielewski, 1991, p. 60.

Material examined. 1 ind., Aejih pond, Taegu Univ., 11 Aug. 1999; 1 ind., same locality, 21 Aug. 1999; 1 ind., same locality, 1 Sep. 1999.

Description. Body stocky, total length about 191.6–206.5 μm . Width of head/neck/trunk 31.0–34.5/21.6–31.2/51.9–56.8 μm (16–17/11–15/27–28U), respectively. Head distinctly five-lobed with four tufts of cephalic cilia, and anterior pleurae smaller than posterior one. Three pairs of dorsal bristles inserted on head, neck and posterior end of trunk. Hypostomion trapeziform. Pharynx 42.0–50.0 μm long, showing a conspicuous bulb at both ends. Dorsal surface covered with 9–10 longitudinal rows of scales; each row composed of 21–25 rhomboid scales; scale bearing a median keel, and posterior edge convexed with very short spiny process. At anterior 2/5 of body length (U39–42), a dorsal series (or a transverse row of 9 dorsal scales) arranged with oblong after pentagonal scales alternately, each armed with long, thick and simple spine; spines on oblong scales a little longer (48.1–54.8 μm) than those of pentagonal ones (44.1–51.0 μm long); the scales in next two rows much elongated (about 1.7 times longer than posterior ones). Ventral interciliary area disposed of a stack of 13–14 smooth, rectangular plates in pharynx region, followed by small scales with spines, densely arranged in 16–18 longitudinal rows at intestinal region. Two pairs of long simple spines locating at posterolateral part (U67–70 and U80–84) of trunk, anterior pair (34.2–38.1 μm long) shorter than posterior ones (40.0–46.5 μm). Caudal adhesive tubes thin and straight, 22.3–25.2 μm long.

Remarks. *Chaetonotus (Z.) succinctus* is readily separated from its congeners by the following combination of characteristics: (1) 9 expansional dorsal spines simple, (2) bearing rhomboidal keeled scales with posterior edges convexed, furnishing with short spiny process, (3) possessing a row of smooth, rectangular plates in the interciliary area at pharyngeal region. Our specimens were coincided with the characteristics above, but different from European ones by the peculiar pattern

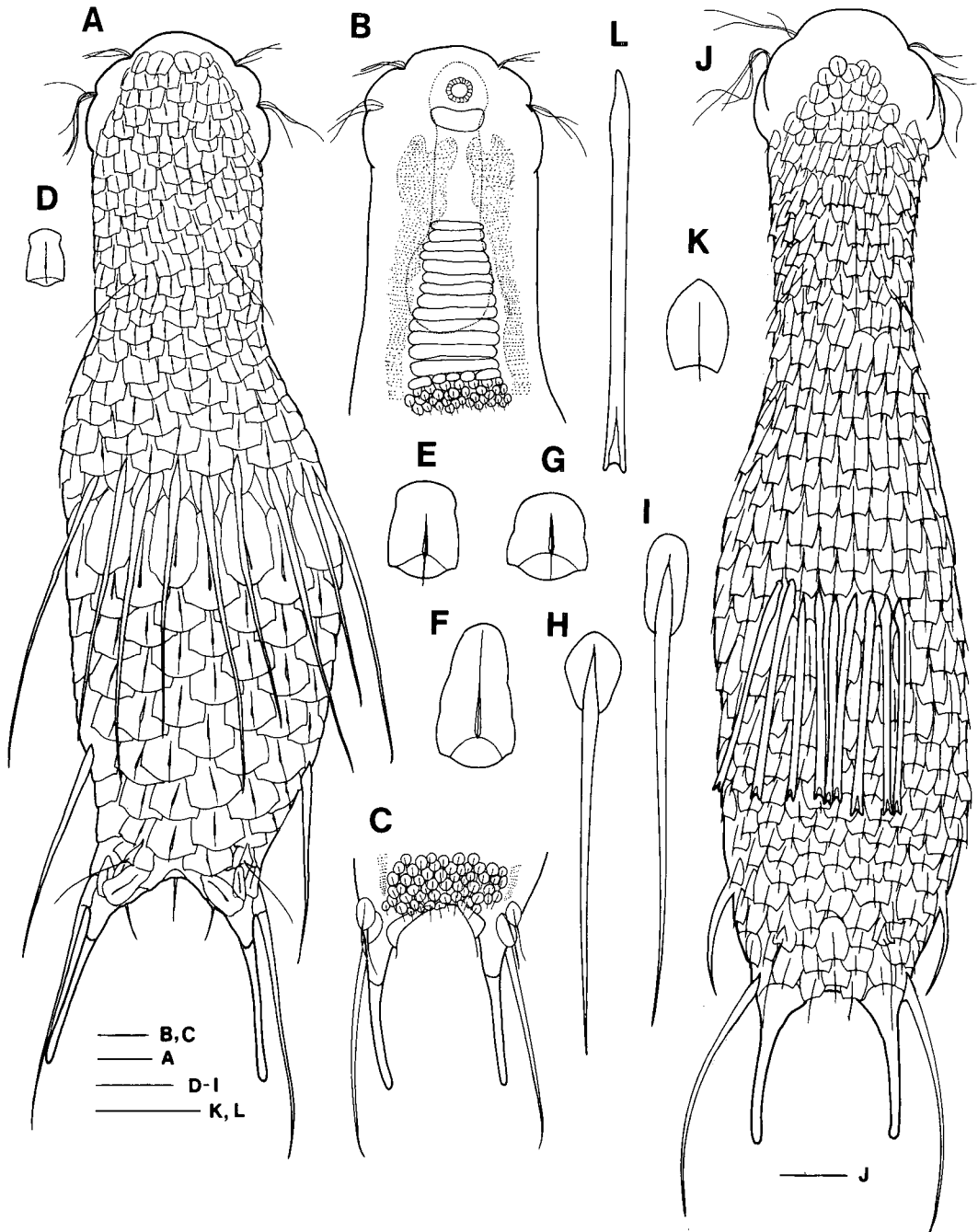


Fig. 3. A-I, *Chaetonotus (Zonochaeta) succinctus* Voigt: A, habitus, dorsal; B, hypostomium and intercalary scales; C, posterior part of trunk, ventral; D, scale on head; E, scale on neck; F-G, scales on trunk; H-I, long spined scales. J-L, *Chaetonotus (Z.) bisacer* Greuter: J, habitus, dorsal; K, dorsal scale; L, long spined scale. Scale bars = 10 μ m.

of the arrangement of dorsal scales, that is, oblong ones after pentagonal ones alternately, each with different length of spine, moreover, by the posterior pair of posterolateral spines relatively short (about 1.2-1.4 times longer than the anterior pair in our specimens while about twice longer in Europeans).

Korean specimens were collected among plant debris at a swampy pond.

Distribution. France, Italy, Norway, Bulgaria, Poland, Rumania, Russia, U.S.A., Japan, Korea.

5. *Chaetonotus (Zonochaeta) bisacer* Greuter, 1917 (Fig. 3J-L)

Chaetonotus bisacer Greuter, 1917, p. 64, fig. 20; Rudescu, 1967, p. 145, fig. 73; Kisielewski, 1979, p. 421.

Chaetonotus truncatus: Saito, 1937, p. 5, fig. 3.

Chaetonotus gurgueto: Grosso, 1973, p. 134, fig. 2 (cited from Schwank, 1990).

Chaetonotus (Zonochaeta) bisacer: Remane, 1936, p. 190, fig. 178; Kisielewski, 1981, p. 62; Schwank, 1990, p. 120, fig. 49; Kisielewski, 1991, p. 58, tab. 24, fig. 70.

Material examined. 1 ind., Okchonsa temple, Mt. Yonhwa, Kosung, 8 May 1999; 5 inds., same locality, 5 June 1999; 1 ind., streamlet at Kwaneumsa valley, Mt. Halla, Cheju I., 16 June 1999; 2 inds., Wolsongjung lake, Uljin, 8 Oct. 1999.

Description. Body slender, 165.2-189.0 μm in length, 28.4-39.5 μm in width. Head 27.7-29.0 μm wide, five-lobed with cephalion, pleurae and 4 ciliary tufts, posterior one of which longer than anterior one. Hypostomion present. Pharynx 37.5-42.6 μm in length (23U), swollen towards both anterior and posterior end. Body covered with 9-11 longitudinal rows of hemi-elliptic scales with keels and concave posterior edges, and generally with spiny process. Near middle of trunk (U43), located a transverse band of 9 lanceolate dorsal scales (or of 6 scales in one specimen), each armed with long, thick, straight spine with bifurcated apex, ranging 30.0-39.4 μm in length (18-21U). Two pairs of extended spines each locating at lateral edge of posterior fifth and at laterodistal edge of trunk; anterior spine about half the length of posterior one (19.0-23.6 μm versus 39.5-45.2 μm); a pair of ventrolateral spines located between them, slenderer than the two pairs above. Two pairs of dorsal bristles inserted on neck and on two scales each with two keels near posterior end. Interciliary field covered with 11-12 longitudinal rows of scales with mesial keel both on pharyngeal and intestinal region; several spiny scales present along hind margin. Caudal adhesive tubes 17.4-18.3 μm long (10-11U).

Remarks. The number of spines on the transverse band at mid-trunk and the length of these spines were somewhat variable. The number of spines on the transverse band was recorded as in the range of 5-20 (generally 9). Our specimens were well coincided with the description of *C. truncatus*, a junior synonym of this species, that was recorded from Hiroshima, Japan by Saito (1937), especially in the number of extended spines with bifurcated posterior end, pharyngeal length and the shape of scales as well as general body shape.

Korean specimens were collected from the washings of bottom sediments and submerged plant materials around streamlets and eutrophicated lake.

Distribution. Switzerland, Germany, Italy, England, Bulgaria, Poland, Rumania, Russia, Japan, Canada, U.S.A., Argentina, Brazil, Korea.

Subgenus *Euchaetonotus* Schwank, 1990

6. *Chaetonotus (Euchaetonotus) polyspinosus* Greuter, 1917 (Fig. 4A-D)

Chaetonotus polyspinosus Greuter, 1917, p. 50, fig. 3; D'Hondt, 1967, p. 388; Rudescu, 1967, p. 209, fig. 112; Kisielewski, 1991, p. 20, tab. 6, figs. 11, 15, 19, 23; Nesteruk, 1986, p. 219; Balsamo, 1990, p. 174.

Chaetonotus (Euchaetonotus) polyspinosus: Schwank, 1990 p. 155, fig. 67; Balsamo and Fregni, 1995, p. 167.

Material examined. 2 inds., pond at Pusan Women's Univ., 3 June 1995; 3 inds., a streamlet, Choneunsa temple, Wonju, 26 July 1999; 3 inds., Ssangsaeng fall, Mt. Naeyeoun, Youngduk, 11 Aug. 1999.

Description. Body slender and elongated, about 220.4-273.9 μm in length. Head, 33.5-40.3 μm wide, five-lobed with a cephalion protruding dorsoposteriorly, well-developed pleurae and 4 ciliary tufts. Two pairs of dorsal bristles present. Hypostomion represented by paired teeth laterally. Pharynx 66.3-72.8 μm in length (27-30U), weakly swollen towards posterior end. Trunk width 53.8 μm in maximum width, decreasing posteriorly. Dorsal cuticular scales in 20-23 longitudinal rows, each column with up to 41-46 arrow-shaped scales with median keel and thin spine; spines appearing short, ranging 3.2-6.3 μm in length, from head to trunk, while 5 to 6 pairs of terminal spines suddenly become longer (9.3-15.6 μm) and thicker at base of caudal appendages. Ventral field covered with cuticular scales both on intestinal and pharyngeal region, similar to dorsal structure but different in the lower number (10-11 longitudinal rows) and size smaller than dorsal ones. Caudal appendages consisting of straight and thin adhesive tubes, 21.9-22.6 μm long (8-10U).

Remarks. Body length, the shape of scales and pleurae, and the scale arrangement of *C. (E.) polyspinosus* showed somewhat wide individual variability, as in *C. (E.) zelinkai* and *C. (Z.) heterospinosus*. This species is most close to *C. (E.) brevisetosus* Roszczack, in having the five-lobed head, the shape and number of longitudinal row of scales, but differs from it in the body length and the number of thick and long spines at base of caudal appendages, and the starting points of spines on the scales of trunk.

Distribution. Switzerland, Germany, Italy, England, France, Rumania, Russia, Canada, Korea.

7. *Chaetonotus (Euchaetonotus) heterospinosus* Balsamo, 1978 (Fig. 4E-I)

Chaetonotus heterospinosus Balsamo, 1978, p. 118, fig. 7; Balsamo, 1990, p. 173.

Chaetonotus (Euchaetonotus) heterospinosus: Schwank, 1990, p. 202, fig. 93; Balsamo and Todaro, 1995, p. 14.

Material examined. 13 inds., Kumho R., Hayang, Kyungsan, 12 Sep. 1995; 3 inds., Aejiho pond, Taegu Univ., 1 Sep. 1999.

Description. Body shape variable, slender or stout, about 187.7-215.0 μm in length, 35.5-52.9 μm in width. Head five-lobed with protruding posterior pleurae and well-developed cephalion; furnished with two-paired tufts of cephalic cilia, and three to five sensory cilia on dorsoanterior portion. Two pairs of dorsal bristles present, one on neck inserted between scales, while another on trunk issued from double-keeled scales. Hypostomion absent. Pharynx 56.8-61.8 μm in length (29-30U), narrowest at its middle, and both ends weakly dilated. Scales, rectangular to slightly

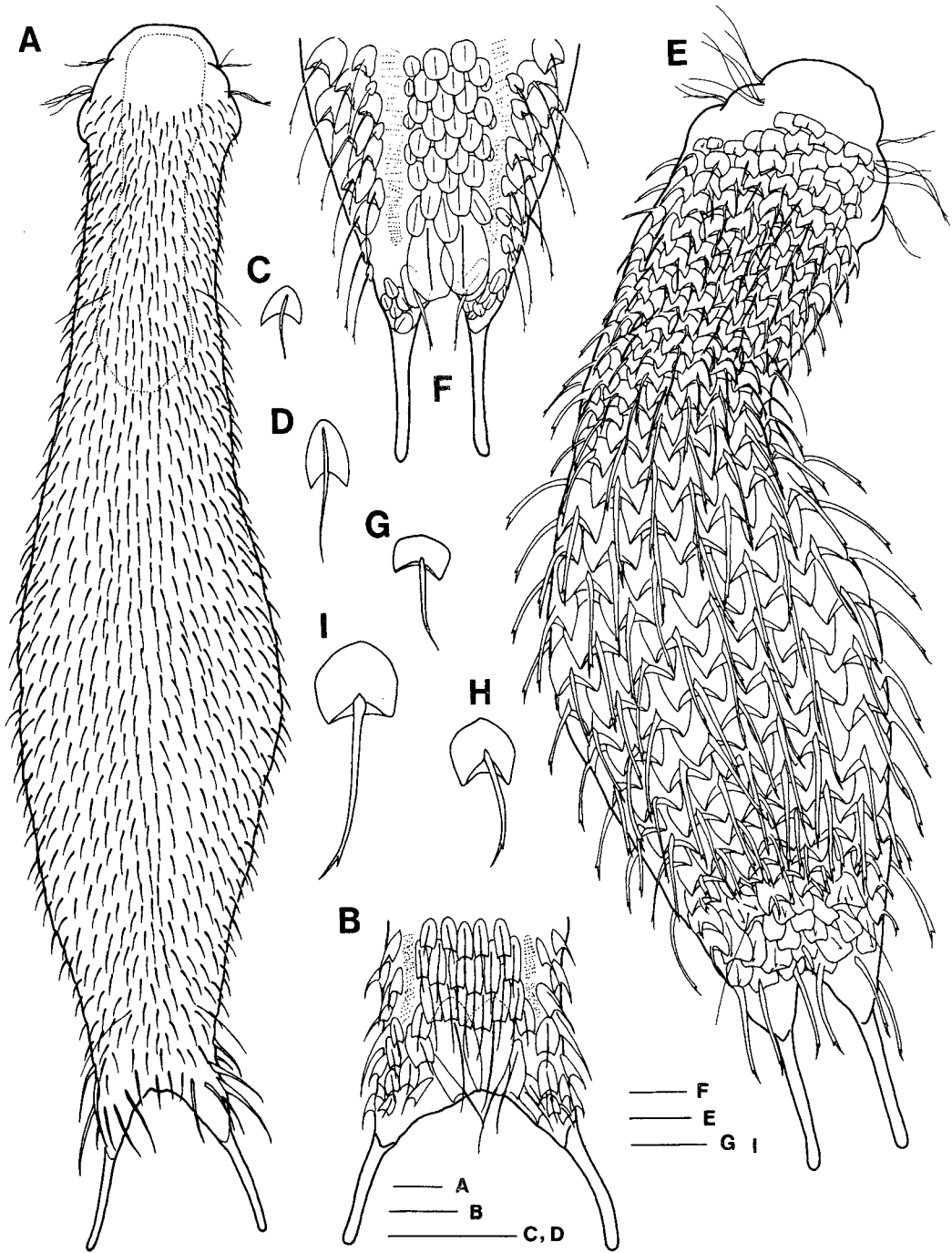


Fig. 4. A-D, *Chaetonotus (Euchaetonotus) polyspinosus* Greuter: A, habitus, dorsal; B, posterior trunk, ventral; C, scale on head; D, scale on trunk. E-I, *Chaetonotus (E.) heterospinosus* Balsamo: E, habitus, dorsal; F, intercalary scales and posterior trunk, ventral; G, scale on head; H, scale on neck; I, scale on trunk. Scale bars = 10 μ m.

pentagonal, arranged in 9-11 longitudinal rows, each composed of 22-24 scales; at forehead, scales either with incomplete keel or naked, and spines absent in some specimens; dorsal and lateral spines moderately thick, each bearing a lateral denticle inserted near tip; ventrolateral spines of 3 longitudinal rows, a little longer and thinner than dorsal and lateral ones; spine lengths at head/neck/trunk 2.3-3.2/4.6-7.2/16.1-21.0 μm , respectively, and distinctly increasing posteriorly, then intermittedly decreased, before three pairs of elongate spines (13.9-17.7 μm long) anterior to base of caudal appendage. Ventral field covered with 4 to 8 longitudinal rows of keeled scales, and with a pair of extensive scales and a pair of spiny ones near terminal margin. Caudal appendage 33.6-34.2 μm long, including straight adhesive tube.

Occurred from the washings of submerged plant materials or organic debris at the swampy pond and the bog of streamside.

Remarks. Our specimens were most coincided with '*Chaetonotus (Euchaetonotus) cfr. heterospinosus* (forma B)' (sensu Balsamo, 1980) among four variable forms considering the body length, the shape of dorsal scales and the arrangement of ventral scales in the intercalary region, but discernible from it in the number of scales with prolonged spine at base of caudal appendage.

Distribution. Italy, Korea.

8. *Chaetonotus (Euchaetonotus) heideri* Brehm, 1917 (Fig. 5A-F)

Chaetonotus heideri Brehm, 1917, p. 315; Rudescu, 1967, p. 196, fig. 104; Balsamo, 1978, p. 103, fig. 3; Balsamo, 1990, p. 173; Kisielewski, 1981, p. 29; Kisielewski, 1991, p. 17, tab. 3.

Chaetonotus (Chaetonotus) heideri: Bertolani and Balsamo, 1989, p. 91.

Chaetonotus (Euchaetonotus) heideri: Schwank, 1990, p. 208, figs. 96, 97.

Material examined. 1 ind., Suta Valley, Mt. Kongjak, Hongchun, 4 Apr. 1999; 1 ind., Nakdong R. (under Kungok bridge), Andong, 29 July 1999; 2 inds., stream in Mt. Hwam, Soonchang, 4 Sep. 1999; 1 ind., ditch near Mt. Chondung, Okchun, 14 Sep. 1999; 3 inds., Yukmojung valley, Namwon, 4 Sep. 1999; 5 inds., Hyungsan R., Angang, Pohang, 1 Oct. 1999; 1 ind., stream behind Kumsansa temple, Mt. Moak, 29 Oct. 1999; 1 ind., Heebangsa valley, Youngju, 13 Nov. 1999; 2 inds., ditch under Bingsanji reservoir, Yesan, 19 Nov. 1999.

Description. Body stumpy, 167.0-183.0 μm in length, including caudal adhesive tube (22.0-24.2 μm , 13U). Head indistinctly five-lobed with small cephalion, 29.7-32.3 μm (16-19U) in width. 4 tufts inserted between cephalic lobes, each comprising 4-5 short cilia. Pharynx cylindrical, 44.5-47.1 μm long (26-28U), less than one third of total body length, weakly swollen towards posterior end (12.9-19.2 μm in maximum width). Two pairs of sensory bristles, frontal one originating between neck scales while caudal one from shortly spined or bifurcately spined scales. Hypostomion absent. Dorsal cuticular scales heart-shaped to pentagonal with sleazy membrane around anterior half, arranged in 7-8 longitudinal rows, each composed of 19-21 scales; spine issuing evidently from behind of center of scale, furnished with denticle between a half and distal third of whole armature, to branch off a thin, upward secondary spine. Paired bands of ventral locomotory cilia extending through whole body; intercalary field ornamented with roundish scales, each bearing a spine, arranged in 6-7 longitudinal rows, and with a pair (or 4 in a few specimens examined) of extended scales with long spine (16.7-19.4 μm) near distal end of trunk.

Occurred from the washings of submerged plant material (esp. fallen leaves) mostly at

mountainous streams or ditches.

Remarks. This species seems to be most close to *C. (E.) cordiformis* Greuter considering the five-lobed head, the shape and number of scales, and the spines with denticle, but is easily distinguished from it by the ratio of pharynx length (about one third of total body length) and the sprouting pattern of secondary spine. In a few Korean specimens were observed the characteristics of 'forma D' mentioned by Balsamo (1980): (1) four extended scales with long spine occurred ventrodistally, (2) a pair of caudal sensory bristle issuing from the scales with the bifurcate spine, not from double-keeled scales. Furthermore, our specimens showed a discrepancy with Schwank's (1990) in having

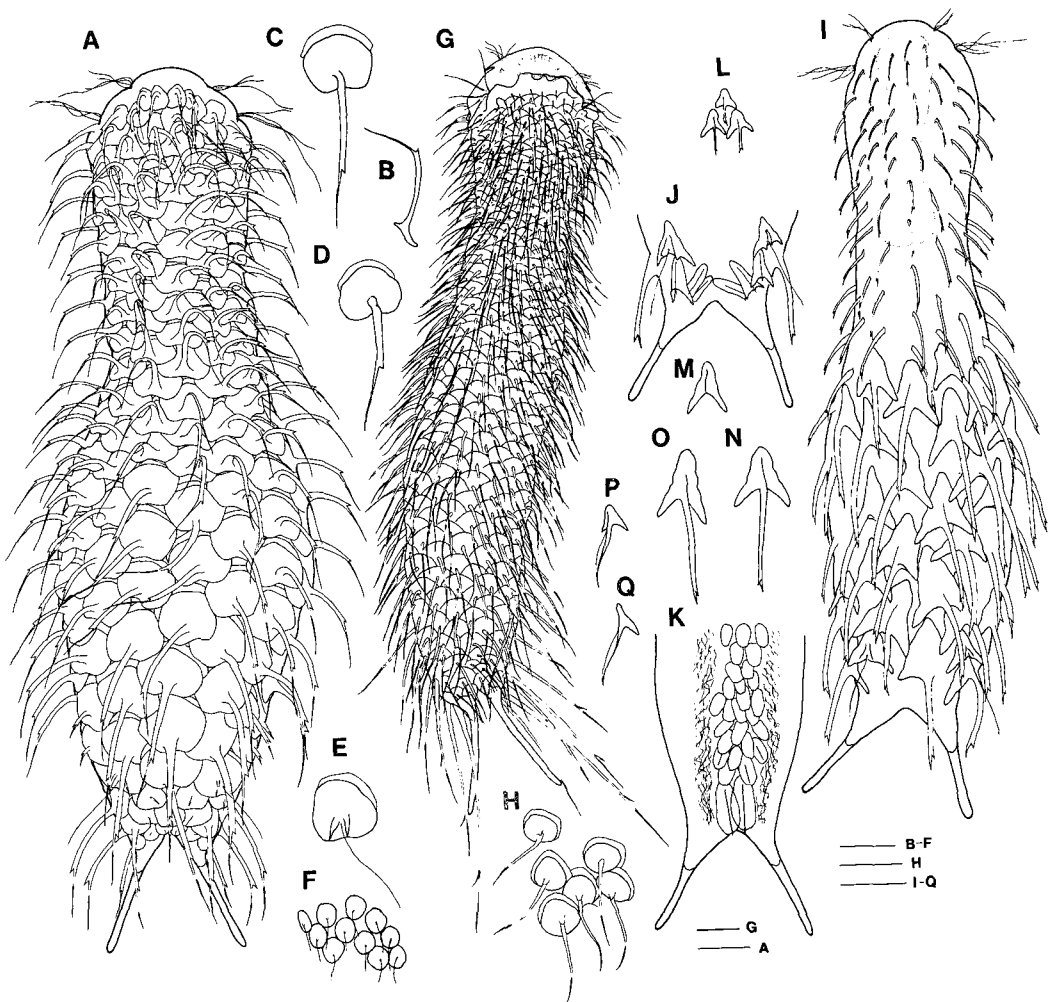


Fig. 5. A-F, *Chaetonotus (Euchaetonotus) heideri* Brehm: A, habitus, dorsal; B-D, dorsal scales on trunk; E, scale issuing sensory bristle; F, interciliary scales. G-H, *Chaetonotus (E.) zelinkai* Grünspan: G, habitus, dorsal; H, scales on trunk. I-Q, *Chaetonotus (Hystrichochoetonotus) persetosus* Zelinka: I, habitus, dorsal; J, hind trunk, dorsal; K, interciliary scales and posterior trunk, ventral; L, scale on head; M-O, scales on trunk; P-Q, ventrolateral scales. Scale bars = 10 μ m.

the ventral interciliary scales each furnished with spine against bearing the smooth or keeled scales in Schwank's.

Distribution. Germany, Switzerland, England, France, Italy, Poland, Rumania, Russia, North America, Korea.

9. *Chaetonotus (Euchaetonotus) zelinkai* Grünspan, 1908 (Fig. 5G-H)

Chaetonotus zelinkai Grünspan, 1908, p. 226, figs. 1, 7, 8, 10; Grünspan, 1910, p. 305, fig. 43; Saito, 1937, p. 52; Beauchamp, 1965, p. 1401, fig. 1126a; Kisielewski, 1981, p. 37; Balsamo, 1990, p. 173; Sudzuki, 1992, p. 68, figs. 5-7.

Chaetonotus zelinkai var. *gracensis*: Grünspan, 1910, p. 307, fig. 44

Chaetonotus (Euchaetonotus) zelinkai: Schwank, 1990, p. 211, fig. 98.

Material examined. 2 inds., Kumho R., Hayang, Kyungsan, 8. Aug. 1994; 2 inds., stream of Ssangchon valley, Mt. Sorak, 25 Aug. 1994; 2 inds., peat bog between Baekdamsa valley, Mt. Sorak, 26 Aug. 1994; 3 inds., submerged mosses at Wachon, Kyungsan, 1 Sep. 1994; 1 ind., submerged mosses at valley of Eunhaesa temple, Youngchon, 3 Oct. 1994; 3 inds., a dropwort field, Kachang, 5 Oct. 1994; 2 inds., bog at Yulsansewon, Kyungsan, 8 June 1995; 3 inds., stream at Janggoksa temple, Mt. Chilgap, Chongyang, 13 June 1995; 4 inds., pond at Changam valley, Misiryung, Mt. Sorak, 28 June 1995; 2 inds., spring at Kumsansa temple, Mt. Moak, Jeonju, 6 July 1995; 3 inds., Kumho R., Kyungan, 12 Sep. 1995; 1 ind., stream at Kosangol valley, Mt. Apsan, Taegu, 27 Sep. 1995; 2 inds., spring, Wolpo, Youngduk, 5 Oct. 1995; 2 inds., stream, Mt. Kumo, Kyungju, 14 Oct. 1995; 4 inds., bog between rocks at Baekhansa temple, Mt. Togyu, Muju, 13 Oct. 1995; 8 inds., Oeosa valley, Pohang, 29 May 1999; 5 inds., ditch, Kumjin, Youngduk, 30 June 1999; 1 ind., stream, Cheongdo, 10 July 1999; 1 ind., ditch, Suknamsa temple, Yangsan, 10 July 1999; 1 ind., Songgye valley, Mt. Worak, 26 July 1999; 2 inds., stream at Yonghungsa temple, Sangju, 26 July 1999; 2 inds., Suta valley, Mt. Kongjak, Hongchun, 27 July 1999; 4 inds., stream, Woljungsansa temple, Mt. Odae, 28 July 1999; 2 inds., Songchon valley, Mt. Odae, 28 July 1999; 2 inds., submerged fallen leaves, Banyasa temple, Mt. Baekhwa, Hwanggan, 13 Sep. 1999; 5 inds., stream at Murung valley, Mt. Duta, Samchuk, 9 Oct. 1999; 7 inds., stream at Dorisa temple, Sonsan, 14 Nov. 1999; 1 ind., stream, Mt. Suri, Gunpo, 8 Nov. 1999; 5 inds., swamp, Mt. Bongdae, Ulsan, 3 Dec. 1999.

Description. Body slender and elongate, 191.0-438.5 μm in length, width of head/neck/trunk, 32.3-69.5/30.3-53.5/31.0-77.5 μm (15-17U/12-16U/16-18U), respectively. Head indistinctly five-lobed with broad cephalion, two pairs of small pleurae, and two pairs of tufts; anterior tufts placed at anteroventral portion of cephalion, and posterior one (comparatively longer) dorsolaterally near pleurae. Pharynx 45.2-104.0 μm long (24-25U), about 1/4 of whole body, and slightly swollen at posterior end (17.0 μm wide). Two pairs of sensory bristles present. Hypostomion lacking. Cuticular scales ellipsoidal and heart-shaped, arranged in 10-11 longitudinal rows, each column in line with 33-35 scales; all scales clearly exhibiting "double" anterior edges with a simple spine, except posterolateral three pairs of bifurcate spines. Spines gradually increasing posteriorly, 6.6-10.0/11.3-28/23.9-43.0 μm long (2-3U/6U/10-13U) on head/neck/trunk, respectively; posterolateral three pairs with bifurcate spines becoming longer posteriorly (last pair longest, 65.6-128.3 μm long, 29-37U). Ventral locomotory ciliary bands running parallel along whole body; 5-

6 longitudinal rows of roundish scales with keel distributed in intercalary field. Caudal adhesive tubes slender, 34.4–66.8 μm long (15–18U).

Remarks. The shape and length of bifurcate terminal spines were shown much variable. *Chaetonotus zelinkai* var. *gracensis* shows some minor discrepancies in bearing lateral denticles on all dorsal spines as well as the three pairs of terminal spines. Our specimens fitted well with the redescription of Schwank (1990), except that a few specimens possessed more than three pairs of bifurcate spines on lateral and dorsoterminal region.

C. (E.) zelinkai is the most common and frequently occurring gastrotrichs in Korea as well as in Europe. It occurred usually among submerged plant materials from the various freshwater bodies from lowland areas to mountainous streams.

Distribution. England, Finland, Norway, Rumania, Hungary, Italy, North America, Japan, Korea.

Subgenus *Hystriochaetonotus* Schwank, 1990

10. *Chaetonotus (Hystriochaetonotus) persetosus* Zelinka, 1889 (Fig. 51-Q)

Chaetonotus persetosus Zelinka, 1889, p. 337, tab. 14, figs. 1–6; Grünspan, 1910, p. 281, figs. 27–29; Saito, 1937, p. 253, fig. 6; Rudescu, 1967, p. 162, fig. 84; Balsamo, 1978, p. 128, fig. 9; Kisielewski, 1991, p. 52, tab. 21, figs. 63, 64.

Chaetonotus (Chaetonotus) persetosus: Bertolani and Balsamo, 1989, p. 91

Chaetonotus (Hystriochaetonotus) persetosus: Schwank, 1990, p. 222, fig. 102.

Material examined. 1 ind., ditch near Laboratory of Forest, Kyungju, 4 Apr. 1999; 4 inds., same locality, 16 Apr. 1999; 1 ind., bog of Kwanumsa valley, Cheju, 16 Jun. 1999; 1 ind., ditch near Mt. Chondung, Okchun, 14 Sep. 1999; 1 ind., Hyungsan R., Angang, Pohang, 1 Oct. 1999; 1 ind., Murung valley, Mt. Duta, Samchok, 9 Oct. 1999; 4 inds., Mihochon R., Jinchon, 15 Oct. 1999; 1 ind., stream of Sonunsa temple, Kochang, 30 Oct. 1999; 3 inds., temporary pool near Kosapo beach, Puan, 30 Oct. 1999; 2 inds., stream of Hugok spring, Yanggu, 6 Nov. 1999; 3 inds., streamlet under Dorisa temple, Kumi, 14 Nov. 1999; 1 ind., Juppo reservoir, 20 Nov. 1999; 2 inds., swamp under Yongbong reservoir, Yesan, 19 Nov. 1999; 3 inds., ditch of Bingsanji reservoir, Yesan, 19 Nov. 1999; 3 inds., swamp at Mt. Bongdae, Ulsan, 3 Dec. 1999; 3 inds., stream at Jangansa temple, Kijang, 10 Dec. 1999.

Description. Body small 130.0–149.0 μm in length, 25.8–33.5 μm in width (20–22U). Head 20.0–23.2 μm wide (15–16U), weakly five-lobed with small cephalion and pleurae. Two pairs of tufts inserted between cephalic lobes, possessing 4–5 cilia. Hypostomion absent. Pharynx, 41.3 μm in length (28U), weakly bulbous at both ends. Two pairs of sensory bristles, frontal one originating between neck scales and caudal one from double-keeled scales. Dorsal cuticular scales in 5–6 longitudinal rows of trigonal scales; each row consisting of 13–15 scales, not overlapping each other; spines thick, straight, and bifurcated at posterior end; eighth or ninth dorsal scale from frontal, in the middle of trunk, appearing to most prominent (17.4–23.2 μm , 9–11U); posterior region of trunk ornamented with two pairs of scales bearing a keel only without spine, which followed by double-keeled scales with sensory bristles, and then other three pairs of keeled ones with spiny process. Ventrolateral spines thinner with hyaline membrane. Intercalary field covered with honeycomb-like simple scales without spine and keel, in 4–5 longitudinal rows, except several scales with keel, a pair of elongated scale with short spine. Caudal adhesive tube 9.7–12.9 μm

long (5-6U), about half of caudal appendage (16.1-22.6 μm long).

Korean specimens were obtained frequently from the small freshwater bodies richly accumulated with plant debris, especially from the eutrophicated bogs, temporary pools, marshes, and ditches.

Remarks. This species belongs to the *hystrix* group of subgenus *Hystricochaetonotus* by sharing the shape of scales, body shape and the arrangement of pattern of dorsal spines. *C. (H.) persetosus* is separated from its relatives by the following combination of characteristics: (1) the distinct trigonal scales similar to a plow, (2) the arrangement of elongated dorsal spines, (3) the membranous ventrolateral spines, (4) the honeycomb-like scale arrangement in intercalary region, (5) the number of longitudinal rows of dorsal scales. Our specimens fitted well with the original description of Zelinka (1889) except that the body length is relatively longer.

Distribution. Germany, England, Italy, Rumania, Bulgaria, Russia, Japan, Argentina, Korea.

A key to the species and genera of family Chaetonotidae from Korea

1. Body large and slender (usu. over 300 μm long); caudal appendage extremely long (more than 1/3 of body length) 2
 Body small and tenpin-shaped; caudal appendage short (less than 1/4 of body length) 3
2. Dorsal scales oblong or ellipsoidal without spine; caudal appendage bare without spines or hairs *Polymerurus rhomboides* (Stokes)
 Dorsal scales pentagonal or hexagonal with spine; caudal appendage with spines or hairs *P. nodicaudus* (Voigt)
3. Dorsal scales roundish pentagonal without any spine or keel *Lepidodermella squamata* (Dujardin)
 Dorsal scales oval or tri- to hexagonal with spine and keel 4 (genus *Chaetonotus*)
4. Dorsal scales trigonal, similar to a plow; dorsal spines becoming strikingly longer on the trunk *C. (Hystricochaetonotus) persetosus* Zelinka
 Dorsal scales hemi-elliptic; bearing a transverse row ("band") of extended spines on the middle of trunk 5 (subgenus *Zonochaeta*)
 Dorsal scales oval or heart-shaped; dorsal spines gradually increasing posteriorly 6 (subgenus *Euchaetonotus*)
5. Dorsal spines of the transverse band bifurcated (bearing lateral denticles) *C. (Z.) bisacer* Greuter
 Dorsal spines of the transverse band not bifurcated *C. (Z.) succinctus* Voigt
6. Dorsal scales without sleazy membrane along anterior margin 7
 Dorsal scales with sleazy membrane along anterior margin 8
7. Dorsal scales arrow-shaped with simple spine, arranged in 20-23 longitudinal rows *C. (E.) polyspinosus* Greuter
 Dorsal scales rectangular to slightly pentagonal, arranged in 9-11 longitudinal rows *C. (E.) heterospinosus* Balsamo
8. Dorsal spines with lateral denticles (bifurcated); spines not showing great divergence in size (relatively longer at middle of trunk) *C. (E.) heideri* Brehm
 Dorsal spines simple, except posterolateral three pairs with lateral denticles; posterolateral spines extremely elongated *C. (E.) zelinkai* Grünspan

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한국 담수산 복모류 Chaetonotidae과의 분류

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요 약

1994년 5월부터 남한의 다양한 담수역 65개 지점에서 채집한 표본들을 관찰한 결과 모두 10종의 담수산 복모류를 동정하였다: *Polymerurus rhomboides* (Stokes), *P. nodicaudus* (Voigt), *Lepidodermella squamata* (Dujardin), *Chaetonotus (Zonochaeta) succinctus* Voigt, *C. (Z.) bisacer* Greuter, *C. (Euchaetonotus) polyspinosus* Greuter, *C. (E.) heterospinosus* Balsamo, *C. (E.) heideri* Brehm, *C. (E.) zelinkai* Grünspan, and *C. (Hystricochaetonotus) persetosus* Zelinka. 저자들은 이들을 재기재하고 도판과 검색표를 작성하였다. 본 연구는 한국 담수산 복모류에 관한 최초의 기록이다.