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Systematic Study on Aspidochirotacea and Apodacea (Echinodermata: Holothuroidea) in Korea

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ABSTRACT

To clarify the taxonomy and the distribuftion on subclass Aspidochirotacea and Apodacea, the authors examined the materials which were collected from 48 localities during the period from 1962 to 1995. As a result, the specimens of holothurians are classified into 3 orders, 5 families and 8 species. Among them, the following 4 species are found to be new to the Korean fauna: *Molpadia oolitica, Paracaudina chilensis, Acaudina molpadioides* and *Caudina similis.*

Key words: Systematics, Aspidochirotacea, Apodacea, Holothuroidea, Korea.

INTRODUCTION

This work is the continuation of a systematic study on the Korean holothuroids. The first work on the Korean holothurians has been done by Mitsukuri (1912), who described only one species, *Stichopus japonicus*, from the eastern coasts of Korea. And then, 25 holothurian species were reported by Kamita and Sato (1941), Rho and Shin (1984), Yi (1985), Rho and Shin (1986), and Rho and Won (1993) in Korean waters. They consist of three orders, Dendrochirotida, Aspidochirotida and Apodida.

The materials for this work were collected from 48 localities (Fig. 1) during years 1962-1995 by the authors and others. They were identified eight holothurian species. Of which four species in order Molpadida turn out to be new to Korean fauna. The authors gave brief redescriptions and plates figures of them.

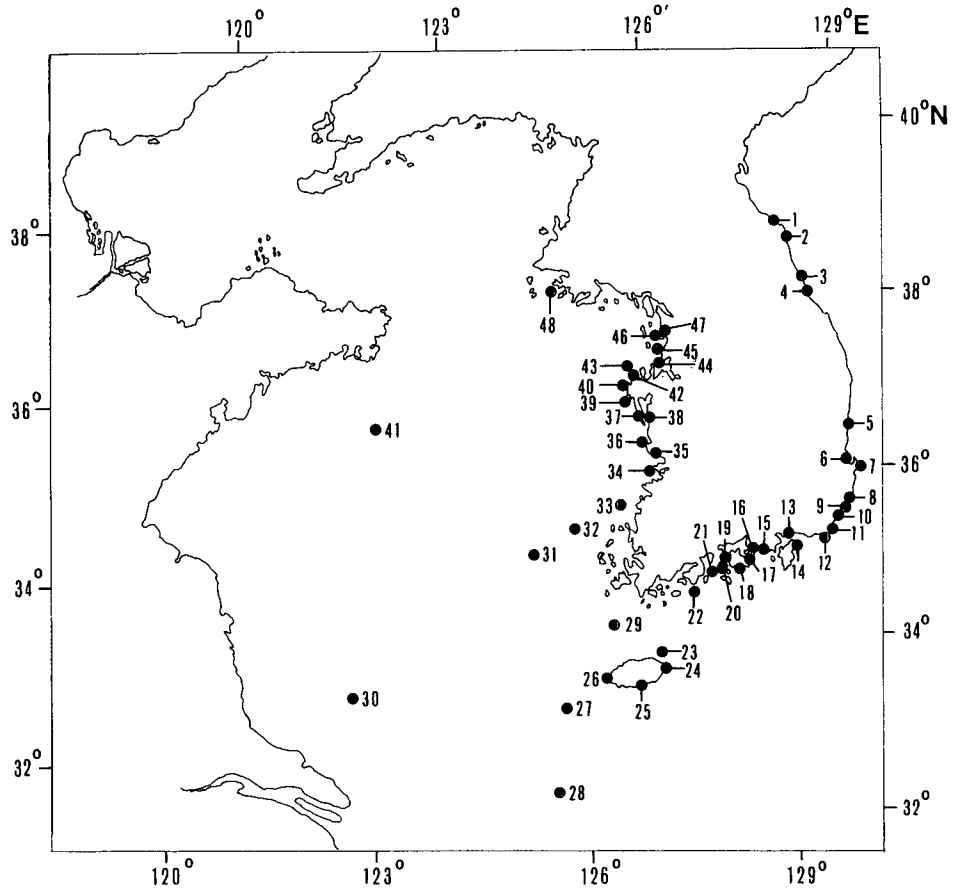

Fig. 1. Diagramatic map of Korea showing the sampling sites during the years 1962-1995. 1, Namae; 2, Kŏjin; 3, Tonghori; 4, Chumunjin; 5, Ch'uksan; 6, P'ohang; 7, Kuryongp'o; 8, Tangsari; 9, Pangŏjin; 10, Ch'undo; 11, Mip'o; 12, Namp'odong; 13, Tokdongri; 14, Esoodo; 15, Charando; 16, Nŭkdo; 17, Mijori; 18, Sangjuri; 19, Odongdo; 20, Tolsando; 21, Changkundo; 22, Changdo; 23, Udo; 24, Sŏngsanp'o; 25, Sŏgwip'o; 26, Mosŭlp'o; 27, 33°N, 125°50'E; 28, 32°N, 125°50'E; 29, Ch'ujado; 30, 33°N, 122°50'E; 31, Hongdo; 32, 35°N, 125° 50'E; 33, Anmado; 34, Piŭngdo; 35, Okp'o; 36, Maryangri; 37, Anmyŏndo; 38, Taech'ŏn; 39, Ŏch'ŏngdo; 40, Manrip'o; 41, 36°N, 122°50'E; 42, Seop'ori; 43, Tŏkchŏkto; 44, Chebudo; 45, Yŏnghŭngdo; 46, Chakyakto; 47, Inch'ŏn; 48, Taech'ŏngdo.

SYSTEMATIC ACCOUNT

The asterisk (*) indicate the species which were newly recorded in Korean fauna.

Phylum Echinodermata Klein, 1784 극피동물문
Class Holothuroidea de Balinville, 1834 해서강
Subclass Aspidochirotacea Grube, 1840 순수아강

Order Aspidochirotida Grube, 1840 순수목

Family Holothuriidae Ludwig, 1894 해삼과

Genus Holothuria Linné, 1758 해삼속

1. *Holothuria monacaria* (Lesson, 1830) 모나카리해삼

Psolus monacaria Lesson, 1830, p. 225.

Holothuria monacaria: Selenka, 1867, p. 331; Théel, 1885, p. 172, pl. 8, fig.10; Ludwig, 1888, p. 806; Bedford, 1898, p. 841; Sluiter, 1901, p. 11; Britten, 1906, p.128; Fisher, 1907, p. 659; Mitsukuri, 1912, p. 112; Ohshima, 1915, p. 247; 1919, p. 142; H.L. Clark, 1920, p. 150; Panning 1934, p. 69; 1951, p. 171; Rho and Shin, 1986, p. 247, pl. 1, figs. 1-11.

Stichopus gyrifer: Selenka, 1867, p. 319.

Holothuria fasciola: Selenka, 1867, p. 341.

Stichopus monacaria: Selenka, 1868, p. 117.

Holothuria minax: Théel, 1885, p. 173, pl. 8, fig. 8; Mitsukuri, 1896, p. 408.

Holothuria macleari: Mitsukuri, 1912, p. 98, textfig. 20.

Material examined. One specimen, Mijori, 31 Jul. 1980 (J.I. Song).

Distribution. Korea (South Sea, Cheju-do), Japan (Southern Honshu, Kyushu, Shikoku), and Indo-Pacific Ocean.

Family Stichopodiidae Haekel, 1896 돌기해삼과

Genus *Stichopus* Brandt, 1835 돌기해삼속

2. *Stichopus japonicus* Selenka, 1867 돌기해삼 **(Plate 1, Figs. 1-7)**

Stichopus japonicus Selenka, 1867, p. 318, p. 18, figs. 33-36; Marenzeller, 1881, p. 136, Pl. 5, fig. 11; Théel, 1885, pp. 160, 194, pl. 7, fig. 3; Mitsukuri, 1896, p. 408; 1897, p. 31; 1912, p. 163, pl. 4, figs. 32-44; Sluiter, 1901, p. 142; H. L. Clark, 1902, p. 563; 1920, p. 563; 1922. p. 61; Britten, 1906, p. 131; Augustin, 1908, p. 6, textfig. 4; Ohshima, 1915, p. 247; 1918, p. 144; Chang, 1934, p. 4; Chang and Liao, 1964, p. 32, figs. 1-3; Oguro, 1961, p. 1; Uchida et al., 1963, p. 27; Liao, 1979, p. 116; Rho and Shin, 1986, p. 249.

Holothuria armata: Selenka, 1867, p. 330, pl. 18, fig. 66.

Stichopus (*Holothuria*) *armatus*: Théel, 1885, p. 196; Mitsukuri, 1896, p. 408.

Stichopus japonicus var. *typicus*: Théel, 1885, p. 161, pl. 8, fig. 2.

Material examined. One specimen, Taech'ŏngdo, 21 May 1958 (H.S. Kim); 4 specimens, Changdo, 22 Jul. 1960; one specimen, Pangŏjin, 11 Jun. 1963 (J.I. Song & S.J.Yun); one specimen, P'ohang, 7 Aug. 1965 (M.S. Gang); 3 specimens, Mijori, 19 Jul. 1967 (B.J.Rho); 3 specimens, Kuryongp'o, 20 Jul. 1968; one specimen, Ŏch'ŏngdo, 31 May, 1969 (B.J.Rho); one specimen, Ch'ujado, 7 Aug. 1969; 2 specimens, Ch'uksan, 10 Aug. 1971 (B.J.Rho); one specimen, Tolsando, 29 Jun. 1974 (B.J. Rho); 4 specimens, Hongdo, 7 Jul. 1978 (B.J.Rho); two specimens, Inch'ŏn, 12 May, 1979; 5 specimen, Namp'odong, 15 May, 1980 (B.J.Rho); 3 specimens, Kŏjin, 21 Nov. 1980 (B.J. Rho & S. Shin); one specimen, Sangjuri, 20 Nov. 1980 (J.I. Song & S.J. Yun); one specimen, Sangjuri, 23 May, 1981 (J.I. Song); one specimen, Mip'o, 5 Jun, 1983 (S. Shin); one specimen, Mip'o, 12 Jan. 1984 (H.S. Han); 2 specimens, Chumunjin, 27 May 1985 (J.I. Song & S. J. Yun); one specimen, Sŏngsanp'o, 6 Jul. 1985 (J.J. Shim); one specimen, Sŏngsanp'o, 7 Oct. 1985 (J.E. Seo); 2 specimens, Mosŭlp'o, 6 Feb. 1986, (S. Shin); 2 specimens, Odongdo, 30 Jun,

1986 (J.E. Seo); many specimens, Anmyŏndo, 14 May, 1988; one specimen, Changkundo, 23 Jul. 1988 (B.J. Rho & J.W. Lee); one specimen, Sangjuri, 25 Apr. 1990 (B.J. Rho); 3 specimens, Namae, 3 Jun. 1990 (B.J. Rho & J.W.Lee); 6 specimens, Taech'ŏn, 3 Sep. 1991 (J.I. Choi); 6 specimens, Taech'ŏn, 15 Sep. 1991 (J.H. Won); one specimen, Sŏngsanp'o, 24 Oct. 1991 (J.I. Song & J.H. Won); one specimen, Sŏgwip'o, 26 Oct. 1991 (J.I. Song & J.H. Won); one specimen, Okp'o, 3 Jul. 1992 (J.H. Won); one specimen, Manrip'o, 12 Jul. 1992 (J.H. Won); one specimen, Charando, 13 Jul. 1994 (J.H. Won); 2 specimens, Taech'ŏn, 27 Nov. 1994 (J.H. Won); one specimen, Tŏkdongri, 11 Feb. 1995 (B.J. Rho); 5 specimens, Esoodo, 12 Feb. 1995 (S.S. Yeom); 5 specimens, Ch'undo, 14 Feb. 1995 (B.J. Rho); 5 specimens, Tangsari, 15 Feb. 1995 (B.J. Rho).

Description. Size of body variable, 1-2 cm in small, 20-30 cm in large but generally 15-20 cm (Pl. 1, Fig. 1). Cylinderic form. Tube feet developped ventrally to form a sole but in relaxed ones, their restriction in three ventral radii observed. Tube feet 5-8 rows in mid-ventral radius and 3-4 rows in two lateral radii but much crowded and difficult to distinguish. In dorsal, turbercles and papillae scattered but 7-8 tubercles each along the lateral side of sole. In relaxed one, turbercles and papillae cone-shaped. Tentacles 20 in number and anterior end of body with 35-45 papillae. Color of body very diverse, yellow, green, red or dark brown. Tentacular ampullae, respiratory tree, one Polian vesicle and one stone canal observed. Gonad of two tufts and each gonotubule very slender and a few branched.

Ossicles of body wall tables, disk 0.05-0.08 mm in diameter, spire 0.06-0.08 mm in height. Spire composed of 4 pillars with 4-8 teeth at end. In tube feet, tables and long plates (Pl. 1, Figs. 4, 5), which 0.13-0.2 x 0.03-0.06 mm, with holes in 6-13 pairs and irregular in outline so often rod-shaped. Large oval plates, 0.2-0.25 x 0.13-0.15 mm, also found in tube feet (Pl. 1, Fig. 7). Around some large holes, many smaller ones exist and their margin undulated. End plate 0.7-0.8 mm in diameter and very complex net-shaped (Pl. 1, Fig. 6). Tubercles and papillae with the same ossicles as tube feet but more reduced end plate. In tentacles, many curved rods found (Pl. 1, Fig. 3). Size variable 0.05-0.07 x 0.005-0.01 mm in small to 0.2-0.35 x 0.05-0.02 mm in large, and with many spines on surface. Ossicles gradually reduced with age. Calcareous ring simple (Pl.1, Fig.2).

Distribution. Korea (East Sea, South Sea, Cheju-do, Yellow Sea), Japan, Hong Kong, Sakhalin, and Vladivostok.

Remarks. This species has been already recorded in Korea (Mistukuri, 1912; Rho and Shin, 1986), but its description was not accomplished. So, in this paper, this species is described in detail.

Subclass Apodacea Brandt, 1835 무족아강

Order Apodida Brandt, 1835 무족목

Family Synaptidae Burmeister, 1837 닻해삼과

Genus Leptosynapta Verrill, 1867 찬닻해삼속

3. *Leptosynapta inhaerens* (O.F. Müller, 1776) 아기닻해삼

Synapta inhaerens O.F. Müller, 1776, p. 232

Synapta girardii: Pourtalés, 1851, p. 14.

Synapta inhaerens: Düben and Koren, 1846, p. 218, pl. 5, figs. 56-62; Herapath, 1865, p.4; Selenka, 1867, p. 364; Théel, 1885, p. 24; Chadwick, 1895, p. 235, pl. 16-17; H.L. Clark, 1896, p. 400; 1898, p. 23; 1901a, p. 170; 1901b, p. 489; Östergren, 1905, p. 149, fig. 2A; Becher,

1906, p. 505.

Synapta ayresii: Selenka, 1867, p. 362.

Synapta gracilis: Selenka, 1867, p. 363; Théel, 1885, p. 25.

Synapta albicans: Selenka, 1867, p. 363; Théel, 1885, p. 25; H.L. Clark, 1901a, p. 170; Caso, 1963, p. 323.

Synapta bifaria: Théel, 1885, p. 22.

Synapta vivipara: Théel, 1885, p. 32; H.L. Clark, 1896, p. 400; 1897, p. 54.

Leptosynapta inhaerens: H.L. Clark, 1907, p. 88, pl. V, figs. 14, 15, 18, 20; 1924, p.483; 1942, p. 370; Ohshima, 1913, p. 253; 1914, p. 468; Bush, 1918, p. 41, pl. 9, figs. 37-39; Koehler, 1921, p. 187; Mortensen, 1927, p. 427; Deichmann, 1930, p. 208; Chang, 1934, p. 38; Domantay, 1953, p. 139; Oguro, 1961, p. 193, figs. 1-3; Yi, 1985, p. 3, pl. 2, figs. 1-4; Rho and Shin, 1986, p. 251.

Material examined. 8 specimens, Nŭkto, 22 Jul. 1984 (B.J. Rho); one specimen, Udo, 7 Oct. 1985 (J.H. Park).

Distribution. Korea (South Sea, Cheju-do, Yellow Sea), Japan, the North Pacific, the North Atlantic, White Sea, English Channel, the Mediterranean, and Burmuda.

Genus *Protankyra* Ostergren, 1898 가시닻해삼속

4. *Protankyra bidentata* (Woodward and Barrett, 1858) 가시닻해삼

Synapta bidentata Woodsward and Barrett, 1858, p.365, pl.15, figs.23-25.

Synapta bidentata: Herapath, 1865, p.6; Théel, 1885, p.29.

Synapta distincta: von Marenzeller, 1881, p.123; Théel, 1885, p.11, pl.2, fig.8; Mitsukuri, 1896, p.412.

Synapta molesta: Théel, 1885, p.29.

Protankyra bidentata: H.L. Clark, 1907, p. 102; Ohshima, 1913, p. 256; 1914, p. 471; Heding, 1928, p. 252, figs. 46-47; Chang, 1934, p. 33; Yang, 1937, p. 28, pl. 4, fig. 1; Chang and Liao, 1964, p. 48, figs. 1-3; A.M. Clark and Rowe, 1971, p. 187; Yi, 1985, p. 1, pl. 1, 6 figs.

Material examined. one specimen, Maryangri, 25 Jul. 1971 (B.J. Rho); one specimen, Piŭngdo, 17 Apr. 1972 (B.J. Rho); many, Chakyakto, 7 Apr. 1973; one specimen, Chakyakto, 12 Jul. 1975; one specimen, Chakyakto, 17 Sep. 1977; many, Chakyakto, 28 Apr. 1979; many, Chakyakto, 12 May, 1979; 10 specimens, Chakyakto, 2 Nov. 1985; many, Chakyakto, 8 Apr. 1989; 6 specimen, Chakyakto, 15 Jun, 1991; 5 specimen, Chakyakto, 28 Sep. 1991; one specimen, Chakyakto, 17 Apr. 1992; many, Chakyakto, 26 Sep. 1992; 3 specimen, Chakyakto, 24 Sep. 1994; many, Chebudo, 16 Apr. 1988 (B.J. Rho); one specimen, Yŏnghŭngto, 16 Jul. 1989 (J.W. Lee); one specimen, Tonghori, 23 Jul. 1989; one specimen, Mip'o, 15 Aug. 1989 (J.I. Song); 3 specimens, Seop'ori, 21 Aug. 1992 (J.I. Song); one specimen, Yellow Sea (33°N, 122°50'E), 19 Sep. 1992 (J.S. Hong).

Distribution. Korea (East Sea, South Sea, Yellow Sea), Japan, China, and the Philippines.

Order Molpadida Haekel, 1896 은족목

Family Molpadiidae Müller, 1850 은족과

Genus *Molpadia* Risso, 1826 은족속

***5. *Molpadia oolitica* (Pourtalés, 1851)** 은족해삼(신칭) **(Plate 2, Figs.6-10)**

Chirodota oolitica Pourtalés, 1851, p. 13.

Molpadia oolitica: Selenka, 1867, p. 357, Taf. 20, fig. 128; H.L. Clark, 1907, p. 160, pl. 10, fig. 14; Mortensen, 1927, p. 423; Deichmann, 1930, p. 195, pl. 22, fig. 1-3, 14-18.

Embolus pauper: Selenka, 1867, p. 359, Taf. 20, fig. 132.

Trochostoma boreale: Théel, 1885, p. 51.

Trochostoma ooliticum: Théel, 1885, p. 53; Edwards, 1908, p. 53; Augustin, 1908, p. 39.

Trochostoma antarcticum: Théel, 1886, p. 16.

Material examined. 3 specimens, Kuryongp'o, 22 Jul. 1986 (J.I. Song); one specimen, Yellow Sea (36°N, 122°50'E), 30 Sep. 1992 (J.S. Hong).

Description. Size of body 7-14 x 2.2-3.5 cm (Pl. 2. Fig. 6) and oral disk 0.9-1cm wide. Body fusiform with a short tail. Tentacles 15 in number, each with three digits, a long terminal digit and two shorter lateral ones. Body wall thin, smooth and contains a lots of phophatic bodies. They mostly oval, yellowish-pink or dark red in color, and irregular in size and shape, but almost less than 0.1 mm (Pl. 2, Fig. 10). Color of body influenced by these bodies so oral disk and tail, which with no phosphatic bodies, white.

Polian vesicle single and 2.5 cm long. Gonad of one tuft and gonoduct connected with body wall at 4 mm below of oral disk. Gonopore open and small genital papillae observed. One stone canal connected with body wall just below the gonoduct. Respiratory tree two, right one long up to calcareous ring but left shorter and up to 1/2 of body. Stem of respiratory tree thick with star shaped branches.

Calcareous ossicle rare but, in two ends of body, tables present. Disk 0.15-0.25 mm wide and spire 0.1 mm high with 3 pillars (Pl. 2, Fig. 7, 8). In tentacles, no ossicles.

All plates of calcareous ring fused and radial with 2-2.5 mm high with a short bifurcated posterior prolongation (Pl. 2. Fig. 9).

Distribution. Korea (East Sea, Yellow Sea), Japan, the North Pacific (North America), Kara Sea, Barents Sea, Norway, and the North Atlantic (Massachusettes).

Remarks. This species is much similar to *Molpadia changi* Pawson and Liao, 1992. *M. changi* distribute from Yellow Sea to the Philippines and has tables with three pillars as the specimens of the present study. But their spire is higher and disk smaller(about 0.1mm), than *M. oolitica*. *M. oolitica* also much resemble *M. andamanensis* of Indian Ocean in shape of tables with moderately high spire but they have ossicles in body wall. The present specimens have no ossiles in body wall except for two ends of body but have numerous phosphatic bodies. In description of Pourtal s (1851) of *M. oolitica,* only phosphatic bodies were explained and they are much similar to the present specimens.

Family Caudinidae Heding, 1931 꼬리햇삼과

Genus *Paracaudina* Heding, 1931 측꼬리해삼속

***6. *Paracaudina chilensis* (Müller, 1850)** 흰해삼(신칭) **(Plate 2, Figs. 1-5)**

Caudina ransonnetii: von Marenzeller, 1881, p. 126, pl. 4, fig. 5; Mitsukuri, 1896, p. 411.

Caudina coriacea: Théel, 1885, p. 47, pl. 3, fig. 4; Dendy, 1897, p. 28, pl. 3, figs. 9-18.

Caudina chilensis: H. L. Clark, 1907, p. 175; Ohshima, 1919, p. 145; Chang, 1934, p. 29; Hozawa, 1928, p. 361, pls. 14-17; Yang, 1937, p. 22, pl. 4, fig. 3.

Caudina abescauda: H. L. Clark, 1907, p. 38, pl. 9, figs. 1-5; Deichmann, 1930, p. 201, pl. 24, figs. 6-8.

Pseudocaudina chilensis: Heding, 1931, p. 283.

Pseudocaudina obescauda: Heding, 1931, p. 283.

Pseudocaudina ransonetti: Heding, 1931, p. 283.

Paracaudina chilensis var. *ransonnetii*: H. L. Clark, 1935, p. 279; 1938, p. 540; 1946, p. 444; Deichmann, 1947, p. 344.

Paracaudina chilensis var. *obescauda*: H. L. Clark, 1935, p. 284; Miller and Pawson, 1984, p. 66, figs. 53-54.

Paracaudina chilensis: Yang, 1937, p. 22, pl. 4, fig. 3; Deichmann, 1947, p. 344; Pawson, 1963, p. 18; 1969, p. 139; 1970, p. 49; 1977, p. 119; Tommasi, 1969, p. 17; A.M. Clark and Rowe, 1971, p. 184; Pawson and Liao, 1992, p. 385, fig. 8.

Material examined. One specimen and a part of posterior body (tail), Tŏkchŏkto, 15 Jul. 1962 (B. J. Rho); a part of posterior body (tail), Yŏnghŭngdo, 16 Jul, 1989 (J.W.Lee & J.E. Seo); one specimen, Anmado, 17 Aug. 1989 (B.L. Choi); 13 tail parts, Seop'ori, 21 Aug. 1992 (J.I. Song); one specimen, Tŏkchŏkto, 21 Aug. 1993 (J.E. Seo).

Description. Size of perfect specimens, 8-10 (trunk 7 cm, tail 3 cm) x 2.3-3.5cm (Pl.2, Fig. 1). The specimen (collected in 1962) that preserved in alcohol for a long time, light brown but newly collected ones white. Oral disk 0.3 cm wide and tentacles 15 with a pair of digits and no terminal one. Body wall thin and long tail part curved up.

Longitudinal muscles with two bands along each radius, and between them, some space exist. Tentacular ampullae 15. Stone canal and polian vesicle single. Stomach developed to 0.9 cm wide. Gonad one tuft and gonoduct connected with body wall at just below the oral disk. Intestine filled up with fine sand and, in cloaca, a parasitic crab (*Pinnixa tumida*) observed.

Ossicles of body a lots of crossed-cups, which 0.04-0.07 cm wide (Pl.2, Fig.3,4). In longitudinal muscles, irregular rods(about 0.1 mm) with some branches (Pl.2, Fig.5).

Calcareous ring 0.8 cm high at radii with a bifurcated posterior prolongation. Interradial plate 0.4 cm high and adhere closely to radial plate but not fused completely.

Distribution. Korea (Yellow Sea), Japan, China, the Pacific (the East Indies, California, Mexico, Chile, Guatemala, New Zealand, Australia), and Bay of Bengal.

Remarks. This species is circum-Pacific in distribution and, in Korea, they were discovered only in Yellow Sea for their muddy habitat. This species lives in deep place (9-990 m) of sand to mud (Pawson, 1970). As in Pl. 2, Fig. 1, they have a long tail which remarkably curved up, maybe for respiration. When we collected this species, they move fast to deeper place so we collected only many tails of this species. But three perfect specimens were also collected, which had a parasitic crab (*Pinnixa tumida*) in cloaca.

Genus *Acaudina* Clark, 1907 민꼬리해삼속

***7. *Acaudina molpadioides* (Semper, 1868) 은족민꼬리해삼(신칭) (Plate 3, Figs. 1-10)**

Haplodactyla molpadioides Semper, 1868, p. 41, pl. 9, pl. 13, figs. 1-4.

Haplodactyla ecalcarea: Sluiter, 1901, p. 118.

Aphelodactyla molpadioides: H.L. Clark, 1907, p. 181; Heding, 1931, p. 284.

Acaudina molpadioides: Chang and Liao, 1964, p. 46, figs. 1-2; A.M. Clark and Rowe, 1971, p. 184, pl. 31, fig. 12; Rowe, 1983, p. 160; Pawson and Liao, 1992, p. 386.

Material examined. 4 specimens, Yellow sea; one specimen, Yellow Sea (33°N, 125°50'E), 20 Sep. 1992 (J.S. Hong); one specimen, Yellow Sea (32°N, 125°50'N), 18 Sep. 1992 (J.S. Hong).

Description. Body barrel-shaped, 14-15 x 6-6.5 cm in size (Pl. 3, Fig. 1). Anterior part of body very contracted so oral disk not observed and posterior part with indistinct tail which about 1.5 cm long. Anal papillae 7-9 at each radus. Color of body light brown in alcohol. Body wall 0.4-0.6 cm thick and smooth on surface. Tentacles 15 and each of them dull at the end but sligtly swollen at both sides of the end.

Longitdinal muscles in pairs at each radius. Tentacular ampullae, one polian vesicle and one stone canal present. Gonad one tuft and gonoduct connected with body wall about 1.2cm below of anterior end. Gonopore found but genital papillae not observed. Intestine filled up with mud and mesenchyme much complex with many oval perforates. Two respiratory trees developed with many branches and purplish pigments and connected the other internal organs.

In tentacles, with no ossicles but, in body wall, many small doughnut-shaped bodies which 0.02 mm broad with usually one, sometimes 2-3 perforates (Pl. 3, Fig. 3, 4). And some brown pigments (0.02-0.07 mm) also found in body wall. Some rods (0.04 mm long) and rarely c-shaped deposits found in longitudial muscles (Pl. 3, Fig. 5). Ossicles of anal papillae irregular perforated plates or dumbbel-shaped bodies (Pl. 3, Figs. 6, 7). Respiratory tree, cloaca and stomach also with variable ossicles (Pl. 3, Figs. 8-10).

Calcareous ring 1.5 cm high at radius and all plates fused (Pl. 3, Fig. 2).

Distribution. Korea (Yellow Sea), China, southeast Asia (Indonesia, Sri Lanka, and the Philippines).

Remarks. The species of *Acaudina* known from China are *A. molpadioides* (Semper, 1868) and *A. leucoprocta* (H. L. Clark, 1938). Pawson and Liao (1992) described that the ossicles of *A. molpadioides* were not abundant, present only at posterior of body and small oval bodies with one or sometimes a few holes. On the other hand, *A. leucoprocta* have numerous ossicles and small oval bodies with three or four holes. But Clark (1938) described the ossicles of *A. leucoprocta* as not abundant, present posteriorly and small oval plates about 40 x 30 μm with three or four holes.

The materials in this study have more or less numerous ossicles in body wall and the ossicles mainly doughnut-shaped bodies about 20 μm with one hole. The difference between these two species, we think, is not much but the specimens in this study are distinctly differnt from *A. leucoprocta* of Clark (1938) in the shape of ossicles.

Genus *Caudina* Stimpson, 1853 꼬리해삼속

***8. *Caudina similis* (Augustin, 1908) 꼬리해삼(신칭) (Plate 4, Figs. 1-6)**

Trochostoma simile Augustin, 1908, p. 38, textfig. 25.

Caudina similis: Heding, 1931, p. 283; H. L. Clark, 1935, p. 278; Pawson and Liao, 1992, p. 379, fig. 4.

Material examined. 4 specimens, Yellow Sea (35°N, 125°50'E), 27 Sep. 1992 (J.S. Hong).

Description. Size of body 8-8.5 x 2 cm (Pl. 4, Fig. 1). Tentacles 15 with 2 pairs of digits respectively. Body fusiform with a long tail, which about 4 cm and gradually tapering. Anal papillae found. Body wall rough to touch for ossicles. Color of body brown in alcohol.

Stone canal and Polian vesicle one. Ossicles of body wall tabels and knobbed buttons (Pl. 4, Figs. 4-7). Disk more or less irregular, 0.09-0.11 mm in diameter and 9-15 perforations around one central hole. Spire 0.05-0.1 mm high, with some spines at the end and at lateral. Knobbed botton irregular in outline, various in size, with 5-13 perforations, and 0.05-0.1 mm in diameter. In anal papillae, some reduced plates found (Pl. 4, Fig. 3).

Calcareous ring simple, 2 mm long at radii with a tail (Pl. 4, Fig. 2).

Distribution. Korea (Yellow Sea), Japan (Sagami Bay), and China (Yellow Sea).

Remarks. This specimens are much close to those of Pawson and Liao (1992) in all aspects, especially in the shape of ossicles. And they distribute in Yellow Sea in common so we have no hesitation in identifing it as *Caudina similis* Pawson and Liao, 1992.

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한국산 순수류와 무족류(극피동물문, 해서강)의 계통분류학적 연구

노분조 · 원정혜
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요 약

한국산 순수아강과 무족아강(해서강, 극피동물문)에 대한 분류 및 분포를 밝히기 위해 1962년부터 1995년까지 우리나라 삼면 연안과 도서지방의 48개 지역으로부터 채집된 재료들을 동정, 분류한 결과 3목 5과 8종에 속하는 해서류가 밝혀졌다. 그 중 은족목에 속하는 4종: *Molpadia oolitica*, *Paracaudina chilensis*, *Acaudina molpadioides* 그리고 *Caudina similis*는 한국미기록종이었다.

PLATE 1

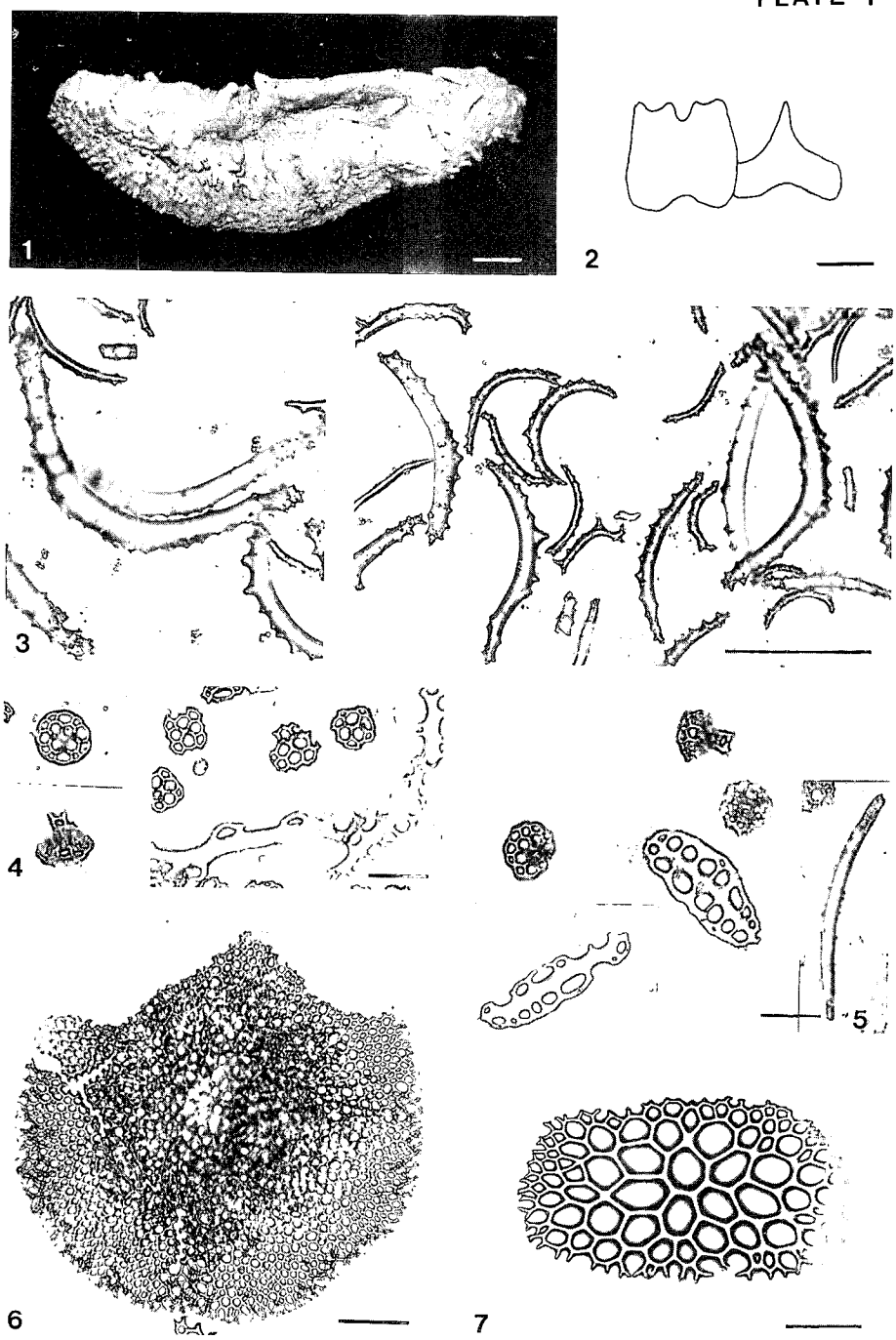

PLATE 1. *Stichopus japonicus* Selenka, 1867 돌기해삼

Fig. 1. right lateral view of body, scale bar=1 cm. **Fig. 2.** a part of calcareous ring, scale bar=2 mm. **Fig. 3.** rods from tentacles, scale bar=0.1 mm. **Figs. 4, 5.** tables and rods from podia, scale bar=0.05 mm. **Fig. 6.** end plate from podia, scale bar=0.1 mm. **Fig. 7.** plate from podia, scale bar=0.05 mm.

PLATE 2

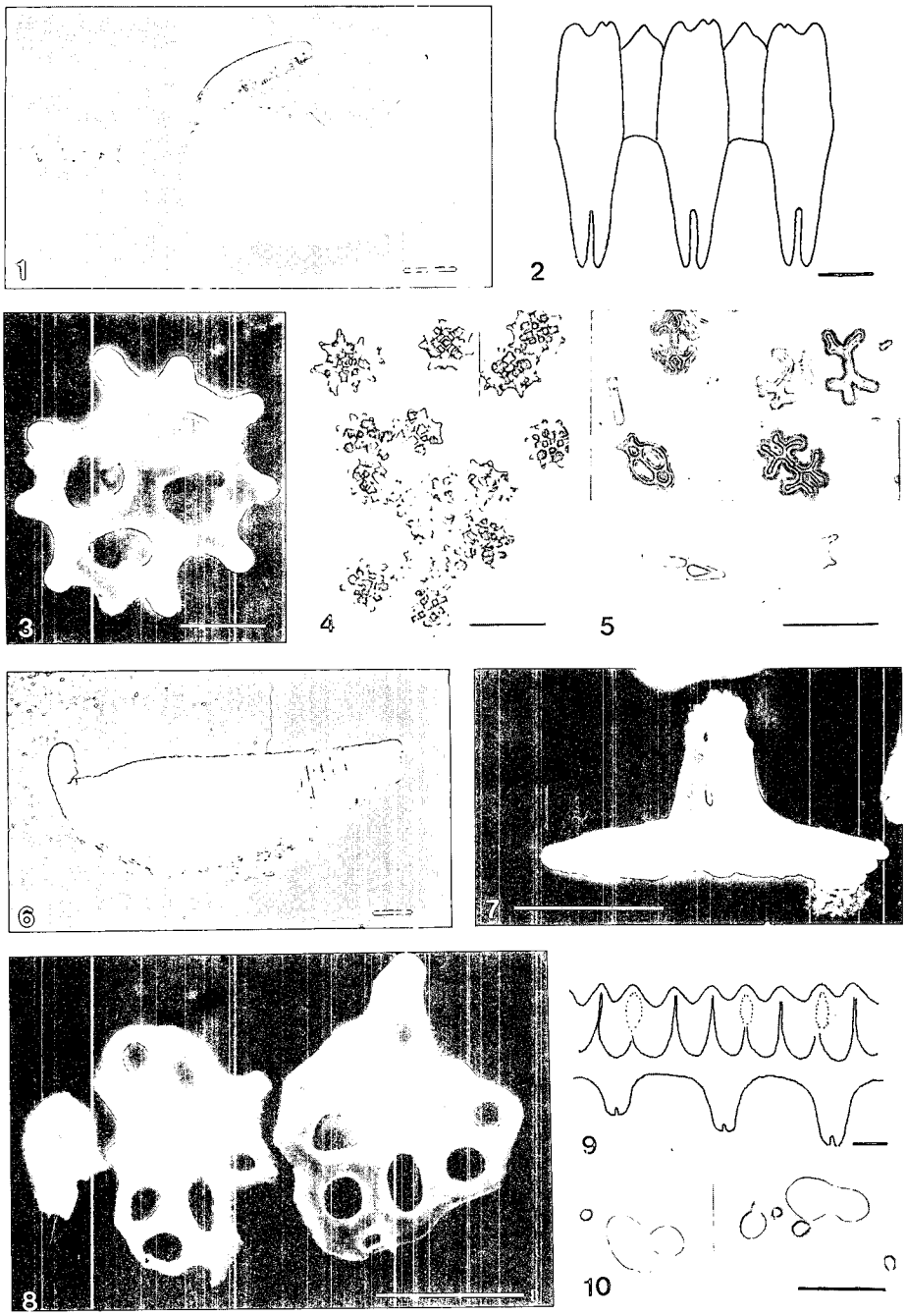

PLATE 2. *Paracaudina chilensis* (Müller, 1850) 흰해삼

Fig. 1. right lateral view of body and *Pinnixa tumida*, scale bar=1 cm. **Fig. 2.** a part of calcareous ring, scale bar=0.05 mm. **Figs. 3, 4.** crossed cup from body, scale bar=0.02 mm. **Fig. 5.** rods from longitudinal muscle, scale bar=0.05 mm.

Molpadia oolitica (Pourtalés, 1851) 은족해삼

Fig. 6. right lateral view of body, scale bar=1 cm. **Fig. 7.** lateral view of table from tail, scale bar=0.1 mm. **Fig. 8.** disk of tables from tail, scale bar=0.1 mm. **Fig. 9.** a part of calcareous ring, scale bar=2 mm. **Fig. 10.** phosphatic deposits from body wall, scale bar=0.1 mm.

PLATE 3

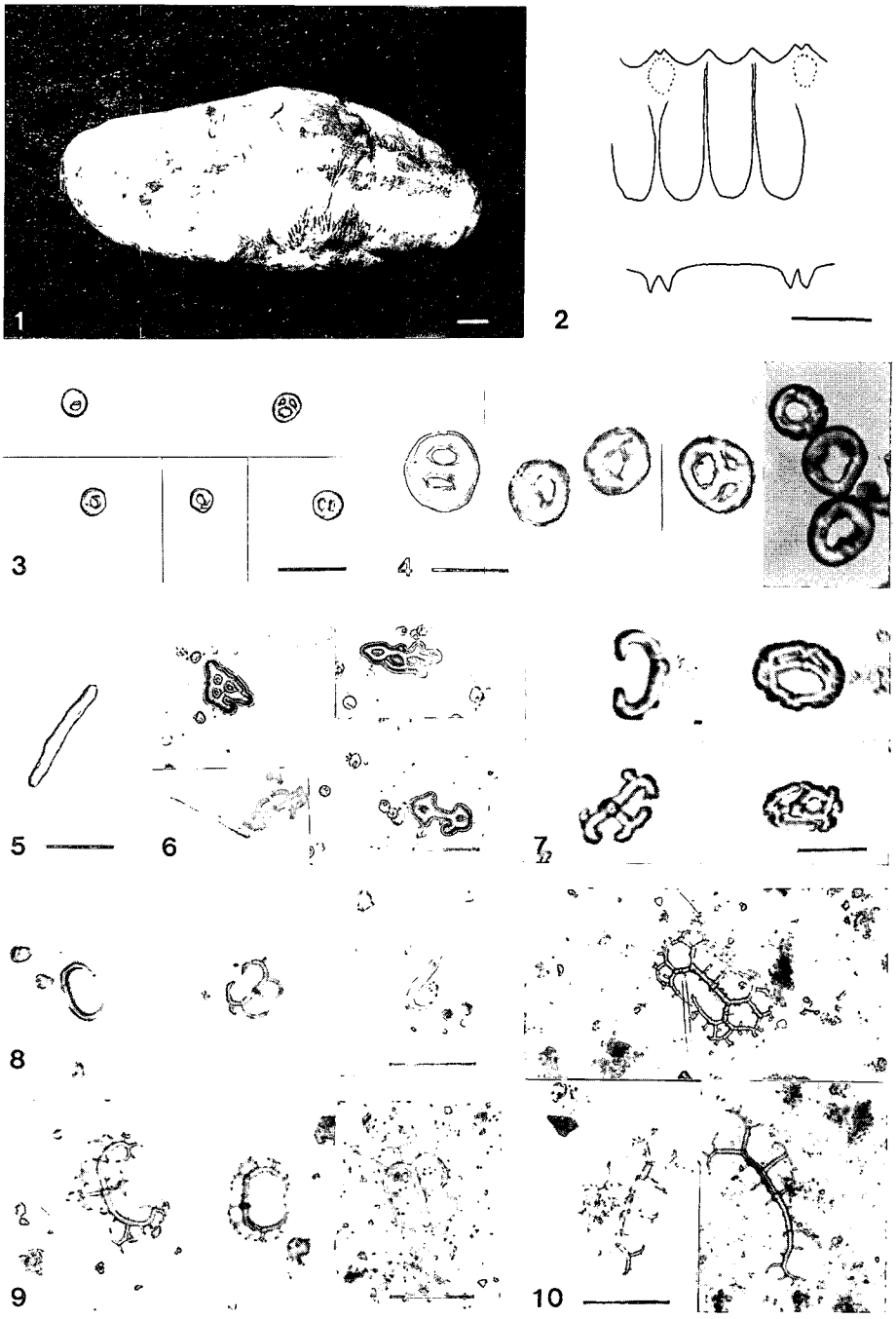

PLATE 3. *Acaudina molpadioides* (Semper, 1868) 은족민꼬리해삼

Fig. 1. right lateral view fo body, scale bar=1 cm. **Fig. 2.** a part of calcareous ring, scale bar=5 mm. **Fig. 3.** donuts from body wall, scale bar=0.05 mm. **Fig. 4.** donuts from body wall, scale bar=0.2 mm. **Fig. 5.** rods from longitudinal muscle, scale bar=0.2 mm. **Figs. 6, 7.** deposits from anal papillae, scale bar=0.2 mm. **Fig. 8.** deposits from respiratory tree, scale bar=0.1 mm. **Fig. 9.** deposits from stomach, scale bar=0.1 mm. **Fig. 10.** deposits from cloaca, scale bar=0.1 mm.

PLATE 4

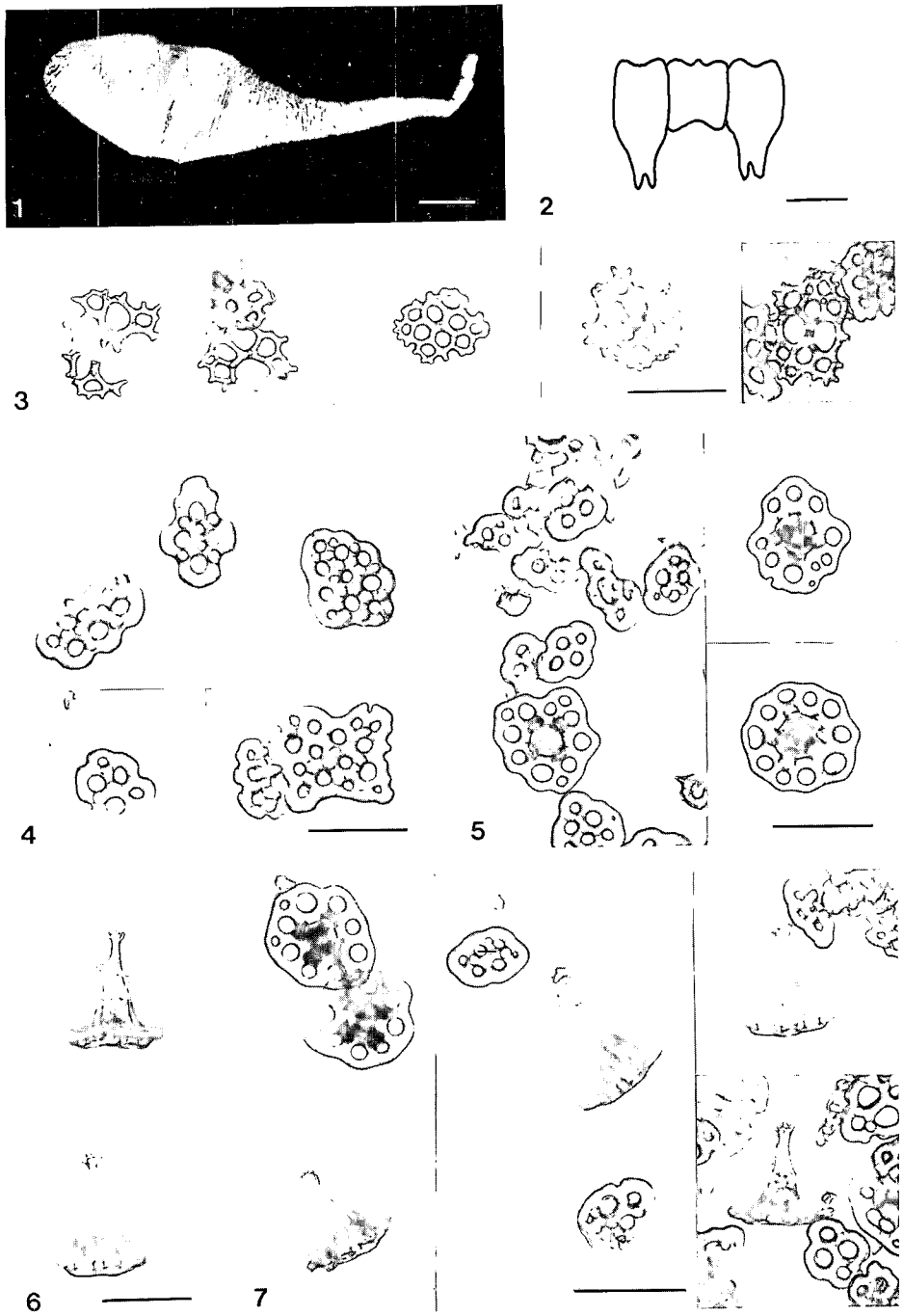

PLATE 4. *Caudina similis* (Augustin, 1908) 꼬리해삼

Fig. 1. left lateral view of body, scale bar=1 cm. **Fig. 2.** a part of calcareous ring, scale bar=1 mm. **Fig. 3.** plates from anal papillae, scale bar=0.1 mm. **Figs. 4, 5, 7.** knobbed plates and tables from body wall, scale bar=0.1 mm. **Fig. 6.** lateral view of tables, scale bar=0.1 mm.