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Ophiuroids of the Order Euryalida (Echinodermata) from Hachijōjima Island and Ogasawara Islands, Japan

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Abstract. Ophiuroids of the order Euryalida were collected from the depth between 20 and 1980 m off Hachijōjima Island and off Ogasawara Islands, southern Japan. A total of 17 species (12 genera, 4 families) were identified.
Key words: Ophiuroidea, Euryalida, taxonomy, deep sea, Japan.

Introduction

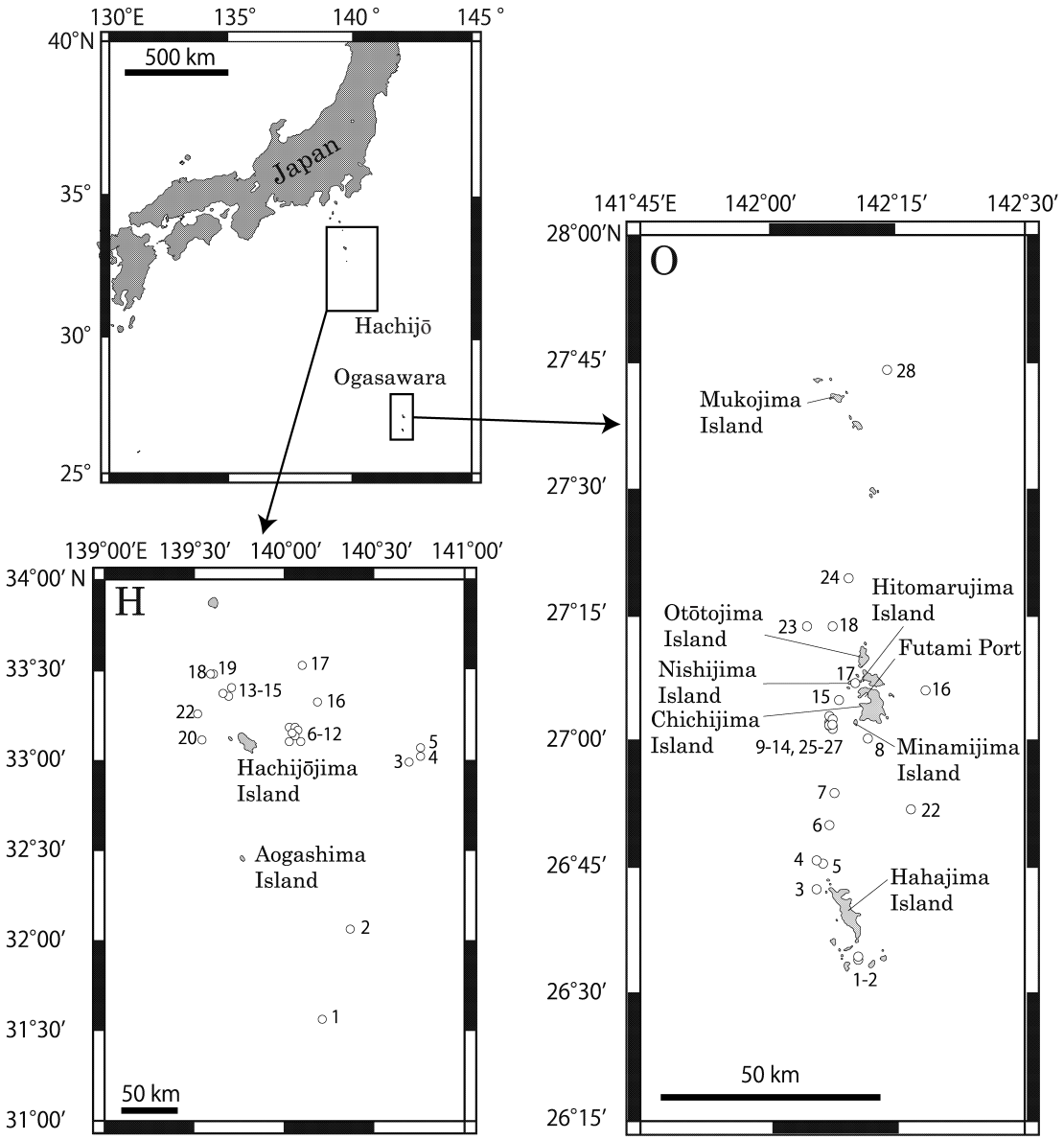
The order Euryalida (Echinodermata: Ophiuroidea) consists of four families, Asteronychidae, Asteroschematidae, Euryalidae and Gorgonocephalidae. Euryalid ophiuroids often live on hard bottoms or attach to soft corals and sponges with their long arms, which they use to feed on planktonic organisms (e.g., Baker, 1980; Stewart, 1998; Fujita, 1988, 2001; Rosenberg *et al*., 2005).

The temperate Hachijōjima Island and subtropical Ogasawara Islands are located approximately 300 km and 1000 km south of the main Japanese islands, respectively. The ophiuroid fauna of Hachijōjima Island has never been completely surveyed. Baker *et al*. (2001) reported one species *Astrogymnotes irimurai* (Ophiomyxidae, Ophiurida) from the Izu-Shichitō Islands, including Hachijōjima Island. The ophiuroid fauna of the Ogasawara Islands has been reviewed by Murakami (1944a) and Irimura and Tachikawa (2003), who reported 7 species from the Euryalidae and the Gorgonocephalidae.

We examined 339 euryalid specimens from Hachijōjima Island and the Ogasawara Islands. Two hundred and fifty one specimens were newly collected by the project "Species Diversity of Sagami Sea and Adjacent Coastal Areas: Origin of Influential Factors" conducted by the National Museum of Nature and Science, Tokyo in addition to 88 specimens already deposited in the National Museum of Nature and Science. In this paper, we present an overview of these euryalid specimens with taxonomic notes and photographs for most of the species.

Materials and Methods

The study area was located around Hachijōjima Island and the Ogasawara Islands in southern Japan (Fig. 1). Euryalid specimens were collected at 52 stations during 1962–2009: by a baited trap cage, two types of beam trawls, a biological dredge and two types of geographical dredges during cruses of the R/Vs *Koyo* and *Takunan* of the Tokyo Metropolitan Islands Area Research and Development Center of Agriculture, Forestry and Fisheries, R/V *Sōyō Maru* of the Fisheries Research Agency and R/V *Tansei Maru* of the Japan Agency for Marine-Earth Science and



Figs. 1. Sampling stations. Open circles on map showing sampling localities. See Table 1 for detailed sampling data. H21, O19–O21, O29, O30 are not shown because the positions are not recorded.

Technology (JAMSTEC); by ground fishing of the fishery boat *Ryōsei Maru* and *Sumiyoshi Maru*; and by scuba diving (Table 1). Except for sampling by scuba diving at the depth of 20 m, the sampling depth by these vessels ranged 52–1980 m. Specimens were fixed with 10% seawater neutralized formalin and later transferred to 70% ethanol, or directly immersed in 99% ethanol. All the materials are deposited in the National Museum of Nature and Science, Tokyo (NSMT) and the Coastal Branch of Natural History Museum and Institute, Chiba (CMNH). Sampling stations are shown by serial number with a prefix "H" and "O" located in waters of Hachijōjima Island and the Ogasawara Islands, respectively. Detailed data of the sampling stations are

Table 1. Sampling stations. Head letter of station number indicates the area: H, Hachijōjima Island area; O, Ogasawara Islands area. Abbreviations for sampling method: BD, ORI-type biological dredge of 50 cm span; BN, beam trawl designed by National Research Institute of Fisheries Science; BT, ORE-type beam trawl of 3 m span; C, baited trap cage; DR, dredge but the type is unknown; F, ground fishing; GD, geological dredge of 50 cm span; GD1, geological dredge of 1 m span; SD, scuba diving. -: data not available.

No	Date	Vessel	Cruise/Station	Gear	Locality	Depth (m)	Ship position
H1	1969.7.3	*Sōyō Maru*	St. B. 4	BN	Southeast of Aogashima Island	1700	31°44.3′N, 140°21.8′E
H2	1965.10.10	*Sōyō Maru*	St. B. 4	BN	Southeast of Aogashima Island	1940–1980	32°04.0′N, 140°21.5′E
H3	1974.11.25	*Sōyō Maru*	St. B. 3	BN	East of Hachijōjima Island	1600	32°59.2′N, 140°41.4′E
H4	1975.11.28	*Sōyō Maru*	St. B. 3	BN	East of Hachijōjima Island	1920	33°00.5′N, 140°45.3′E
H5	1976.7.28	*Sōyō Maru*	St. B. 3	BN	East of Hachijōjima Island	1570	33°03.5′N, 140°45.3′E
H6	1962.6.3	*Sōyō Maru*	St. B. 3	BN	East of Hachijōjima Island	455	33°05.7′N, 140°01.5′E
H7	1968.7.5	*Sōyō Maru*	St. B. 3	BN	East of Hachijōjima Island	490	33°06.1′N, 140°05.1′E
H8	1963.5.25	*Sōyō Maru*	St. B. 3	BN	East of Hachijōjima Island	500–510	33°08.0′N, 140°03.0′E
H9	1971.11.11	*Sōyō Maru*	St. B. 3	BN	East of Hachijōjima Island	475	33°09.0′N, 140°02.1′E
H10	1972.6.21	*Sōyō Maru*	St. B. 3	BN	East of Hachijōjima Island	505–510	33°09.3′N, 140°04.2′E
H11	1972.11.15	*Sōyō Maru*	St. B. 3	BN	East of Hachijōjima Island	470	33°10.4′N, 140°01.4′E
H12	1968.12.1	*Sōyō Maru*	St. B. 3	BN	East of Hachijōjima Island	490	33°10.8′N, 140°03.8′E
H13	1975.7.28	*Sōyō Maru*	St. 4, D-122	DR	Northwest of Hachijōjima Island	130	33°23.9′N, 139°42.4′E
H14	1974.7.23	*Sōyō Maru*	St. 4, D-110	DR	Northwest of Hachijōjima Island	120	33°28.6′N, 139°36.3′E
H15	1973.7.23	*Sōyō Maru*	St. 4, D-108	DR	Northwest of Hachijōjima Island	130–190	33°29.0′N, 139°36.0′E
H16	1974.11.26	*Sōyō Maru*	St. 4, D-4	DR	Northeast of Hachijōjima Island	230	33°31.0′N, 140°06.2′E
H17	2008.7.17	*Takunan*	St. 4	BD	Northeast of Hachijōjima Island	205.1–201.4	33°19.28′N, 140°10.92′E; 33°19.12′N, 140°10.43′E
H18	2007.9.10	*Takunan*	St. 5	BD	Northwest of Hachijōjima Island	150.9–147.3	33°21.69′N, 139°39.47′E; 33°21.97′N, 139°39.58′E
H19	2007.11.26	*Tansei Maru*	KT-07-29 St. L-2-700	GD	Northwest of Hachijōjima Island	212–177	33°20.83′N, 139°41.24′E; 33°21.19′N, 139°40.44′E
H20	2009.2.22	*Ryōsei Maru*	−	−	West of Hachijōjima Island	470	33°07′N, 139°32.5′E
H21	2008.1.22	*Ryōsei Maru*	−	−	Northwest of Hachijōjima Island	600	−
H22	2006.5.25	*Sumiyoshi Maru*	−	F	Off Hachijōjima Island	500	33°18–19′N, 139°30–31′E
O1	2009.7.14	*Koyo*	St. 14	BD	South of Hahajima Island	92–93.1	26°34.02′N, 142°10.80′E; 26°34.03′N, 142°10.81′E
O2	2009.7.14	*Koyo*	St. 13	BD	South of Hahajima Island	96.5–92	26°34.09′N, 142°10.79′E; 26°34.02′N, 142°10.80′E
O3	2009.7.13	*Koyo*	St. 12	BD	West of Hahajima Island	97.3–102.7	26°42.24′N, 142°05.79′E; 26°42.30′N, 142°05.79′E
O4	2009.7.13	*Koyo*	St. 8	BD	North of Hahajima Island	98.3–102.4	26°45.20′N, 142°06.44′E; 26°45.38′N, 142°06.55′E
O5	2009.7.13	*Koyo*	St. 9	BD	North of Hahajima Island	102.1–118.2	26°45.64′N, 142°05.75′E; 26°45.87′N, 142°05.87′E
O6	2009.7.13	*Koyo*	St. 11	BD	North of Hahajima Island	147.2–145.2	26°50.01′N, 142°07.07′E; 26°50.09′N, 142°07.11′E
O7	2009.7.13	*Koyo*	St. 10	BD	North of Hahajima Island	145.6–150.7	26°50.24′N, 142°07.09′E; 26°50.04′N, 142°07.16′E
O8	2008.10.24	*Koyo*	−	BD	South of Chichijima Island	712.4–743.1	26°53.66′N, 142°14.07′E
O9	2008.10.28	*Koyo*	St. 12	BD	West of Minamijima Island	129–127	27°00.19′N, 142°11.60′E; 27°00.02′N, 142°11.74′E
O10	2009.7.10	*Koyo*	St. 7	BD	West of Minamijima Island	138.2–136	27°01.72′N, 142°07.38′E; 27°01.92′N, 142°07.28′E
O11	2009.7.10	*Koyo*	St. 6	GD1	West of Minamijima Island	135.8–126.7	27°01.79′N, 142°07.36′E; 27°01.90′N, 142°07.27′E

Table 1. (cont.)

No	Date	Vessel	Cruise/Station	Gear	Locality	Depth (m)	Ship position
O12	2009.7.16	*Koyo*	St. 33	BD	West of Minamijima Island	136.5–136.6	27°02.19′N, 142°07.25′E; 27°02.27′N, 142°07.26′E
O13	2009.7.10	*Koyo*	St. 1	GD1	West of Minamijima Island	136.8–136.8	27°02.22′N, 142°07.24′E; 27°02.12′N, 142°07.31′E
O14	2009.7.16	*Koyo*	St. 34	BD	West of Minamijima Island	139.8–140.9	27°02.34′N, 142°07.52′E; 27°02.55′N, 142°07.34′E
O15	2008.10.24	*Koyo*	St. 6	GD	West of Minamijima Island	88–88	27°04.64′N, 142°08.51′E; 27°04.69′N, 142°08.68′E
O16	2008.10.29	*Koyo*	St. 19	BD	East of Chichijima Island	175–176	27°06.07′N, 142°18.56′E; 27°06.06′N, 142°18.75′E
O17	2009.7.15	*Koyo*	St. 28	BD	East of Nishijima Island	52.1–52	27°07.04′N, 142°10.68′E; 27°07.01′N, 142°10.68′E
O18	2009.7.15	*Koyo*	St. 21	BD	Northwest of Otōtojima Island	135.8–135.5	27°13.08′N, 142°09.19′E; 27°13.19′N, 142°09.22′E
O19	1998.11.1	*Koyo*	−	C	East of Chichijima Island	300	−
O20	1989.12.12	*Koyo*	−	−	Off Nishijima Island	200	−
O21	1999.11.8	*Koyo*	−	C	Southeast of Hahajima Island	550	−
O22	2001.7.17	*Koyo*	−	C	East of Hahajima Island	907	26°53.705′N, 142°16.830′E
O23	1976.8.4	*Sōyō Maru*	St. 5, D-5	DR	Northwest of Otōtojima Island	200–220	27°13.6′N, 142°04.5′E
O24	1977.7.6	*Sōyō Maru*	St. R. 8	BN	North of Otōtojima Island	160	27°19.2′N, 142°09.4′E
O25	2009.3.19	*Tansei Maru*	KT-09-02 St. TW-01-01	BD	West of Minamijima Island	145.2–138.6	27°01.39′N, 142°07.40′E; 27°01.36′N, 142°07.46′E
O26	2009.3.19	*Tansei Maru*	KT-09-02 St. TW-01-02	BD	West of Minamijima Island	137.9–138.3	27°01.37′N, 142°07.46′E; 27°01.34′N, 142°07.48′E
O27	2009.3.19	*Tansei Maru*	KT-09-02 St. TW-02-04	BD	West of Minamijima Island	138–136	27°02.94′N, 142°07.16′E; 27°02.94′N, 142°07.25′E
O28	1997.7.7	*Tansei Maru*	KT-97-07 St. MK-05	BT	Northeast of Mukojima Island	521–536	27°44′N, 142°14′E
O29	1976.7.22	−	St.5	−	Off Futami Port, Chichijima Island	65	−
O30	1996.10.29	−	−	SD	Hitomarujima Island	20	−

shown in Table 1. In Materials examined, numbers of specimens are shown by numerals following "×". Disk diameter is shown by dd.

Ossicles were isolated by immersion in domestic bleach (approximately 5% sodium hypochlorite solution), washed in deionized water, dried in air, and mounted on SEM stubs using double-sided conductive tape. The ossicles were sputter-coated with gold-palladium and examined with a Jeol JSM 5200LV SEM.

Descriptive terminology follows Byrne (1994) and Okanishi and Fujita (2009).

Results and Discussions

Seventeen species belonging to 12 genera within four families were recognized. Three species, *Astroboa nigrofurcata, Astrothrombus rugosus* and *Ophiocreas oedipus* are new records for Japan.

Family **Asteronychidae** Ljungman, 1867

Genus ***Asteronyx*** Müller and Troschel, 1842

Asteronyx loveni Müller and Troschel, 1842 (Figs. 2A–C) [Japanese name: Kinugasa-moduru]

Asteronyx loveni Müller and Troschel, 1842: 119, pl. 10 figs. 3–5.

Asteronyx locardi Koehler, 1896: 88.

Asteronyx dispar Lütken and Mortensen, 1899: 185.

Asteronyx cooperi Bell, 1909: 22.

Ophiuropsis lymani Studer, 1884: 85, pl. 5 figs. 12a–d.

See Paterson 1985, for the other synonymous records.

Materials examined. Disc diameter range is 3.0–21.1 mm (×3). St. H2, SE of Aogashima Island, 1940–1980 m (NSMT E-2515, ×2); St. H11, E of Hachijōjima Island, 470 m (NSMT E-2695, ×1).

Remarks. Two species of Asteronychidae, *Asteronyx loveni* and *Astrodia tenuispina* are distributed in Japanese waters. *Asteronyx loveni* can be distinguished from *A. tenuispina* by having fewer than 9 hook-shaped arm spines at each tentacle pore (Döderlein, 1927) (Figs. 2A–C).

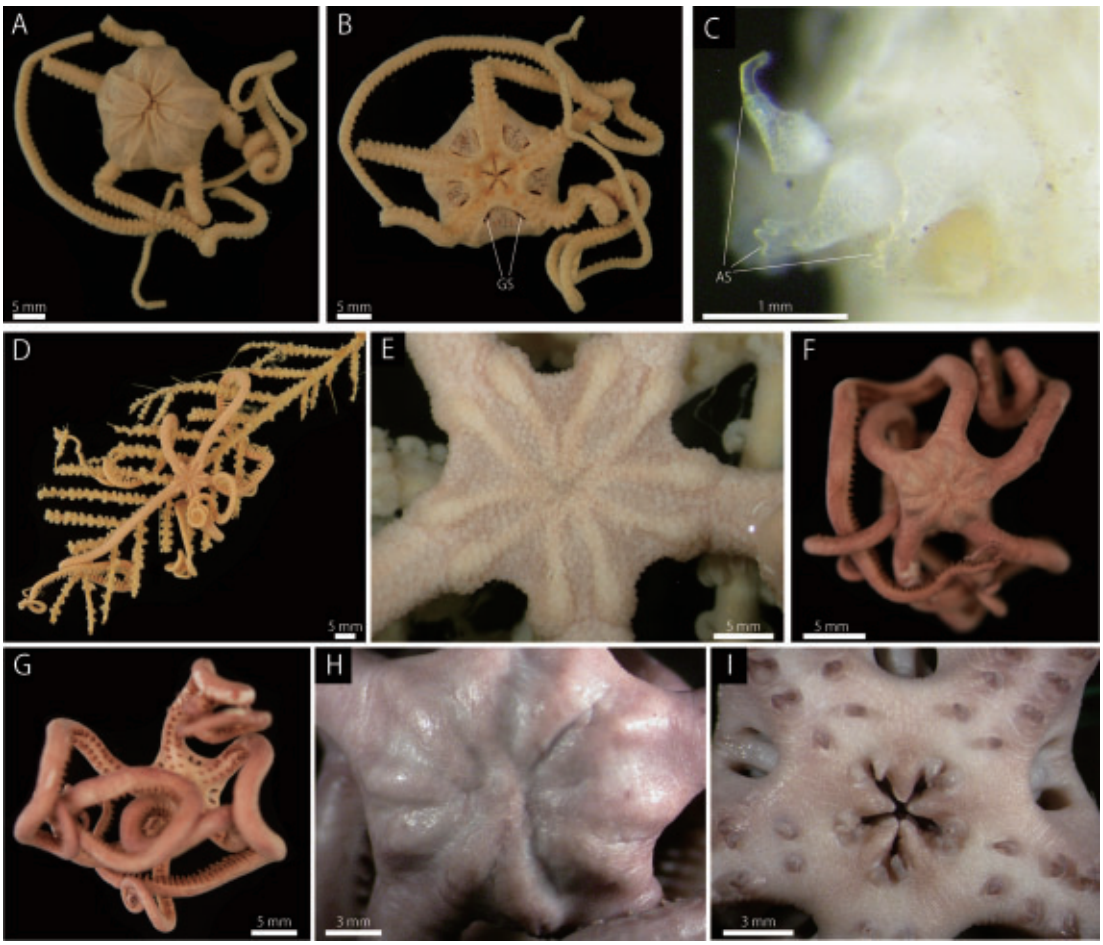
Distribution. *Asteronyx loveni* is widely distributed in deep-waters all over the world except for Arctic Ocean and parts of the Southern Ocean. The bathymetric range is ca. 100–4721 m (see Paterson, 1985). This is the first record of Asteronychidae from off Hachijōjima Island.

Family **Asteroschematidae** Verrill, 1899

Genus ***Asteroschema*** Lütken, 1856

Asteroschema ferox Koehelr, 1904 (Figs. 2D, E)
[Jn.: Madaratsubu-hitode-modoki]

Asteroshcma ferox Koehler, 1904: 162–164, pl.



Figs. 2. A–C, *Asteronyx loveni* (NSMT E-2515, dd 21.1 mm). A, aboral view; B, oral view; C, oral middle portion of the arm. D, E, *Asteroschema ferox* (NSMT E-6699, dd 9.9 mm), clinging to a gorgonacean coral colony. D, aboral view; E, aboral disc. F–I, *Ophiocreas caudatus* (NSMT E-6358, dd 11.8 mm). F, aboral view; G, oral view; H, aboral disc; I, oral disc. Abbreviations: AS, arm spine; GS, genital slit.

32 figs. 4–6, pl. 33 figs. 1–2; Döderlein, 1911: 111; 1927: 73, pl. 10 figs. 4–4a; Koehler, 1931: 38; Guille, 1981: 421, pl. 1 figs. 3–4; Fujita and Irimura, 2005: 363, fig. 2.

Asteroschema tubiferum—Irimura and Kubodera, 1998: 138 (non *Asteroschema tubiferum* Matsumoto, 1911).

Materials examined. Disc diameter range is 9.9–10.0 mm (×2). St. O28, NE of Mukojima Island, 521–536 m (NSMT E-6699, ×2).

Remarks. Some species included in *Asteroschema* show taxonomic overlap with *Astrocharis*. Okanishi and Fujita (2009) have suggested revision for these genera. The present species is identified as *Asteroschema* based on the presence of cone-shaped dermal ossicles which are also found on the type species *Asteroschema oligactes* Pallas, 1778. The present species can be distinguished from the other congeners by more sparse cone-shaped dermal ossicles (Figs. 2D, E).

Distribution. Japan: East China Sea (Irimura and Kubodera, 1998; Fujita and Irimura, 2005), off Ogasawara Island (new record, present study). Philippines: off Lubang Island (Guile, 1981). Indonesia: off Kei Island (Koehler, 1904, 1931), off Ternate (Döderlein, 1927). The bathymetric range is 170–536 m.

Genus ***Ophiocreas*** Lyman, 1879

Ophiocreas caudatus Lyman, 1879 (Figs. 2F–I) [Jn.: Tako-kumohitode]

Ophiocreas caudatus Lyman, 1879: 64, pl. 16 figs. 439–442; 1882: 281–282, pl. 32 figs. 5–8; Irimura, 1990: 76. fig. 35.

Ophiocreas caudatum—H.L. Clark, 1915: 177; Matsumoto, 1911, 626–627, figs. 9–10.

Ophiocreas oedipus—H.L. Clark, 1911: 283 (non *Ophiocreas oedipus* Lyman, 1879).

Asteroschema (*Ophiocreas*) *caudatum*—Döderlein, 1911: 113; Matsumoto, 1912b: 382; 1917: 49–51, fig. 13.

Asteroschema (*Ophiocreas*) *sagaminum* Döderlein, 1911: 60–61, pl. 6 figs. 6–6a, pl. 7 fig. 10.

Asteroschema caudatum granulosum A.H. Clark, 1949: 7–9, fig. 2a.

Asteroschema caudatum obscurum A.H. Clark, 1949: 9–10, fig. 2b.

Materials examined. Disc diameter range is 9.8–11.8 mm (×3). St. H21, Off Hachijōjima Island, 600 m (NSMT E-6358, ×3).

Remarks. *Ophiocreas* is covered by thick skin which sometimes contains fine granule-shaped dermal ossicles. In the present study, three species of *Ophiocreas* were found and they can be distinguished in following points; *O. caudatus* lacks wrinkled skin, purplish body color and has uniformly narrow arms (Figs. 2F–I); *O. glutinosus* has wrinkled skin, yellowish body color and uniformly narrow arms (Figs. 3A–C); *O. oedipus* has quite thin skin embedded granule-shaped dermal ossicles, yellowish body and grayish aboral disc and widened basal portion of arms (Figs. 3D–F).

Distribution. Japan: south of Shizuoka Prefecture (H.L. Clark, 1911), Sagami Sea, (Lyman, 1879, 1882; H.L. Clark, 1915; Döderlein, 1911; Matsumoto, 1911, 1912b, 1917), Tosa Bay, 400 m, (Irimura, 1990), off Hachijōjima Island (new record, present study). North Pacific Oceans: off Hawaii Island (A.H. Clark, 1949). The bathymetric range is 49–1570 m.

Ophiocreas glutinosus Döderlein, 1911 (Figs. 3A–C) [Jn.: Udebuto-tako-kumohitode]

Asteroschema (*Ophiocreas*) *glutinosum* Döderlein, 1911: 59–60, pl. 6 figs. 5–5a, pl. 7 fig. 9; Matsumoto, 1912b: 383; 1917: 53–55, fig. 15.

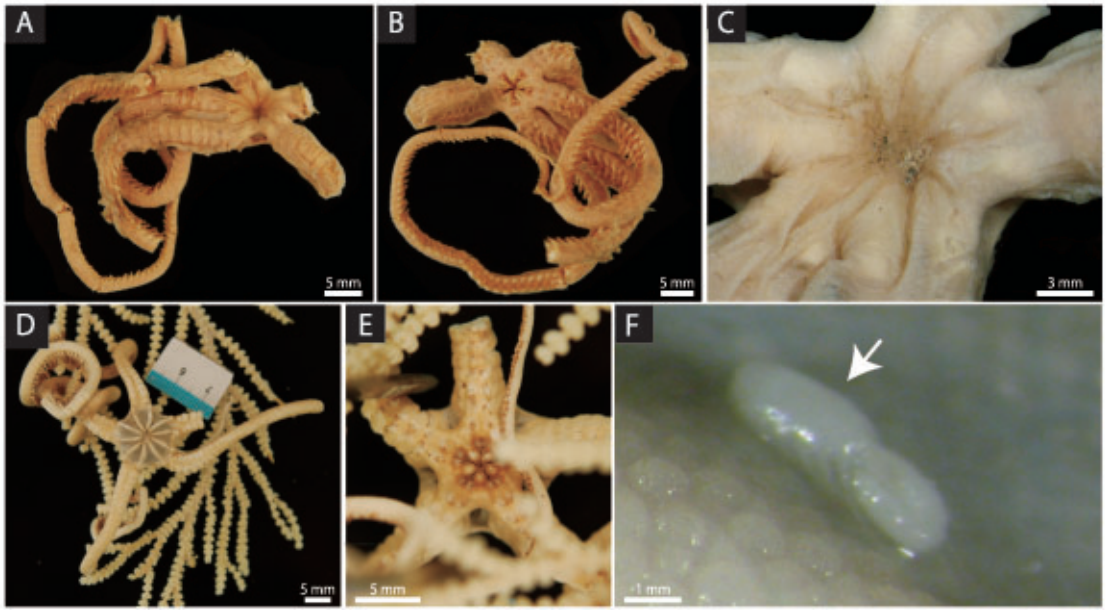
Ophiocreas brevis Matsumoto, 1911: 630; 1912a: 207, figs. 19–21.

Materials examined. Disc diameter is 9.8 mm (×1). St. H5, E of Hachijōjima Island, 1570 m (NSMT E-2836, ×1).

Distribution. Japan: Sagami Sea (Döderlein, 1911; Matsumoto, 1911, 1912a, 1912b, 1917), off Hachijōjima Island (new record, present study). The bathymetric range is 425–1570 m.

Ophiocreas oedipus Lyman, 1879 (Figs. 3D–F) [New Jn.: Kobuude-tako-kumohitode]

Ophiocreas oedipus Lyman, 1879: 65, pl. 16 figs. 443–446; 1882: 283, pl. 31 figs. 5–8, pl. 43 fig.



Figs. 3. A–C, *Ophiocreas glutinosus* (NSMT E-2836, dd 9.8 mm). A, aboral view; B, oral view; C, aboral disc. D–F, *Ophiocreas oedipus* (NSMT E-6375, dd 17.1 mm), clinging to a gorgonacean colony. D, aboral view; E, oral disc; F, aboral periphery of the disc, a copepod attaching to a radial shield is indicated by an arrow.

1; Koehler, 1904: 166–167; 1909: 206, pl. 7 fig. 3; H.L. Clark, 1915: 178; Baker, 1980: 28, figs. 7, 30; Paterson, 1985: 18, fig. 10; McKnight, 1993: 174; 2000: 34–35, pl. 12.

Materials examined. Disc diameter range is 10.0–18.3 mm (×5). St. H1, SE of Aogashima Island, 1700 m (NSMT E-1385, ×1); St. H3, E of Hachijōjima Island, 1600 m (NSMT E-2747, ×1); St. H12, E of Hachijōjima Island, 490 m (NSMT E-2120, ×1); St. H20, W of Hachijōjima Island, 470 m (NSMT E-6375, ×2).

Remarks. An ectoparasitic copepod was associated with two specimens from east of Hachijōjima Island (NSMT E-6375) (Fig. 3F).

Distribution. Japan: off Aogashima Island, off Hachijōjima Island (new record, present study). Indonesia: off Ternate (Koehler, 1904, 1909). New Zealand: north of New Zealand (Baker, 1980; McKnight, 1993, 2000). South Atlantic Ocean: off Ascension Island (Lyman, 1879, 1882; H.L. Clark, 1915; Paterson, 1985). Morocco: off Medeira (Koehler, 1909). The bathymetric range is 470–1968 m. This is the first record of *O. oedipus* from Japan.

Genus ***Astrocharis*** Koehler, 1904.

Astrocharis ijimai Matsumoto, 1911 [Jn.: Himemoduru]

Astrocharis ijimai Matsumoto, 1911: 628–629, fig. 13; 1915, 54–55; 1917, 56–58, fig. 16; H.L. Clark, 1915, 178; Irimura, 1991, 118, figs. 41A–B; Okanishi and Fujita, 2011b: 152–155, figs.7–9.

Astrocharis gracilis Mortensen in Mortensen and Stephensen, 1918: 264–267, figs. 1–6; Döderlein, 1927: 77–78, pl. 9 figs. 5–5c, 6–6a.

Astrocharis virgo Koehler, 1904: 160–161, pl 20 fig. 1, pl 30 fig. 8 (part: ZMA E2041).

Materials examined. Disc diameter range is 1.6–4.4 mm (×34). St. H6, E of Hachijōjima Island, 455 m (NSMT E-1587, ×1); St. H8, E of Hachijōjima island, 500–510 m (NSMT E-1531, ×26); St. H10, E of Hachijōjima Island, 505–510 m (NSMT E-995, ×7).

Remarks. Okanishi and Fujita (2011b) synonymized *Astrocharis gracilis* with *A. ijimai* and determined that one of the syntype specimens of *Astrocharis virgo* was *A. ijimai*. *Astrocharis iji-*

mai can be distinguished from its congeners by having relatively large (0.11–0.24 mm in length) plate-shaped dermal ossicles on the aboral disc, 2 arm spines for each tentacle pore, vertebrae completely concealed by dermal ossicles and uniformly creamy white body color (Okanishi and Fujita 2011b).

Distribution. Japan: Sagami Sea (Matsumoto, 1911, 1915, 1917), off Hachijōjima Island, (Irimura 1991; Okanishi and Fujita, 2011b), Southeast of Kagoshima Prefecture, (Okanishi and Fujita, 2011b). Philippines: south of Olutanga, Mindanao Island (Mortensen and Stephensen, 1918), Jolo Sea (Döderlein, 1927). Indonesia: Gilolo Strait (Koehler, 1904). Bathymetric range is 455–1089 m.

Family **Euryalidae** Gray, 1840
Genus ***Astroceras*** Lyman, 1879

Astroceras annulatum Mortensen, 1933 (Figs. 4A–C) [Jn.: Mutsuude-tsuno-moduru]

Astroceras annulatum Mortensen, 1933a: 47–49, fig. 32, 33b; Murakami, 1944b: 261–262; Irimura, 1969: 39; 1981: 17–18, pl. 1 fig. 2–3; 1982: 18–20, fig. 11, pl. 5 fig. 4–6; Saba *et al*. 1982: 26, pl. 13 fig. 5–6; Rho and Shin, 1987: 212; Irimura and Tachikawa, 2003: 6.

Astroceras annulatum gemmiferum Mortensen, 1933a: 50, pl. 5 fig. 26–29.

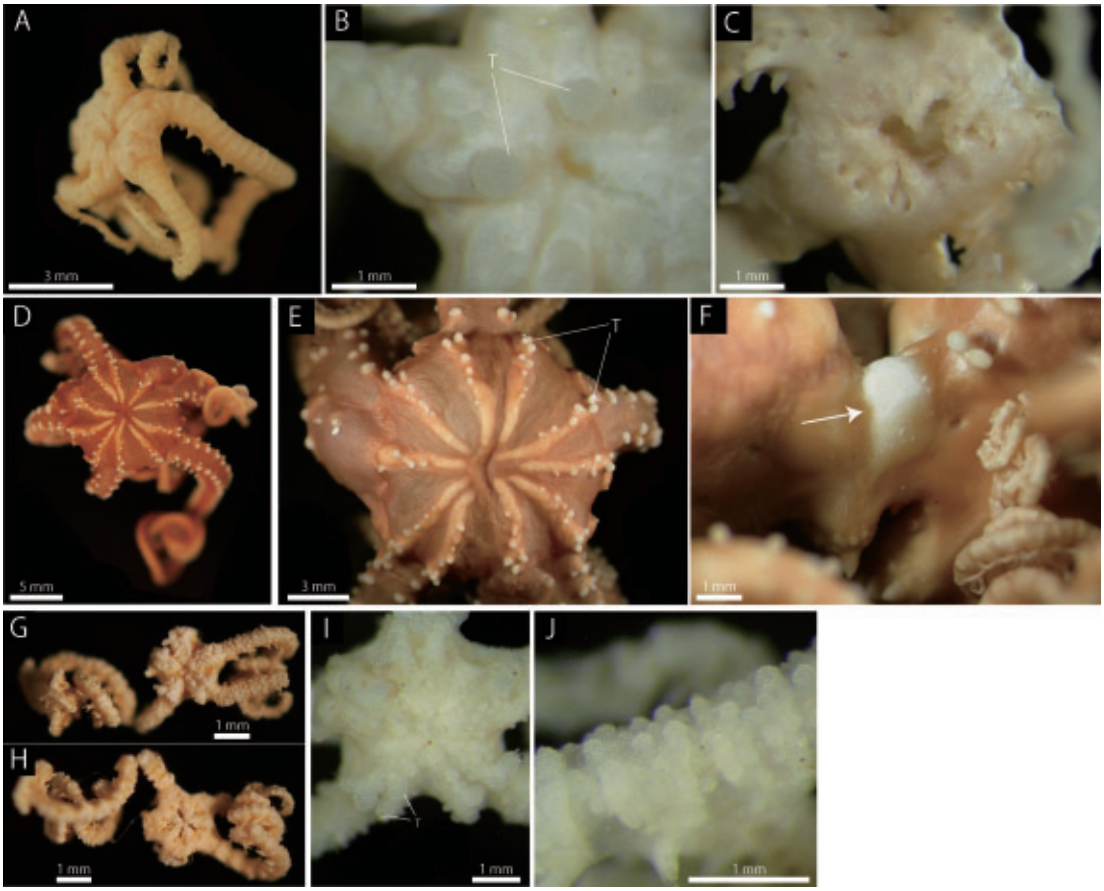
Astroceras pergamena Lyman, 1879: 62–63, pl. 18 fig. 478-480; H.L. Clark, 1911: 284–285 (part); Matsumoto, 1917: 35–37, fig. 7b; Döderlein, 1927: 79–80, 100 (part).

Materials examined. Disc diameter range is 0.87–4.98 mm (×170). St. H13, NW of Hachijōjima Island, 130 m (NSMT E-2950, ×2); St. H17, NE of Hachijōjima Island, 205.1–201.4 m (NSMT E-6639, ×1); St. H19, NE of Hachijōjima island, 212–177 m (NSMT E-6268, ×2); St. O1, S of Hahajima Island, 92–93.1 m (NSMT E-6660, ×2, E-6659, ×1, E-6668, ×36, E-6669, ×26, E-6671, ×1); St. O3, W of Hahajima Island, 97.3–102.7 m (NSMT E-6664, ×1, E-6652, ×1, E-6658, ×7); St. O4, N of Hahajima Island, 98.3–102.4 m (NSMT E-6663, ×1); St. O5 N of Hahajima Island, 102.1–118.2 m (NSMT E-6665, ×1, E-6666, ×5, E-6670, ×6); St. O10, W of Minamijima Island, 138.2–136 m (NSMT E-6641, × 12, E-6642, ×1, E-6643, ×10, E-6644, ×2, E-6645, ×3, E-6646, ×4, E-6647, ×1, E-6648, × 1, E-6649, ×6, E-6654, ×1, E-6655, ×1, E-6656, ×2, E-6657, ×3); St. O11, W of Minamijima island, 135.8–126.7 m (NSMT E-6640, ×1, E-6651, ×2, E-6653, ×1); St. O12, W of Minamijima Island, 136.5–136.6 m (NSMT E-6661, ×2); St. O13, W of Minamijima Island, 136.8–136.8 m (NSMT E-6650, ×5); St. O16, E of Chichijima Island, 175–176 m (NSMT E-6275, ×1, E-6338, ×1, E-6339, ×2); St. O18, NE of Otōtojima Island, 135.8–135.5 m (NSMT E-6662, ×8); St. O24, N of Otōtojima Island, 160 m (NSMT E-3008, ×2); St. O25, W of Minamijima island, 145.2–138.6 m (NSMT E-6504, ×2).

Remarks. Three species of *Astroceras*, *A. annulatum*, *A. comper* and *A.* sp. were recognized in this study. *Astroceras annulatum* can be distinguished from the other species by having large domed tubercles on radial shields and/or basal portion of the arms, transverse rows of small 3–5 granule-shaped dermal ossicles on middle to distal portion of the arms and relatively wide (approximately twice longer than width) radial shields, (Figs. 4A–C). The present species is considered as fissiparous. Out of 173 specimens, 154 specimens (89%) had 6 arms and the other 19 specimens (11%) had 5 arms. Most of 6 arms specimens had a trace of past fission on their discs.

Distribution. Japan: around Kyūshū Island, south of Shikoku and Honshū Islands (Lyman, 1879; H.L. Clark, 1911; Matsumoto, 1917; Döderlein, 1927; Mortensen, 1933a; Murakami, 1944b; Irimura, 1969, 1982; Saba *et al*., 1982), off Ogasawara Islands (Irimura and Tachikawa, 2003; present study), Hachijōjima Island (new record, present study). Korea: off Cheju Island (Rho and Shin, 1987). The bathymetric range is 92–500 m.

Astroceras compar Koehler, 1904 (Figs. 4D–J) [New Jn.: Tsubu-tsunomoduru]



Figs. 4. A–C, *Astroceras annulatum* (NSMT E-3008, dd 2.8 mm). A, aboral view; B, aboral disc, C, oral disc. D–F, *Astroceras compar*, a larger specimen (NSMT E-6674, dd 12.8 mm). D, aboral view; E, aboral disc; F, oral periphery of the disc, part of skin is removed to observe an adoral plate indicated by an arrow. G–J, *A. compar*, a smaller specimen (NSMT E-6342, dd 2.4 mm). G, aboral view; H, oral view; I, aboral disc and basal portion of arms; J, basal portion of the arm, lateral view. Abbreviation: T, tubercle.

Astroceras compar Koehler, 1904: 158–159, pl. 22 fig. 5, pl. 33 fig. 9, pl. 32 fig. 3; Döderlein, 1927: 80, pl. 9 figs. 2–2b, 3-3a; Koehler, 1931: 23–24; Mortensen, 1933a: 54–56, figs. 39–41; H.L. Clark, 1939: 39.

Astroceras verrucosum Koehler, 1931: 29–32, pl. 4, figs. 6–8.

Materials examined. Disc diameter range is 2.4–12.8 mm (×2). St. O19, E of Chichijima Island, 300 m (NSMT E-6342, ×1); St. O28, NE of Mukojima Island, 521–536 m (NSMT E-6674, × 1).

Remarks. Mortensen (1933a) showed growth changes in morphology of *Astroceras compar*. Young individuals have numerous small granule-shaped dermal ossicles on the body and several tubercles on radial shields (Figs. 4G–J). The granule-shaped dermal ossicles gradually disappear in larger specimens with only single tubercles remaining on radial shields in adults. Mortensen (1933a) did not show disc diameters of his examined adult specimens. Döderlein (1927) showed maximum disc diameter of this species as 19.0 mm. One specimen of intermediate size (dd 12.8 mm), lacked granule-shaped dermal ossicles on the body, but possessed only 4–8 tubercles on each radial shield (Figs. 4D–F) . This specimen suggests that those individuals

with a disc diameter of 12.8 mm are not yet adults.

Distribution. Japan: off Gotō Islands (Mortensen, 1933a), off Ogasawara Islands (new record, present study). Philippines: Matocot Port, off Hermanos Islands (Döderlein, 1927). Indonesia: Flores Sea (Döderlein, 1927), Kei Islands (Koehler, 1904, 1931). Indian Ocean: off Maldive Islands (H.L. Clark, 1939). The bathymetric range is 170–550 m.

Astroceras sp. (Figs. 5A–C)

?*Astroceras mammosum* Koehler, 1931: 24–27, pl. 4 figs. 5, 13.

Materials examined. Disc diameter range is 1.2–6.0 mm (×21). St. O10, W of Minamijima Island, 138.2–136.0 m (NSMT E-6673, ×1); St. O15, W of Minamijima Island, 88–88 m (NSMT E-6327, ×1, E-6328, ×1, E-6329, ×1, E-6330, ×1, E-6331, ×1); St. O16, E of Chichijima Island, 175–176 m (NSMT E-6262, ×1, E-6332, ×1, E-6333, ×1, E-6334, ×1, E-6335, ×1, E-6336, ×1, E-6344, ×2); St. O23, NW of Otōtojima Island, 200–220 m (NSMT E-2979-A, ×1, E-2979-B, ×1); St. O26, W of Minamijima Island, 137.9–138.3 m (NSMT E-6672, ×1); St. O29, off Futami Port, Chichijima Island, 65 m (NSMT E-1834-A, ×2, E-1834-B, ×2).

Remarks. The present specimens were close to *A. mammosum* Koehler, 1931 in having large domed tubercles on the aboral surface of the arms. *Astroceras mammosum* has two tubercles every 3–5 arm segments, whereas the present species have one tubercle every 1 or 2 arm segments (Figs. 5A, C). Body color of living specimens is also different: *A. mammosum* is uniformly yellowish white (Koehler, 1931), but the present specimens are bright red with whitish area with many brown spots on the aboral surface (Fig. 5B). The present specimens are probably an undescribed species.

Distribution. Japan: off Ogasawara Islands. The bathymetric range is 65–220 m (present study).

Family **Gorgonocephalidae** Ljungman, 1867

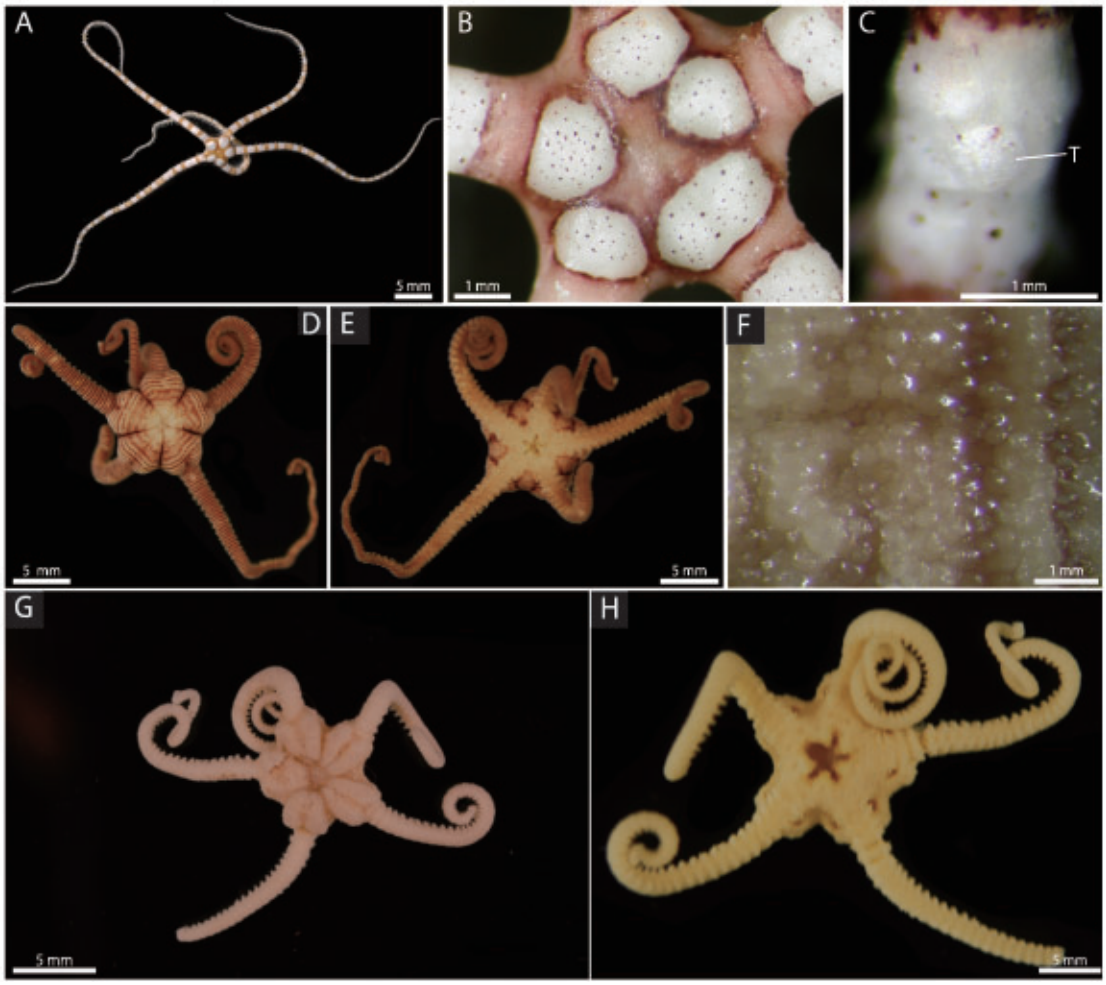
Genus ***Asteroporpa*** Lütken, 1856

Subgenus ***Asteroporpa*** (***Asteroporpa***) Lütken, 1856

Asteroporpa (***Asteroporpa***) ***hadracantha*** H.L. Clark, 1911 (Figs. 5D–F) [Jn.: Shigetou-moduru]

Asteroporpa hadracantha H.L. Clark, 1911: 280–281, fig. 142; 1915: 182; Döderlein, 1911: 101; 1927: 89; 1930: 381, pl. 2 figs. 7–8; Matsumoto, 1912a: 193–194, figs. 1, 2; 1917: 67–68, fig. 17; Mortensen, 1933a: 27, fig. 19; Murakami, 1944a: 247; Chang *et al*., 1962: 57–58, fig. 2; 1964: 135; Irimura, 1981: 20, pl. 1 figs. 1–2; 1982: 15–16, fig. 9, pl. 1 fig. 4, pl. 3 fig. 3; 1991: 123, figs. A, B; Liao and A.M. Clark, 1995: 166–167, fig. 72; Irimura and Tachikawa, 2003: 7.

Materials examined. Disc diameter range is 0.6–10.8 mm (×60). St. H15, NE of Hachijōjima Island, 130–190 m (NSMT E-2918, ×1); St. H17, NE of Hachijōjima Island, 205.1–201.4 m (NSMT E-6676, ×1); St. H18, NE of Hachijōjima Island, 150.9–147.3 m (NSMT E-6675, ×1); St. H19, NW of Hachijōjima island, 212–177 m (NSMT E-6376, ×9); St. O2, S of Hahajima Island, 96.5–92.0 m (NSMT E-6690, ×1); St. O4, N of Hahajima Island, 98.3–102.4 m (NSMT E-6695, ×2); St. O5, N of Hahajima Island, 102.1–118.2 m (NSMT E-6697, ×1); St. O6, N of Hahajima Island, 147.2–145.2 m (NSMT E-6696, ×1); St. O7, N of Hahajima Island, 145.6–150.7 m (NSMT E-6689, ×7, E-6698, ×2); St. O9, W of Minamijima Island, 129–127 m (NSMT E-6337, ×1); St. O10, W of Minamijima Island, 138.2–136.0 m (NSMT E-6687, ×1, E-6688, ×1, E-6682, ×1, E-6683, ×1, E-6684, ×1, E-6686, ×1); St. O11, W of Minamijima Island, 135.8–136.7 m (NSMT E-6685, ×4); St. O14, W of Minamijima Island, 139.8–140.9 m (NSMT E-6694, ×1); St. O17, E of Nishijima Island 52.1–52.0 m (NSMT E-6692, ×1); St. O18, NW of Otōtojima Island, 135.8–135.5 mm (NSMT E-6691, ×6, E-6693, ×2); St. O23, NW of Otōtojima Island, 200–220 m (NSMT E-2985, ×1); St. O25, W of Minamijima island, 145.2–138.6 m (NSMT



Figs. 5. A–C, *Astroceras* sp. (NSMT E-6262, dd 3.9 mm). A, aboral view; B, aboral disc; C, aboral distal portion of the arm. D–F, *Asteroporpa (Asteroporpa) hadracantha* (NSMT E-6337, dd 8.9 mm). D, aboral view; E, oral view; F, aboral periphery of the disc. G–H. *Asteroporpa (Astromoana) koyoae*. (NSMT E-6341-A, dd 9.4 mm). G, aboral side; H, oral side. Abbvreviation; T, tubercle

E-6503, ×7, E-6678, ×1, E-6679, ×1, E-6681, × 1); St. O26, W of Minamijima Island, 137.9–138.3 m (NSMT E-6680, ×1); St. O27, W of Minamijima Island, 138–136 m (NSMT E-6677, × 1).

Remarks. The present species is one of the more common gorgonocephalids found in Japanese waters. Two species of *Asteroporpa*, *A*. (*Asteroporpa*) *hadracantha* and *A*. (*Astromoana*) *koyoae*. were recognized in this study. The subgenus *Asteroporpa* (*Asteroporpa*) has alternating, concentric ridges and intervening furrows on the aboral surface of the disc. The ridges consist of rows of raised hooklet-bearing plates, and intervening furrows consist of rows of lower granule-shaped dermal ossicles (Baker, 1980) (Figs. 5D–F).

Distribution. Japan: off Yaeyama Islands (Murakami, 1944a), south of Kyūshū, Shikoku and Honshū Islands (H.L. Clark, 1911, 1915; Matsumoto, 1912a, 1917; Döderlein, 1911, 1927, 1930; Mortensen, 1933a; Irimura, 1981, 1982, 1991), off Ogasawara Islands (Murakami, 1944a; Irimura and Tachikawa, 2003; present study).

China: off Hainan Island (Chang *et al*., 1962, 1964; Liao and A.M. Clark, 1995). The bathymetric range is 62–366 m.

Subgenus ***Asteroporpa*** (***Astromoana***) Baker, 1980

Asteroporpa* (*Astromoana*) *koyoae Okanishi and Fujita, 2011 (Figs. 5G, H) [Jn.: Koyo-moana-moduru]

Asteroporpa (*Asteromoana* [sic]) *koyoae* Okanishi and Fujita, 2011a: 33–37, figs. 6–9.

Materials examined. Disc diameter range is 8.3–9.4 mm (×2). St. O8, S of Chichijima Island, 712.4–743.1 m (E-6341-A, holotype×1, E-6341-B, paratype×1).

Remarks. The subgenus *Astromoana* has only scattered hooklet-bearing plates at periphery of the disc instead of the concentric ridges of raised hooklet-bearing plates on the aboral surface of the disc like *Asteroporpa* (*Asteroporpa*). The present species falls within subgenus *Asteroporpa* (*Astromoana*). *Asteroporpa* (*Astromoana*) *reticulata* and *A.* (*Astromoana*) *indicus* have only granule-shaped dermal ossicles on the disc (Baker, 1980), whereas *A.* (*Astromoana*) *koyoae* has cone-shaped dermal ossicles which bear terminal projections on the disc (Okanishi and Fujita, 2011a).

The subgeneric name "Astromoana" is misspelled as "Asteromoana" in Okanishi and Fujita (2011a).

Distribution. Japan: Hahajima Island, Ogasawara Islands (Okanishi and Fujita, 2011a). The bathymetric range is 712.4–743.1 m. This subgenus has been known from southern Japan, northwest of New Zealand and western Australia (Baker, 1980; McKnight, 2000: Okanishi and Fujita, 2011a).

Genus ***Astroboa*** Döderlein, 1911

Astroboa nigrofurcata Döderlein, 1927 (Figs. 6A–F) [New Jn: Hanmon-tedurumoduru]

Astroboa nigrofurcata Döderlein, 1927: 45–47, pl. 4 figs. 1–4; Koehler, 1931: 19, pl. 3 fig. 12; Baker, 1980: 60, 62, figs. 23, 28, 33; Rowe and Gates, 1995: 363.

Materials examined. Disc diameter is 44.5 mm (×1). St. O30, Hitomarujima Island, 20 m (NSMT E-3524, ×1).

Remarks. Three other species of *Astroboa*, *A. arctos, A. globifera and A. nuda*, are known from Japanese waters. *Astroboa nigrofurcata* can be distinguished from these other species based on the presence of tiny cone-shaped dermal ossicles on aboral surface of the disc, polygonal plate-shaped dermal ossicles on aboral surface of the disc, large madreporite and black spots of each arm segment along the aboral midline (Figs. 6C–F).

Distribution. Japan: off Hitomarujima, Ogasawara Islands (new record, present study). Philippines: off Observatory Island, off Corandagos Island, off Bubuan Island (Döderlein, 1927). Indonesia: off Kei Island (Koehler, 1931). Australia: west of Carnarvon, north west of Dampier (Baker, 1980; Rowe and Gates, 1995). The bathymetric range is 20–128 m. This is the first record of *A. nigrofurcata* from Japan.

Genus ***Astrocladus*** Verrill, 1899

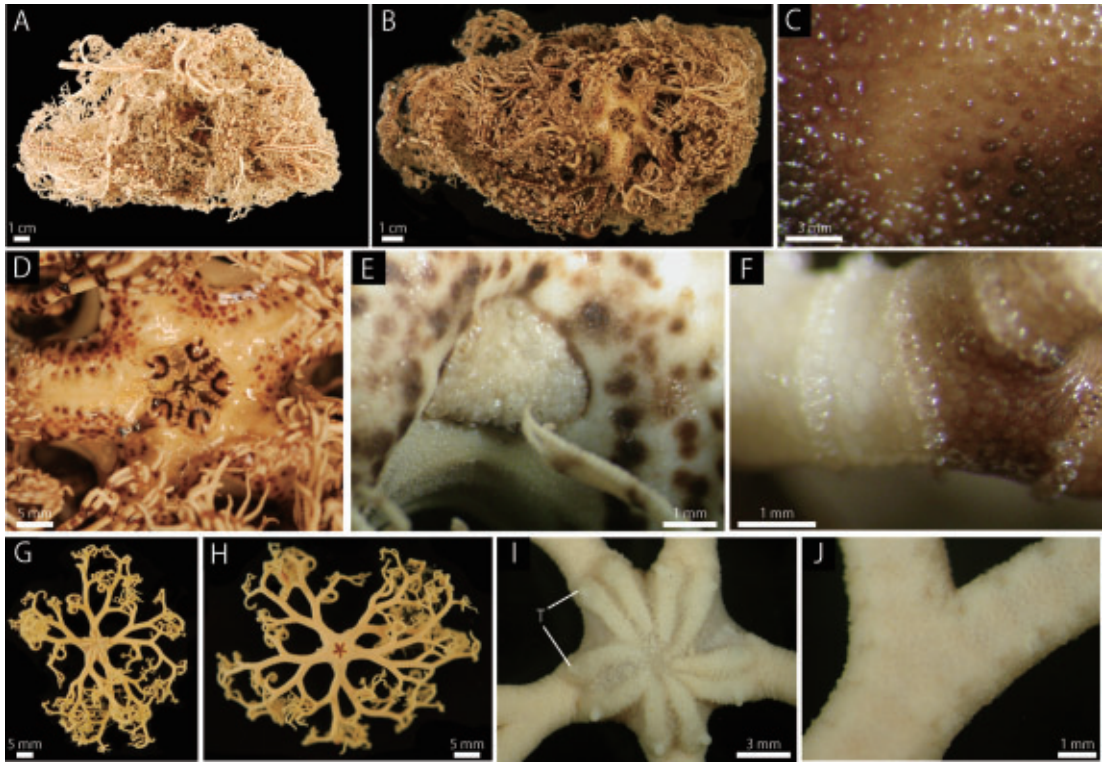
Astrocladus coniferus (Döderlein, 1902) (Figs. 6G–J) [Jn.: Seno-tedurumoduru]

Astrophyton coniferum Döderlein, 1902: 325–326.

Astrocladus coniferus—Döderlein, 1911: 46–49, 106, pl. 2 figs. 7–7a, pl. 3 figs. 1–3a, pl. 7 figs. 5–6a, fig. 16; 1912: 267; H.L. Clark, 1915: 186; Matsumoto, 1912a: 204, figs. 14–16; 1912b: 388–389; 1917: 77–79, fig. 23; Murakami, 1944a: 247–248; 1944b: 262; Djakonov, 1949: 50; 1954: 20; Irimura, 1969: 39; 1981: 18–19; 1990: 75, pl. 34; Fujita and Kohtsuka 2003: 27–28, pl. 1B; Fujita *et al*., 2004: 192–193.

Astrocladus coniferus var. *coniferus*—Irimura 1982: 9–11, fig. 5, pl. 1, 3; Saba *et al*.,1982: 26; Rho and Shin, 1987: 211.

Astrocladus dofleini Döderlein, 1910: 256; 1911: 41–46, pl. 2 fig. 6, pl. 4 figs. 4–5, pl. 7 figs.



Figs. 6. A–F, *Astroboa nigrofurcata* (NSMT E-3524, dd 44.52 mm). A. aboral view; B, oral view; C, aboral periphery of the disc; D, oral disc; E, lateral interradial disc; F, aboral basal portion of the arm. G–J, *Astrocladus coniferus* (NSMT E-2922, dd 7.66 mm). G, aboral view; H, oral view; I, aboral disc; J, oral basal portion of the arm. Abbreviation: T, tubercle.

15–15b; 1927: 35–36, pl. 3 figs. 2–2a.

Astrocladus coniferus var. *dofleini*—Irimura, 1982: 11–12, fig. 6, pl. 4, figs. 5–6.

Materials examined. Disc diameter is 7.7–137.9 mm (×6). St. H14, NW of Hachijōjima Island, 120 m (NSMT E-2922, ×1); St. H22, NW of Hachijōjima Island, ca. 500 m (NSMT E-5483, ×4); St. O20, off Nishijima Island, 200 m (NSMT E-6667, ×1).

Remarks. *Astrocladus coniferus* is closely related to *A. dofleini* Döderlein, 1910. These species were historically distinguished by the distribution, including the lack of large tubercles on aboral surface of the arms. However, intermediate forms found in Japanese specimens (Matsumoto, 1917; Fujita and Kohtsuka, 2003) led to the synonymy of *Astrocladus dofleini* with *A. coniferus* by Fujita *et al*. (2004).

Distribution. Widely distributed in northwestern Pacific to Indian Ocean (Irimura, 1982). Bathymetric range is low tide level to 880 m.

Genus ***Astrocrius*** Döderlein, 1927

Astrocrius sp. (Figs. 7A–E)

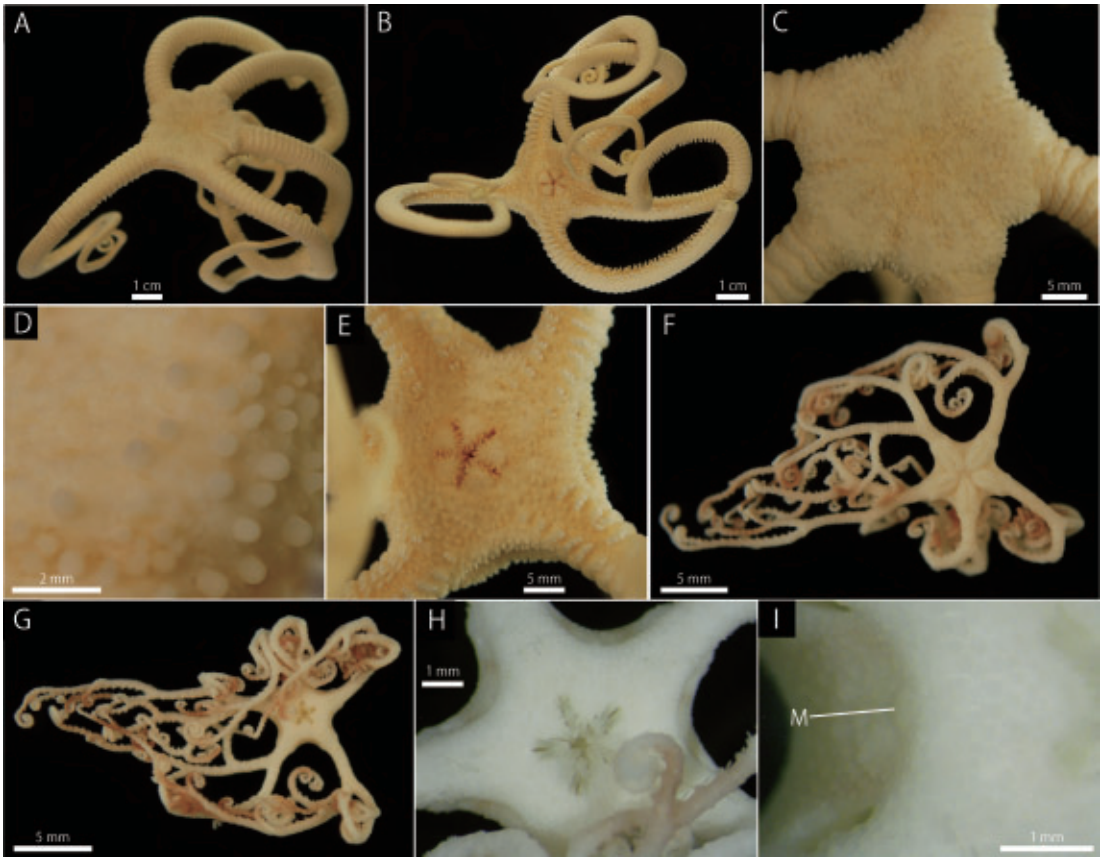
Astrocrius sp. Irimura and Tachikawa, 2003: 7.

?*Astrothamnus parens* Koehler, 1931: 9, pl. 1 figs. 3–7.

?*Astrocrius parens*—Mortensen, 1933a: 12–14, fig. 6.

Materials examined. Disc diameter is 22.3 mm (×2). St. O21, SE of Hahajima Island, 550 m (NSMT E-6343, ×1); St. O22, E of Hahajima Island, 907 m (CMZH-ZE 00875, ×1).

Remarks. The present specimens resemble *Astrocrius parens* Koehler, 1931 in having numerous tubercles on the aboral surface of the disc (Figs. 7C, D). Irimura and Tachikawa (2003) sug-



Figs. 7. A–E, *Astrocrius* sp. (NSMT E-6343, dd. 22.27 mm). A, aboral view; B, oral view; C, aboral disc and basal portion of the arms; D, aboral periphery of the disc; E, oral disc and basal portion of the arms. F–I, *Astroglymma sculptum* (NSMT E-6506, dd 4.46 mm). F, aboral view; G, oral view; H, oral disc; I, oral periphery of the disc. Abbreviation: M, madreporite.

gested that one of the present specimens (CMZH-ZE 00875) was probably an undescribed species of *Astrocrius*. They mentioned that the dermal ossicles on the aboral and lateral surface of the arms are granule-shaped for *A. parens* but are triangular in outline on the specimen and prior descriptions of *A. parens* (Koehler, 1931; Mortensen, 1933a) lack figures of the dermal ossicles making a final species determination inconclusive.

Distribution. Japan: off Chichijima Island, Ogasawara Islands (present study). The bathymetric range is 540–550 m.

Genus ***Astroglymma*** Döderlein, 1927

Astroglymma sculptum (Döderlein, 1896) (Figs. 7F–I) [Jn.: Aka-tedurumoduru]

Astrophyton sculptum Döderlein, 1896: 299, figs. 29, 29a–b.

Astrodactylus sculptus—Döderlein, 1911: 56, fig. 13; H.L. Clark, 1915: 190.

Astroglymma sculptum—Döderlein, 1927: 47–48, 96, pl. 1 figs. 3–4, pl. 5 fig. 13; Koehler, 1931: 15–16, pl. 2 figs. 10–12; Mortensen, 1934: 5, pl. 6; Murakami, 1944a: 248; 1944b: 263–264, pl. 1 fig. 1; Chang *et al*., 1962: 60–61, pl. 3 figs. 1–2; 1964: 138; Irimura, 1969: 40; 1981: 20; Baker, 1980: 66, figs. 19, 28, 31; Liao and A.M. Clark, 1995: 170, fig. 74; Rowe and Gates, 1995: 365.

Astroglymma sculpta—Irimura 1991: 121, pl. 44.

Astroglymma robillardi—Döderlein, 1927: 96;

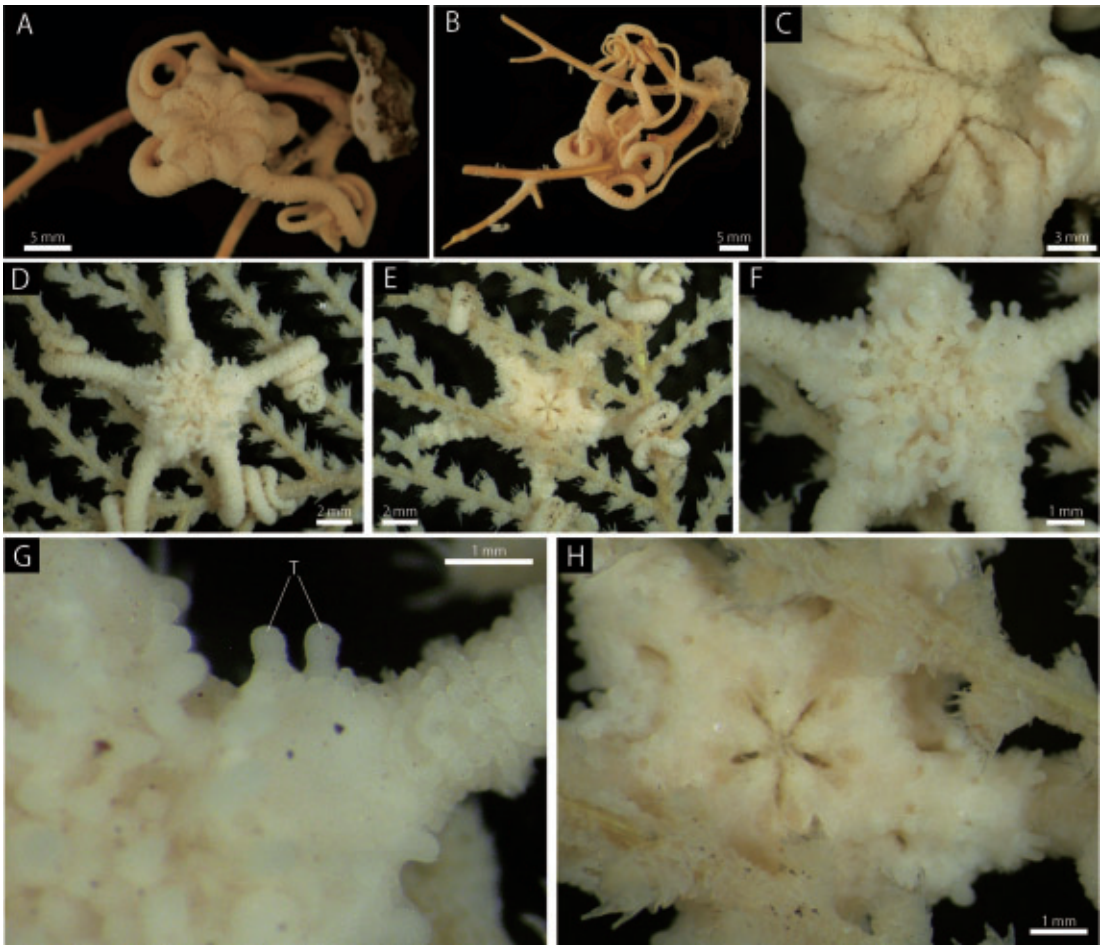
Mortensen, 1933a: 34–38, pl. 3 figs. 1–2, pl. 4 fig. 1.

Gorgonocephalus robillardi Loriol, 1900: 31–34, pl. 3 fig. 3; Rowe and Gates, 1995: 365.

Materials examined. Disc diameter is 4.5 mm (×1). St. O27, W of Minamijima Island, 138–136 m (NSMT E-6506, ×1).

Remarks. *Astroglymma* is monotypic and is distinguished from other gorgonocephalid genera by having five madreporites and girdle hooklets with one inner tooth (Fig. 7I).

Distribution. Japan: off Tomioka (Murakami, 1944b; Irimura, 1969, 1991), off Seto (Irimura, 1981), off Minamijima Island, Ogasawara Islands (new record, present study). Philippines: off Ambon Island (Döderlein, 1896, 1911; H.L. Clark, 1915), off Corandagos Island (Döderlein, 1927), off Kei Island, (Koehler, 1931). China: off Hainan Island (Chang *et al*., 1962, 1964; Liao and A.M. Clark, 1995), off Hong Kong, Taiwan Strait (Mortensen, 1934). Australia: northwest of Australia (Baker, 1980; Rowe and Gates, 1995). Mauritious: (Loriol, 1900; Döderlein, 1927, Mortensen, 1933a). The bathymetric range is 73–300 m.



Figs. 8. A–C, *Astrothorax misakiensis* (NSMT E-2673, dd 12.40 mm), clinging to a gorgonacean colony. A, aboral view; B, oral view; C, aboral disc. D–H, *Astrothrombus rugosus* (NSMT E-2926, dd 4.52 mm), clinging to a gorgonacean colony. D, aboral view; E, oral view; F, aboral disc and basal portion of the arms; G, aboral periphery of the disc; H, oral disc. Abbreviation: T, tubercle.

Genus ***Astrothorax*** Döderlein, 1911

Astrothorax misakiensis Döderlein, 1911 (Figs. 8A–C) [New Jn.: Yoroi-fushi-moduru]

Astrothorax misakiensis Döderlein, 1911: 24–26, pl. 6 figs. 2–2b, pl. 7 fig. 12; 1927: 88; 1930: 379–380; Matsumoto, 1917: 87–88.

Materials examined. Disc diameter is 9.8–14.4 mm (×3). St. H6, E of Hachijōjima Island, 455 m (NSMT E-1549, ×1); St. H9, E of Hachijōjima Island, 475 m (NSMT E-2673, ×2).

Remarks. *Astrothorax misakiensis* is the only known species of *Astrothorax* in Japanese waters. It can be distinguished from other congeners based on its large domed plate-shaped dermal ossicles and the small granule-shaped dermal ossicles between them (Fig. 8C).

Distribution. Japan: off Misaki, Sagami Sea (Döderlein, 1911, 1927, 1930; Matsumoto, 1917), off Hachijōjima Island (new record, present study). The bathymetric range is 130–220 m.

Genus ***Astrothrombus*** H.L. Clark, 1909

Astrothrombus rugosus H.L. Clark, 1909 (Figs. 8D–H) [New Jn.: Kobu-fushi-moduru]

Astrothrombus rugosus H.L. Clark, 1909: 548–549, 54 fig. 3; Mortensen, 1933a: 16–17, figs. 8f, g; Pawson, 1969: 54–55, figs. 2A, B, 13; Baker and Clark, 1970: 7; Baker, 1980: 32–34, fig. 9 upper.

Astrotoma benhami Bell, 1917: 8. Mortensen, 1924: 104–106, fig. 3, pl. 4 figs. 6, 7; Fedotov, 1927: 373, figs. 26–34; Baker and Clark, 1970: 7.

Astrothamnus benhami—Mortensen, 1933a: 14–15, fig. 7.

Materials examined. Disc diameter is 3.1–7.7 mm (×23). St. H4, E of Hachijōjima Island, 1920 m (NSMT E-2725, ×2); St. H7, E of Hachijōjima Island, 490 m (NSMT E-2637, ×19, E-2637-B, ×1); St. H16, NE of Hachijōjima Island, 230 m (NSMT E-2926, ×1).

Remarks. Two species of *Astrothrombus*, *A. rugosus* and *A. chrysanthi* are known in Japanese waters. *Astrothrombus rugosus* can be distinguished from *A. chrysanthi* by having conspicuously large tubercles on aboral surface of the disc (Figs. 8F, G).

Distribution. Japan: off Hachijōjima Island (new record, present study). Southwestern Pacific (H.L. Clark, 1909; Bell, 1917; Mortensen, 1924, 1933a; Pawson, 1969; Baker and H.S.E. Clark, 1970; Baker, 1980). The bathymetric range is 37–1920 m.

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八丈島および小笠原諸島より採集されたツルクモヒトデ類（棘皮動物）

岡西政典・山口邦久・堀井善弘・藤田敏彦

国立科学博物館のプロジェクト調査「相模湾における生物多様性の起源探究に関する研究」によって，八丈島および小笠原諸島の水深20～1980 mの海底より，ドレッジ，ビームトロール，スキューバダイビングなどによってツルクモヒトデ類の採集を行った．既存の標本と合わせ339個体のツルクモヒトデ類を同定したところ，4科12属17種のツルクモヒトデ類が認められた．