

Three New Species of *Hemiliostraca* and a Redescription of *H. conspurcata* (Gastropoda: Caenogastropoda: Eulimidae) from Japan, with a Revised Diagnosis of the Genus

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Abstract: Three new species of the eulimid gastropod genus *Hemiliostraca* Pilsbry, 1917, i.e., *H. capreolus* n. sp., *H. tenuis* n. sp., and *H. maculata* n. sp., are described and *H. conspurcata* (A. Adams, 1863) is redescribed based on newly obtained material from Japan. The diagnosis of the genus is also revised. *Hemiliostraca capreolus* n. sp. was previously misidentified as *H. samoensis* in museum collections and in literature. This new species was collected from Okinawa-jima Island and Amami-Oshima Island, southern Japan, and can be distinguished from *H. samoensis* by its distinct color patterns and markings. A recently collected specimen from an unidentified species of ophiuroid from Wakayama Prefecture, central Japan, is herein confirmed to be identifiable with *H. conspurcata*, which has not been recorded since its originally description from central Japan in 1863. *Hemiliostraca tenuis* n. sp. was collected from an unidentified species of sponge and the ophiuroid *Ophiarachnella septemspinosa* from Kume-jima Island, southern Japan. This new species is characterized by a slender, oval, transparent shell with indistinct brownish markings. *Hemiliostraca maculata* n. sp. from the Ogasawara Islands, Amami-Oshima Island, and Okinawa-jima Island, all in southern Japan, is very similar to *H. conspurcata* in shell appearance, but *H. maculata* n. sp. is distinguished from *H. conspurcata* by its color markings consisting of solid lines, and columella-parietal wall that forms very weak angle.

Keywords: *Hemiliostraca*, ophiuroids, taxonomy, redescription, new species, Porifera

Introduction

Caenogastropods of the family Eulimidae Philippi, 1853 are minute to small marine gastropods parasitic on echinoderms including asteroids, ophiuroids, echinoids, holothuroids, and crinoids (Warén, 1984). Among them the genus *Hemiliostraca* Pilsbry, 1917 is a relatively large group, which is widely distributed in the temperate to tropical regions of the world (e.g., Laseron, 1955; Warén, 1980, 1984, 2008; Engl, 2002). The genus currently contains 20 valid species, three of which are known to parasitize ophiuroids (Warén, 1980; Matsuda *et al.*, 2013; Takano *et al.*, 2016; MolluscaBase, 2019).

Six species of *Hemiliostraca* have been reported from Japan: *H. metcalfei* (A. Adams in H. Adams & A. Adams, 1853), *H. peasei* (Tryon, 1886) (as *H. "distorta"* in Hori & Matsuda, 2017), *H. ophiarachnicola* Matsuda, Uyeno & Nagasawa, 2013, *H. fasciata* Matsuda, Uyeno &

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Nagasawa, 2013, *H. conspurcata* (A. Adams, 1863), and *H. samoensis* (Crosse, 1867) (sometimes as species of *Eulimitra* and *Eulima*) (Higo *et al.*, 1999; Matsuda *et al.*, 2013; Hori & Matsuda, 2017; MolluscaBase, 2019). Of these six, *H. samoensis* and *H. conspurcata* are insufficiently known for their taxonomic status to be clear. *Hemiliostraca samoensis* was originally described as *Leiostraca samoensis* from Samoa Island (Crosse, 1867). In Japan, Kuroda (1928) identified an eulimid specimen from Amami-Oshima Island as “*Subularia* cf. *samoensis*” (Japanese name: Hoshifu-hanagōna). The species has subsequently been reported as “*Eulimitra samoensis*” in this country without any explanation of its genetic status (Higo, 1973; Higo & Goto, 1993; Higo *et al.*, 1999). Héros *et al.* (2007) reported *H. samoensis* from New Caledonia, but neither a description nor illustration was given. Recently, we examined four eulimid specimens which are labeled as *Eulima samoensis* in the Sakurai Collection at the National Museum of Nature and Science, Tsukuba (NSMT), Japan. This examination has revealed that the specimens do not agree with the original description of *H. samoensis* but represent an undescribed species of the genus. We also had the opportunity to examine two shell specimens of this undescribed species collected by Mr. Hiroyuki Kinjo from Okinawa-jima Island, southern Japan. Using these six specimens together, we herein describe a new species, *H. capreolus* n. sp. Also, following examination of two NSMT specimens which are labeled as *Eulima samoensis* from Amami-Oshima Island and three specimens which are labeled as *Leiostraca samoensis* from Society Islands in the south Pacific Ocean (loaned from the Bishop Museum, Honolulu), we briefly discuss identification of these specimens.

Hemiliostraca conspurcata was originally described as *Leiostraca conspurcata* by Adams (1863) from “Takano-Sima” [= Takano-Shima, Tateyama, Chiba Prefecture, central Japan (Pilsbry, 1902)]. Recently, we observed a single specimen collected by Mr. Shin-ichi Ikebe from an unidentified ophiuroid from the Pacific coast of Wakayama Prefecture, central Japan, and found that morphological features of the specimen agree well with those of a syntype of *H. conspurcata* preserved in the Museum Victoria, Australia. We herein redescribe the species based on the newly collected specimen.

In addition, two new species of *Hemiliostraca* are herein described from Japan. They are *H. tenuis* n. sp. collected from the ophiidermatid ophiuroid *Ophiarachnella septemspinosa* (Müller & Troschel, 1842) and an unidentified species of sponge at Kume-jima Island, southern Japan, and *H. maculata* n. sp. collected as empty shells from beach drift at the Ogasawara Islands, Amami-Oshima Island, and Okinawa-jima Island, southern Japan. We also revised the diagnosis of *Hemiliostraca* based on newly acquired knowledge.

Abbreviations: ANSP – Academy of Natural Sciences of Drexel University, Philadelphia PA, USA; BPBM – Bernice Pauahi Bishop Museum, Honolulu, Hawai’i, USA; NMV – Museum Victoria, Victoria, Australia; NSMT – National Museum of Nature and Science, Tsukuba, Japan.

Materials and Methods

Dry eulimid specimens examined in the present study were either loaned from museums, such as the NSMT and the BPBM, or provided by Japanese colleagues, such as Messrs Hiroyuki Kinjo, Taiji Kurozumi, Masafumi Sano, and Shin-ichi Ikebe. For *H. conspurcata*, digital images of its syntype (catalogue number F31404) taken by Mr. Chris Rowley of the NMV, were also examined.

Two live specimens were collected by one of the authors (DU) from the ophiidermatid ophiuroid *Ophiarachnella septemspinosa* and an unidentified species of sponge in coastal waters of Kume-jima Island, the Ryukyu Islands, Okinawa Prefecture, southern Japan. They were sampled during the KUMEJIMA 2009 Expedition organized by the Transdisciplinary Research Organization for Subtropical and Island Studies of the University of the Ryukyus, the Center for Marine Bioscience & Biotechnology of the National Taiwan Ocean University, the Raffles Museum of Biodiversity Research of the National University of Singapore, and the Biodiversity Research Center of the

Academia Sinica (see Naruse *et al.*, 2012). The specimens were fixed in 70% ethanol in the field, brought to the laboratory, and examined for parasitic gastropods. In particular, the sponge was cracked to find eulimid specimens.

Measurements of shells were made from digital images. The following shell dimensions were measured on digital images using Adobe Photoshop®; AL, aperture length; LL, last whorl length (as “BL, body whorl length” in Matsuda *et al.*, 2010); L, distance from the posterior extremity of the outer lip margin to widest point along OL; OL, chord of the outer lip margin (distance from the posterior extremity to the anterior extremity of the outer lip margin); SL, shell length; SW, shell width (see Matsuda *et al.*, 2010: fig. 1A, D). Type specimens of the new species are deposited in the molluscan (Mo) collection of the NSMT.

Taxonomy

Family Eulimidae Philippi, 1853

Genus *Hemiliostraca* Pilsbry, 1917

Subularia Monterosato, 1884 — Bartsch, 1917: 134; Pilsbry, 1917: 228 [not *Subularia* Monterosato, 1884: 103].

Hemiliostraca Pilsbry, 1917: 228 (type species: *Leiostraca distorta* Pease, 1861, by monotypy) [as a section of *Subularia* Monterosato, 1884].

Hemiliostraca Pilsbry, 1917 — Rehder, 1980: 55 [as a full genus].

Hemiliostraca Pilsbry, 1918 [*sic*; =1917] — Warén, 1980: 288; Warén, 1984: 48.

Eulimitra Laseron, 1955: 94 (type species: *Eulimitra vittata* Laseron, 1955, by original designation); Warén, 1984: 46.

Revised diagnosis: Shell slender, conical with constricted and blunt apex, smooth, polished, transparent to semipellucid white with brownish markings. Spire straight or curved, sometimes flexed. Whorls straight-sided or weakly convex. Suture invisible, barely impressed, false suture often distinct. Protoconch dome shaped with more or less brownish markings, demarcated by indistinct incremental scar. Aperture elongate, narrow, occupying more than half of last whorl, not extending anteriorly beyond base. Last whorl relatively large, often dorsoventrally compressed, sometimes with a short keel below. Inner lip nearly straight or slightly sinuous in middle, callous. Outer lip orthocline or slightly prosocline, evenly curved in lateral view.

Remarks: *Hemiliostraca* was erected by Pilsbry (1917) as a section of the genus *Subularia* for species possessing a curved shell “without color markings”. However, the syntypes of the type species of *Hemiliostraca*, *Leiostraca distorta* Pease, 1861, which Pilsbry examined, were beachworn specimens with faint traces of color markings (Warén, 1980; Rehder, 1980), and fresh specimens of the species possess a clear dark brown spiral stripe around the periphery (*e.g.*, Warén, 1984: figs 104–105). Furthermore, Pilsbry’s concept of *Subularia*, which was adopted from Bartsch (1917), was different from that of Monterosato, 1884 as discussed in detail by Rehder (1980). Rehder (1980) concluded that “*Subularia*” *sensu* Bartsch (1917) [not Monterosato, 1884] and *Hemiliostraca* Pilsbry, 1917 are synonyms, and regarded the latter as the valid name of this taxon. Warén (1980) redefined *Hemiliostraca* as a genus characterized by a brownish larval shell with about 3.5 rather convex whorls, a more or less distinct color pattern and a rather square aperture with a distinctly flattened or excavated columella, and reported the color pattern as brownish axial lines or irregular blotches. However, spiral lines may be more common than axial lines because the former are found on most of the species of the genus including *H. sloani* Warén, 1980 (*e.g.*, Rehder, 1980; Matsuda *et al.*, 2013). In addition, some species of the genus are known to have fewer larval whorls (*e.g.*, 2.25 whorls for *H. bahamondei*; 2.5 for *H. fasciata*) (Rehder, 1980;

Matsuda *et al.*, 2013).

Currently, *Eulimitra* has been relegated to a junior synonym of *Hemiliostraca* (MolluscaBase, 2019) on the basis of uncertainty concerning their morphological separation as indicated by Warén (1984). We agree with this view because two species originally assigned to *Eulimitra*, including the type species *H. vittata* (Laseron, 1955), only differ from *Hemiliostraca* by the possession of a minute shell with fewer whorls (Laseron, 1955). On the other hand, although Habe (1975) transferred *Eulima kawamurai* Habe, 1961 to *Eulimitra*, it should be placed in *Sticteulima* Laseron, 1955 because its morphological features approach those of *Sticteulima cameroni* Laseron, 1955, the type species of the genus (see below), not *Hemiliostraca* spp. These features include a broader shell with slightly convex whorls, lower apical whorls, and an anteriorly extended aperture (Hori & Matsuda, 2017: pl. 101, fig. 5; H. Matsuda, personal observations).

Sticteulima has a certain similarity to *Hemiliostraca* in its general morphology, such as a conical shell with brownish markings and a calloused inner lip margin (Laseron, 1955; Warén, 1984), and the mode of attachment to ophiuroid hosts (Bouchet & Warén, 1986), but we consider that both genera are distinguishable from each other. Although the species of *Sticteulima* have relatively small shells (*e.g.*, 2–4 mm in SL in Warén, 1984; 1.5–3.5 mm in Mifsud & Ovalis, 2019), size is not a reliable character to separate them from *Hemiliostraca* because the species of *Hemiliostraca* have shells ranging from 2–12 mm in SL (Warén, 2008). Based on the original description (Laseron, 1955) as well as photographs of the syntype, Australian Museum C.103030 available on the web (Beechey, 2020), *S. cameroni* has the following morphological characters: 1) broader shell (SW/SL = *ca.* 0.43; estimated, apical end broken), 2) lower apical whorls; 3) slightly convex whorls; 4) shallow but distinct suture; 5) moderately inflated last whorl; 6) aperture extending anteriorly beyond the base. The broader shell with rather convex whorls is shared by other species currently assigned to *Sticteulima* (*e.g.*, Warén, 1984; Bouchet & Warén, 1986; Engl, 1997) but differs from those of *Hemiliostraca* spp. Moreover, the aperture morphology is different between two genera: the aperture projects downward in *Sticteulima* spp. (Laseron, 1955; Warén, 1980, 1984), whereas it does not protrude and the basal lip is connected to the left last whorl line in *Hemiliostraca* spp. (Pilsbry, 1917; Warén, 1980; Matsuda *et al.*, 2013). A revision is needed for *Sticteulima* because several species of the genus possess heterogeneous characters and may be transferred to other genera.

Hemiliostraca capreolus n. sp.

(Figs 1A, B, 2A)

Type material: Holotype, NSMT-Mo 79163 (Fig. 1A), 7.25 mm SL, sandy bottom at depths of 20–25 m off Seragaki, Onna-son, Okinawa-jima Island, Okinawa Prefecture, East China Sea, Japan, 2011, *leg.* H. Kinjo; paratype #1, NSMT-Mo 79164, apical part broken, collection site, date and collector same as for holotype; paratypes #2–5, NSMT-Mo 111294 (*ex.* the Sakurai Collection) (Fig. 1B), 6.02–7.15 mm SL, Amami-Oshima Island, Kagoshima Prefecture, Japan, date unknown, *leg.* K. Sakurai (labeled as *Eulima samoensis*).

Other material examined: NSMT-Mo 102466, 6.43 mm SL, collection site, date and collector unknown.

Description: Shell slender (7.25 and 1.99 mm in SL and SW, respectively, for holotype; 6.02–7.15 and 1.74–2.10 mm for paratypes), straight and conical in form, glossy, translucent, ornamented with brown spiral band mainly parallel to suture; band sometimes branches in direction of apical part, with its intensity unequal (Fig. 1A, B, Table 1). In dorsal view, two bands present on last whorl; upper band connected to brown blotches. Protoconch smooth, consisting of slightly more than 3.0 whorls with visible height of *ca.* 450 µm in holotype (Fig. 2A). Demarcation between protoconch and teleoconch dimly seen using SEM. Teleoconch comprises 8.1 whorls in

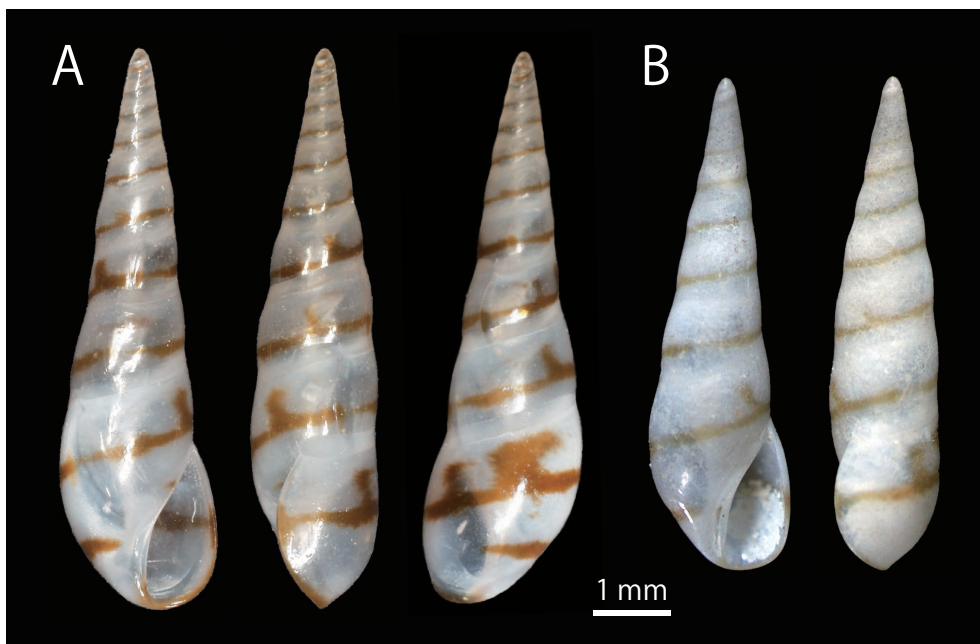


Fig. 1. *Hemiliostraca capreolus* n. sp. **A.** Ventral, lateral, and dorsal views of shell, holotype, NSMT-Mo 79163, SL = 7.25 mm. **B.** Ventral and lateral views of shell, paratype #2, NSMT-Mo 111294, SL = 6.40 mm. All at the same scale.

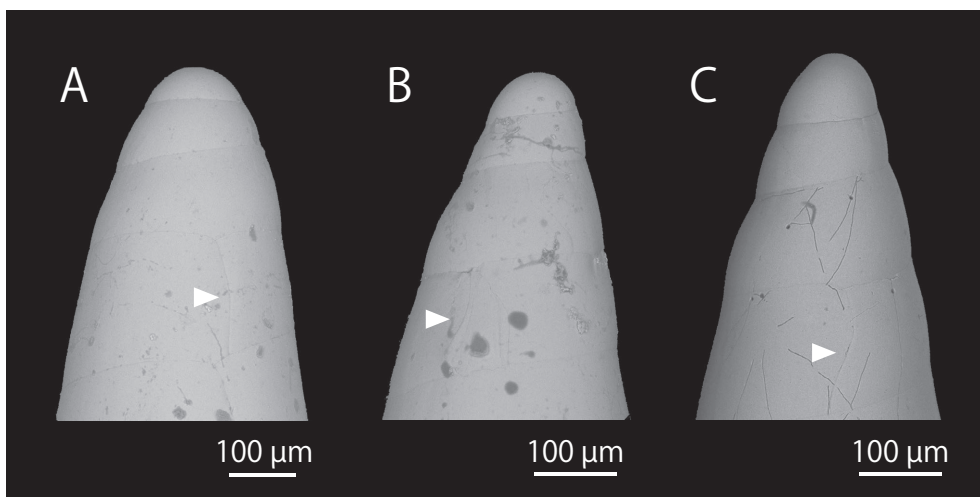


Fig. 2. Scanning electron micrographs of the protoconch. **A.** *Hemiliostraca capreolus* n. sp., holotype, NSMT-Mo 79163. **B.** *H. conspurcata*, NSMT-Mo 79170, from an unidentified species of ophiuroid, Sakai, Minabe, Hidaka, Wakayama Prefecture, North Pacific Ocean, Japan. **C.** *H. maculata* n. sp., holotype, NSMT-Mo 79167. Arrows indicate scars between protoconch and teleconch.

holotype, upper four whorls flat sided, lower whorls slightly convex. Last whorl occupies less than half of shell length ($LL/SL = 0.46$ for holotype, $0.45\text{--}0.49$ for paratypes); periphery rounded, with flattened area between columella and short angular ridge on left side. Incremental scars very thin, shallow, indistinct, colorless, appearing every *ca.* 0.5 whorl from aperture. Aperture small for genus

Table 1. Shell dimensions for four *Hemiliostraca* spp.

	<i>Hemiliostraca capreolus</i> n. sp.				<i>H. conspurcata</i>			<i>H. tenuis</i> n. sp.		<i>H. maculata</i> n. sp.	
	Holotype		Paratypes		Lectotype	NSMT-Mo		Holotype	Paratype	Holotype	Paratypes
	NSMT-Mo 79163	NSMT-Mo 79164	NSMT-Mo 111294	NSMT-Mo 102466	NMV F31404	NSMT-Mo 79170	NSMT-Mo 79165	NSMT-Mo 79166	NSMT-Mo 79167	NSMT-Mo 79168	NSMT-Mo 79169
SL (mm)	7.25	–	7.03	6.43	2.66*	2.43	3.09	1.44	3.33	3.26	2.77
SW (mm)	1.99	1.97	2.10	1.74	0.86	0.79	0.83	0.48	1.01	1.03	0.91
LL (mm)	3.37	3.30	3.39	3.06	1.53	1.44	1.65	0.89	1.70	1.75	1.58
AL (mm)	2.17	2.08	2.12	1.94	0.95	0.93	1.04	0.53	1.13	1.13	1.01
OL (mm)	2.16	2.13	–	1.98	1.00	0.97	1.04	0.59	1.19	1.19	–
L (mm)	1.12	1.10	–	1.04	0.53	0.58	0.56	0.29	0.67	0.71	–
SW/SL	0.27	–	0.30	0.27	–	0.33	0.27	0.33	0.30	0.32	0.33
LL/SL	0.46	–	0.48	0.48	–	0.59	0.49	0.62	0.51	0.54	0.57
AL/SL	0.30	–	0.30	0.30	–	0.38	0.34	0.37	0.34	0.35	0.37
L/OL	0.52	0.52	–	0.53	0.53	0.60	0.54	0.49	0.56	0.60	–

* Measured from the uppermost end to the base because the specimen has a broken protoconch

(AL/SL = 0.30 for holotype, 0.29–0.31 for paratypes), pear shaped; aperture base flattened, not extending anteriorly. Columellar-parietal wall forms slightly curved arc, its base brown in color. Columellar lip reflected, with shallow furrow behind. In lateral view, ventral end of suture almost straight. Outer lip margin slightly retracted at suture and curved with middle part protruding (L/OL = 0.52 for holotype and paratypes). Middle to lower periphery of aperture rimmed with brown in color, connecting to spiral band ornamentation.

Type locality: off Seragaki, Onnason, Okinawa-jima Island, Okinawa Prefecture, East China Sea, Japan.

Distribution: Amami-Oshima Island, Kagoshima Prefecture, Japan; off Seragaki, Onnason, Okinawa-jima Island, Okinawa Prefecture, Japan.

Etymology: The specific name of the new species refers to its tendril-like ornamentation.

Remarks: The generic position of the new species is determined by its distinct color pattern, its flattened columella, the flattened area between the columella and a short angular ridge on the left side, and its dorsoventrally compressed shell, all of which are similar to the features of the type species of the genus (Pilsbry, 1917; Warén, 1984). Paratypes #2–5 from the Sakurai Collection were previously identified as *H. samoensis* (labeled as “*Eulima samoensis*”). However, *H. samoensis* can be readily separated from the new species by having a slightly larger shell (SL = 9 mm for *H. samoensis* in the original description) with an interrupted line ornamentation and colored incremental scars, and a relatively broader shell [SW/SL = 0.31 for *H. samoensis* (based on Crosse, 1867) vs. 0.27 for *H. capreolus* n. sp.]. *Hemiliostraca delicata* (Pilsbry, 1918) is similar to the new species in having slender apical whorls but

differs in having an interrupted line ornamentation and a relatively larger last whorl [LL/SL = 0.53 for *H. delicata* (based on the photographs of the syntype, ANSP-117632, from the website of the ANSP malacology collection, accessed on October 20, 2019) vs. 0.46 for *H. capreolus* n. sp.]. *Hemiliostraca metcalfei* can be differentiated from the new species by its larger shell (SL = 11 mm for *H. metcalfei*) and interrupted line ornamentation (Tryon, 1886).

In this study, we also observed five other specimens identified as *H. samoensis*; two by Dr. T. Kuroda (labeled as “*Eulima samoensis*”) (NSMT-Mo 9095; ex. Y. Hirase Collection) from Amami-Oshima Island (Fig. 3A, B) and three (labeled as “*Leiostraca samoensis*”) from the Society Island loaned from the BPBM (Fig. 3C). The former specimens are considered vouchers reported by Kuroda (1928) in a catalogue of the molluscan fauna of Amami-Oshima Island. All of these five specimens generally agree with the original description and figure of *H. samoensis* (Crosse, 1867), but we cannot confirm the identification because of the presence of closely similar species, i.e., *H. delicata* from Oahu, Hawaii (Pilsbry, 1918; photographs of the syntype available online as noted above), and *H. metcalfei* from the “Sandwich Islands” (A. Adams, 1854: pl. 170, figs 12, 13; Tryon, 1886: pl. 70, fig. 83; Pilsbry, 1917: fig. 13a, b), which also have an interrupted line ornamentation and incremental scars on both lateral sides. A detailed examination of the type material and other specimens of *H. samoensis* from Samoa Island, and comparison with types of other two taxa would be needed for the precise identification of these specimens.

Both *H. auricincta* (Abbott, 1958) from the northwest Atlantic and Caribbean and *H. sloani* from the Indian Ocean have a single band ornamentation just above the suture (Abbott, 1958; Warén, 1980), which is also found in *H. capreolus* n. sp. However, the first two species can be distinguished from the new species by having a smaller shell with an unbranched band ornamentation, a relatively larger aperture (AL/SL = 0.33 for *H. sloani*, based on Warén, 1980, and 0.35 for *H. auricincta*, based on the photographs of the holotype, ANSP 199840, from the website of ANSP Malacology collection, accessed on October 20, 2019) vs. 0.30 for *H. capreolus* n. sp.

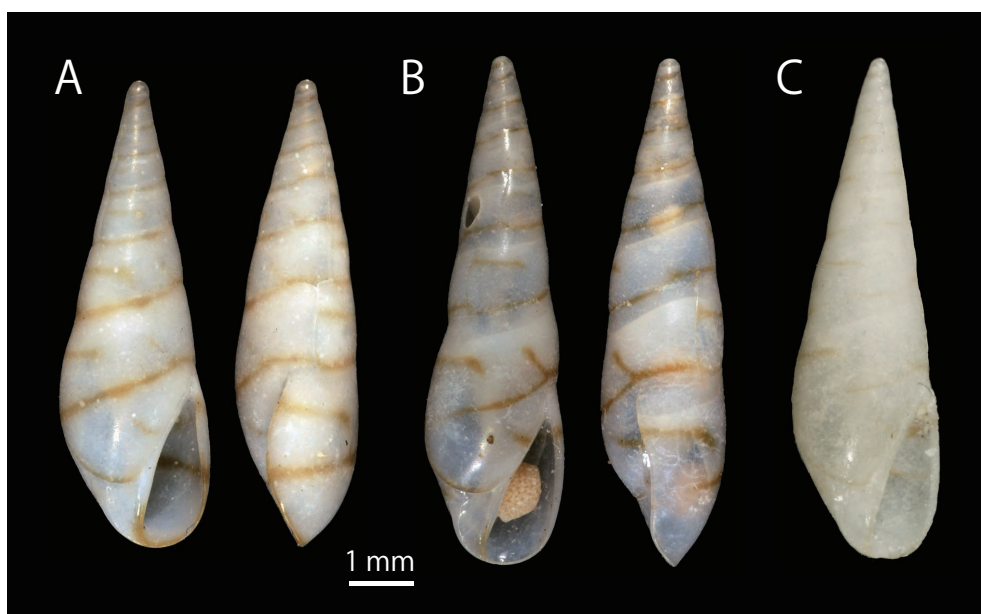


Fig. 3. “*Hemiliostraca samoensis*”. **A, B.** Ventral and lateral views of two specimens (SL = 7.27 mm in A; 7.93 mm in B) identified by T. Kuroda as “*Eulima samoensis*”, NSMT-Mo 9095, Amami-Oshima Island, Kagoshima Prefecture, Japan (ex. Y. Hirase Collection). **C.** Ventral view of “*Leiostraca samoensis*”, BPBM 2591, Society Island, SL = 7.80 mm. All at the same scale.

***Hemiliostraca conspurcata* (A. Adams, 1863)**

(Figs 2B, 4A, B)

Leiostraca conspurcata A. Adams 1863: 87–88.*Eulima conspurcata* (A. Adams, 1863) — Tryon, 1886: 283; Higo, 1973: 70; Higo & Goto, 1993: 167; Higo *et al.*, 1999: 185.

Type material: One syntype, which is designated herein as the lectotype (Fig. 4A), NMV F31404, 2.66 mm SL (measured from the uppermost end to the base because the specimen has a broken protoconch), “Takano-Sima” [= Takano-Shima, Tateyama, Chiba Prefecture, Japan (Pilsbry, 1902)], date unknown.

Material examined: 1 specimen (Fig. 4B), NSMT-Mo 79170, 2.43 mm SL, from an unidentified species of ophiuroid, Sakai, Minabe, Hidaka, Wakayama Prefecture, North Pacific Ocean, Japan, January 6, 1978, *leg.* S. Ikebe.

Original description: *L. subulata, recta, teretiuscula, sordide alba, lineis maculisque fuscis irregulariter reticulata; spira attenuata; anfractibus normalibus 6, planis, suturis obsoletis; apertura elongato-ovata, antice dilatata, postice acuminata.*

Redescription: Shell rather small for genus (2.66 and 0.86 mm in SL and SW, respectively, for lectotype; 2.43 and 0.79 mm for non-type specimen), slender, conical, almost straight in form, smooth, translucent, ornamented with irregular reticulate markings, consisting of brownish blotches and dots (Fig. 4A, B, Table 1). Protoconch smooth, consisting of 3.5 slightly convex whorls with visible height of *ca.* 360 μ m, demarcated from teleoconch by indistinct incremental scar (Fig. 2B). Teleoconch whorls 4.0 in number in non-type specimen, apical whorl slender, gradually increasing in diameter towards last whorl, their profile almost straight but very slightly convex on lower whorls. Last whorl relatively large, constituting more than half of shell length (LL/SL = 0.59 for non-type specimen), periphery slightly angulated. Suture shallow and invisible toward lower whorls. Incremental scars colorless, not aligned, appearing 0.6, 1.1, 1.6, 2.2, 2.7, 3.2 and 4.0 whorls from aperture. Aperture slender, ear-shaped, base rather flattened, not extending anteriorly. Columella brown in color, columella-parietal wall forming arc. In lateral view, outer lip margin

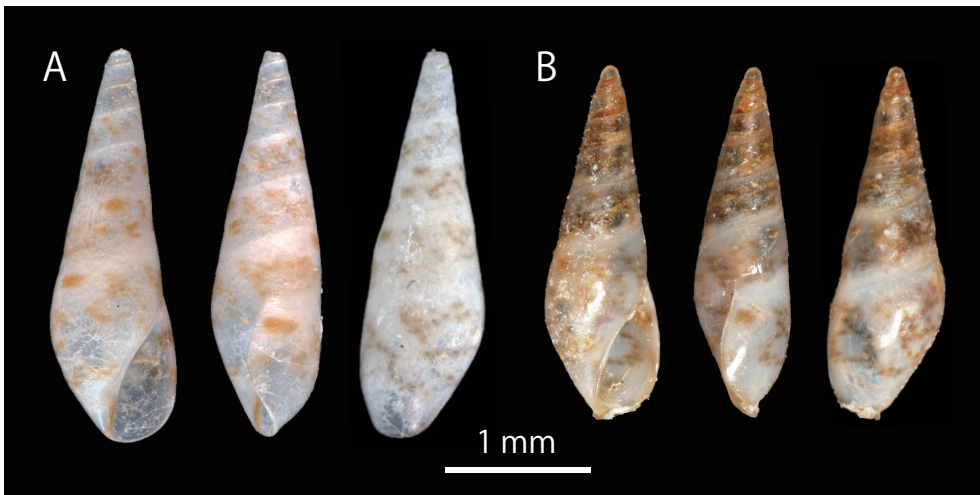


Fig. 4. *Hemiliostraca conspurcata*. **A.** Ventral, lateral, and dorsal views of the lectotype of *Leiostraca conspurcata* A. Adams, 1863, NMV F31404, SL = 2.66 mm (photographed by Mr. Chris Rowley, Copyright Museum Victoria, Australia CC BY). **B.** Ventral, lateral, and dorsal views of shell, NSMT-Mo 79170, SL = 2.43 mm.

very slightly prosocline, retracted at suture and evenly curved with anterior part protruding (L/OL = 0.53 for lectotype, 0.60 for non-type specimen).

Distribution: North Pacific Ocean along the coast of Honshu from Chiba to Wakayama Prefectures, Japan.

Remarks: Although many molluscan taxa were described by A. Adams from Japanese waters in the 19th century, most of them have been considered “unclear or obscure species” by subsequent workers, because his descriptions were very brief and in most cases lacked measurements and figures. In addition, his potential type material has been scattered through many institutions in the world and its location has never been adequately documented (Kuroda & Habe, 1954; Ponder & Keyzer, 1992). *Leiostraca conspurcata* is one such case, but its probable syntype has been located in the NMV (Boyd & Phillips, 1985), and is designated herein as the lectotype. The species has been assigned to *Eulima* (Higo, 1973; Higo & Goto, 1993; Higo *et al.*, 1999) and *Hemiliostraca* (MolluscaBase, 2019). Our identification of the above specimen is based on comparison with digital images of the lectotype taken from several directions. The color marking of *H. conspurcata* is composed of small dots, which superficially resemble those of *Sticteulima* spp. (e.g., *S. cameroni* and *S. lentiginosa*) (Adams, 1861; Laseron, 1955). However, the present species can correctly be placed in *Hemiliostraca* based on a slender shell with flat whorls, an inconspicuous suture, slender aperture with a straight inner lip.

The coloration and general appearance of the shell of *H. conspurcata* resemble those of *H. clarimaculosa* (Raines, 2003) (as “*Eulima*” *clarimaculosa* from Easter Island: Raines, 2002 [2003]). The latter species, however, differs from *H. conspurcata* by having a larger shell (SL = 4.46 mm in the holotype) and a brown edge of the outer lip margin. *Hemiliostraca joshuana* (Gatliff & Gabriel, 1910) from Australia is also morphologically similar to *H. conspurcata* but has broader apical whorls (based on the photographs of the holotype, NMV F717, from the website of the NMV collections, accessed on October 20, 2019) than the latter species (Gatliff & Gabriel, 1910). The shell of *Sticteulima amamiensis* (Habe, 1961) from Amami-Oshima Island, Japan, resembles that of *H. conspurcata*: both have markings consisting of dots and a brown columella (see Habe, 1961; Hori & Matsuda, 2017). However, *S. amamiensis* is distinguished from *H. conspurcata* by its larger shell (SL = 3.8 mm in the holotype) and anteriorly extended aperture, as well as by the presence of numerous small dots forming bands.

***Hemiliostraca tenuis* n. sp.**

(Fig. 5A–E)

Type material: Holotype, NSMT-Mo 79165 (Fig. 5A), 3.09 mm SL, attached to dorsal disc of *Ophiarachnella septemspinosa* (Müller & Troschel, 1842) (Ophiacanthida: Ophiidermatina: Ophiidermatidae) (Fig. 5D), at a depth of 15 m, off east coast of Kume-jima Island (26°21'N, 126°49'E), Okinawa Prefecture, East China Sea, Japan, November 10, 2009, *leg.* D. Uyeno; paratype #1, NSMT-Mo 79166, 1.44 mm SL (Fig. 5B), from an unidentified species of sponge on the gravel bottom at a depth of 40 m, off west coast of Kume-jima Island (26°20'N, 126°43'E), Okinawa Prefecture, East China Sea, Japan, November 12, 2009, *leg.* D. Uyeno.

Description: Shell small (3.09 and 0.83 mm in SL and SW, respectively, for holotype; 1.44 and 0.48 mm for paratype), straight, slender ovate in form, smooth, highly polished, vitreous, and transparent with indistinct brownish oblique stripes and irregular blotches. Protoconch smooth, polished, consisting of 3.5 slightly convex whorls, *ca.* 450 µm long, separated from teleoconch by shallow and indistinct scar; almost transparent, but single continuous brownish band situated on suture (Fig. 5C). Teleoconch consisting of 4.5 whorls in holotype, with shallow, inconspicuous oblique suture and more distinct false suture, their profile almost straight. Incremental scars indistinct, colorless, not situated regularly, appearing 1.5, 2.0, 3.0, 4.0 and 4.5 whorls from aperture

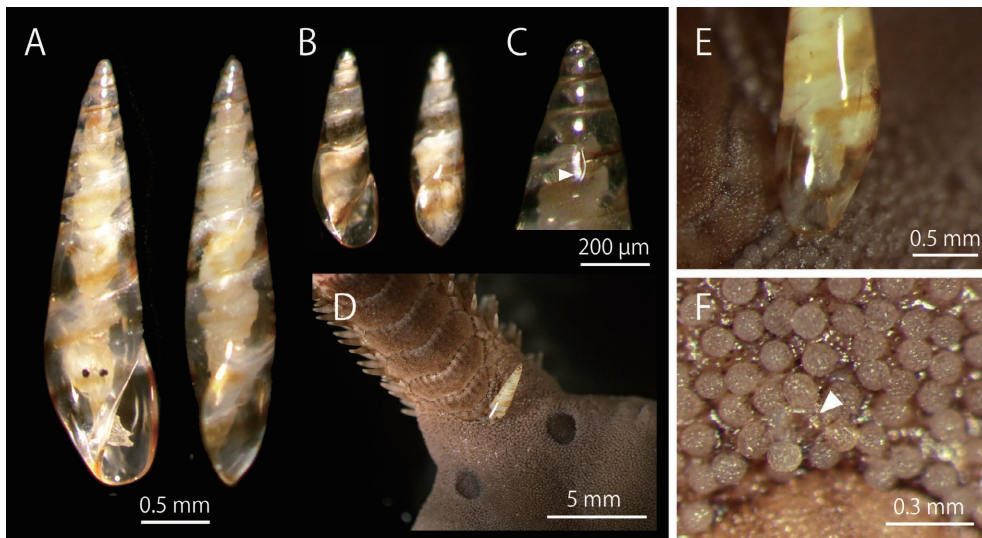


Fig. 5. *Hemiliostraca tenuis* n. sp. and its host *Ophiarachnella septemspinosa*. **A–B.** Ventral and lateral views of shell; **A**, Holotype, NSMT-Mo 79165, SL = 3.09 mm; **B**, paratype, NSMT-Mo 79166, SL = 1.44 mm. **C.** protoconch of holotype with a scar (arrowhead) between protoconch and teleoconch. **D.** *H. tenuis* n. sp. attached to *O. septemspinosa*. **E.** Proboscis of *H. tenuis* n. sp. visible through the transparent shell. **F.** Scar (arrowhead) caused by *H. tenuis* n. sp. **A** and **B** at the same scale.

in holotype. Last whorl occupying almost half of shell length ($LL/SL = 0.49–0.62$), with flattened area between columella and short angular ridge on left side. Aperture large, slender, ear-shaped, base rather flattened, not extending anteriorly. Periphery of aperture stained brown. Columella-parietal wall almost straight with slight umbilical chink. Inner lip reflected on columella and continuous with parietal callus. Outer lip margin orthocline, retracted at suture and curved with its most protruding part situated at the middle of its height ($L/OL = 0.49–0.54$) in lateral view. In basal view, shell dorsoventrally compressed.

Type locality: Off Kume-jima Island, Okinawa Prefecture, East China Sea, Japan.

Distribution: Known only from the type locality.

Ecology: Of the two specimens of *H. tenuis* n. sp. described herein, one was found attached by its proboscis to the dorsal disc of *O. septemspinosa* (Fig. 5D, E). It was difficult to detect a live individual of the new species on a host due to its transparent shell. When this individual was removed from the host, a small scar was found at the attachment site (Fig. 5F). The other specimen was collected from an unidentified species of sponge without observing its modes of attachment to or feeding on the host.

Etymology: The specific name of the new species refers to its slender form.

Remarks: The present new species can be distinguished from other *Hemiliostraca* species by the combination of a slender, oval, transparent shell with indistinct brownish oblique stripes and irregular blotches on the teleoconch whorls. *Hemiliostraca sloani* is similar to the new species in the appearance and size of the shell (Warén, 1980) but can be distinguished by having a clear brownish spiral band above the suture and another close to the base of the last whorl, and a relatively broader profile [$SW/SL = 0.33$ for *H. sloani* (based on Warén, 1980) vs. 0.27 for *H. tenuis* n. sp.].

The new species has a transparent shell, and the internal soft parts are visible through the shell. A similar observation has been made for *H. ophiarachnicola* (Matsuda *et al.*, 2013: fig. 3E). Among *Hemiliostraca* spp., some have a transparent shell (e.g., *H. sloani*, *H. vittata*, and *H. diauges*), while others a translucent shell (e.g., *H. bahamondei*) and a bluish white shell (e.g., *H.*

irafca) (Bartsch, 1915; Tomlin & Shackelford, 1915; Laseron, 1955; Warén, 1980; Rehder, 1980). Coloration and transparency of the shell is known to differ even in the same species as reported by various authors, probably due to the condition of the shells; e.g., for *H. peasei*, semipellucid (Adams, 1854), white and pellucid (Pease, 1861), transparent (Tryon, 1886) and bluish-white (Pilsbry, 1917).

***Hemiliostraca maculata* n. sp.**

(Figs 2C, 6A, B)

Type material: Holotype, NSMT-Mo 79167 (Fig. 6A), 3.33 mm SL, sandy bottom at depths of 20–25 m off Seragaki, Onna-son, Okinawa-jima Island, Okinawa Prefecture, East China Sea, Japan, 2011, *leg.* H. Kinjo; paratype #1, NSMT-Mo 79168 (Fig. 6B), 3.26 mm SL, Tsuchihama Beach, Amami-Oshima Island, Kagoshima Prefecture, North Pacific Ocean, Japan, October 4, 2006, *leg.* M. Sano; paratype #2, NSMT-Mo 79169, 2.77 mm SL, Chichi-jima Island, Ogasawara Islands, Tokyo, North Pacific Ocean, Japan, March 1985, *leg.* T. Kurozumi.

Description: Shell small (3.33 and 1.01 mm in SL and SW, respectively, for holotype; 2.77–3.26 and 0.91–1.03 mm for paratypes), conical, almost straight, smooth, polished, translucent, ornamented with inconspicuous blotches on upper four whorls, two parallel lines and oval line markings on subsequent whorls, and three lines and oval line marking on last whorl (Fig. 6A, B), together forming reticulate markings. Protoconch consisting of 3.6 slightly convex whorls, with visible height of *ca.* 440 μ m, demarcated from teleoconch by indistinct incremental scar (Fig. 2C). Teleoconch whorls 5.4 in number, their profile almost straight, suture barely impressed. Last whorl relatively large, constituting more than half of shell length (LL/SL = 0.51 for holotype; 0.54–0.57 for paratypes), periphery rounded. Incremental scars colorless, inconspicuous, appearing 0.7, 1.7, 2.8, 3.2, 4.1 and 4.9 whorls from aperture in holotype. Aperture somewhat rectangular, slender, base rather flattened, not extends anteriorly. Columella-parietal wall forming weak angle. Columella to aperture base rimmed with pale brown. In lateral view, outer lip margin very slightly retracted at suture and curved with anterior part protruding (L/OL = 0.56 for holotype; 0.60 for paratype #1; outer lip broken in paratype #2).

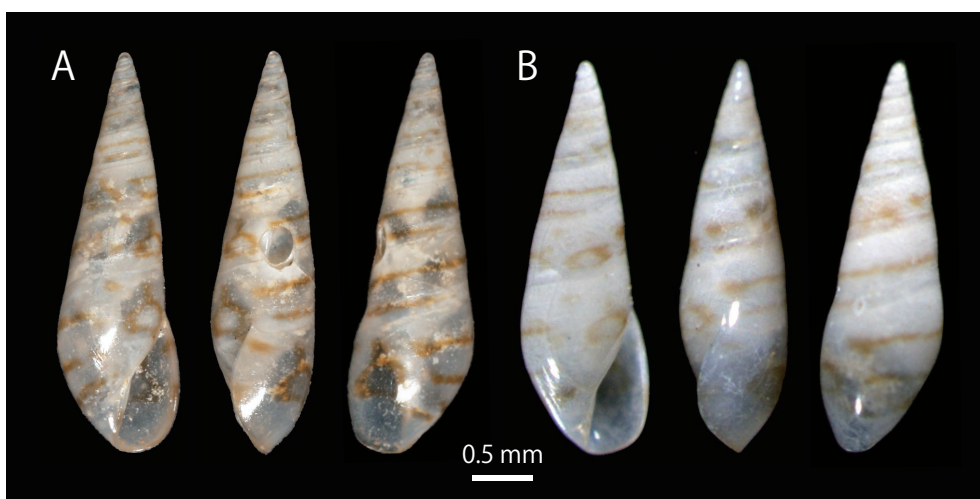


Fig. 6. *Hemiliostraca maculata* n. sp. **A.** Ventral, lateral, and dorsal views of shell, holotype, NSMT-Mo 79167, SL = 3.33 mm. **B.** Ventral, lateral, and dorsal views of shell, paratype #1, NSMT-Mo 79168, SL = 3.26 mm. All at the same scale.

Type locality: Off Seragaki, Onna-son, Okinawa-jima Island, Okinawa Prefecture, East China Sea, Japan.

Distribution: Chichi-jima Island, Ogasawara Islands, Tokyo, North Pacific Ocean, Japan; Amami-Oshima Island, Kagoshima Prefecture, North Pacific Ocean, Japan; Okinawa-jima Island, Okinawa Prefecture, East China Sea, Japan.

Etymology: The specific name of the new species refers to its mottled ornamentation.

Remarks: *Hemiliostraca maculata* n. sp. resembles *H. conspurcata* in shell size and in having irregular reticulate brown markings on the shell but is distinguished by its broader apical whorls and markings consisting of solid lines. The columella-parietal wall of *H. maculata* n. sp. forms a weak angle, while that of *H. conspurcata* is a slightly curved arc. The pattern of markings of the new species is similar to that of *Sticteulima jeffreysiana* (Brusina, 1869), but the latter species has a smaller shell [SL = 2.25 mm for *S. jeffreysiana* (based on Brusina, 1869)] than the new species and an aperture extending anteriorly beyond the base (Gaglioni, 1981).

Discussion

The present study demonstrates that a total of nine named species of *Hemiliostraca*, including three new species described herein, are now known to occur in Japanese waters. These species were collected from the western North Pacific Ocean and/or the East China Sea (Higo *et al.*, 1999; Matsuda *et al.*, 2013; Hori & Matsuda, 2017; MolluscaBase, 2019; this paper). Although Warén (1984) stated that numerous undescribed *Hemiliostraca* species are distributed in tropical oceans, they appear to be abundant and diverse also in subtropical and temperate waters.

In the present study, both *H. tenuis* n. sp. and *H. conspurcata* were found associated with ophiuroid hosts. Three other species of the genus also have been reported from ophiuroids: *H. peasei* (Tryon, 1886), the type species of the genus, was originally described based on an empty shell, but it was recently found on the ophiuroid *Ophiocoma dentata* Müller & Troschel, 1842 in Japan (Takano *et al.*, 2016). *Hemiliostraca ophiarachnicola* Matsuda, Uyeno & Nagasawa, 2013 and *H. sloani* Warén, 1980 were described from ophiuroids, respectively, from Taiwan and Okinawa-jima Island (Matsuda *et al.*, 2013) and Aldabra Island (Warén, 1980). It is accepted that *Hemiliostraca* is associated with ophiuroids because eulimids of a single genus usually occur on hosts of a single class or a lower taxon (Warén, 1984). While *H. metcalfei* was reported from the holothuroid *Holothuria atra* (Kay, 1979), this host association requires verification since the congeneric eulimid species are all associated with ophiuroids and some ectoparasitic eulimids, including *H. peasei*, are able to detach from their host and crawl freely when disturbed (Matsuda *et al.*, 2015; Takano *et al.*, 2016). *Hemiliostraca tenuis* n. sp. is described herein from an unidentified sponge and the ophiuroid *Ophiarachnella septemspinosa*. Some eulimid species have been reported initially from non-echinoderm animals but later confirmed to be associated with echinoderms: for example, *Scalenostoma* from cavities of a stone coral (Warén, 1984) but later from echinoderms (Severns, 2011); *Stilapex teramachii* from an undetermined red-colored soft animal (Habe, 1958) but later from ophiuroids (A. Warén, personal communication). *Melanella boscii* was found on holothuroids (DeLongueville & Scaillet, 2009) and also crawled on the ascidian *Microcosmus sulcatus* (Scuderi & Criscione, 2011). *Hemiliostraca tenuis* n. sp. from a sponge could thus be another such case. Since ophiuroids inhabit various microhabitats, including in sponges (Stöhr *et al.*, 2012), the new species was most probably associated with an ophiuroid that was contained in the sponge.

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日本周辺海域から採集されたハナゴウナ科クテンハナゴウナ属の3新種と 1既知種の再記載および同属の再定義

松田春菜・上野大輔・長澤和也

要 約

クテンハナゴウナ属はクモヒトデに寄生することが知られるグループで、日本からは6種報告されている。本研究では、博物館に所蔵されている標本と、新たに採集された標本に基づき3新種を記載するとともに、原記載以降に詳細な情報を欠いていた1種を再記載した。また、本属の形態的特徴を再定義した。国立科学博物館の櫻井欽一氏寄贈コレクションで *Hemiliostraca samoensis* (Crosse, 1867) ホシフハナゴウナに同定されていた奄美大島産標本を精査したところ、原記載の特徴とは一致せず、未記載種であることがわかった。沖縄県瀬良垣から新たに採集された標本も同一種であったため、両標本に基づき、新種 *Hemiliostraca capreolus* n. sp. カラクサハナゴウナ (新称) として記載した。本種は赤褐色の色帯が縫合線と平行に現れ、時折短い突起のような枝分かれが見られる点、無色の成長痕を有する点によって、同属他種と区別できる。

Hemiliostraca conspurcata (A. Adams, 1863) は原記載以来報告がなかったが、和歌山県で採集されたクモヒトデの1種に寄生していた個体がシントタイプの一つと同種であることが明らかになった。本種は小型で、殻全体に斑点によって構成される網目状の模様を持つことが特徴である。本種を再記載するとともに、カスリハナゴウナの和名を新称した。また、当該シントタイプをレクトタイプに選定した。

また、久米島に生息するクロメクモヒトデの腕基部とカイメンの群体内から得られた標本に基づき新種 *Hemiliostraca tenuis* n. sp. クロメクモヒトデハナゴウナ (新称) を記載した。本種は透明で細長い卵型で、不明瞭な赤褐色の帯状模様を持つ点などから、同属他種と区別できる。

小笠原諸島父島、琉球諸島の奄美大島と沖縄県から得られたハナゴウナ類について、殻形態の詳細な観察に基づき、新種 *Hemiliostraca maculata* n. sp. コモンハナゴウナ (新称) として記載した。本種は *H. conspurcata* に酷似するが、殻頂部がより太く、殻全体に線で構成される模様を有すること、軸唇と壁唇の間に境界が見られることによって、他種と区別される。

なお、ホシフハナゴウナは黒田 (1928) によって奄美大島から *Subularia* cf. *samoensis* (Crosse, 1867) として報告されたものである。黒田博士の同定とみられる奄美大島産標本はハワイ・ビショップ博物館から借用したソシエテ諸島産の "*Hemiliostraca samoensis* (Crosse, 1867)" と同定されていた標本とともに原記載に良く合うが、本種には近似した幾つかの種があり、正確な同定のためにはこれらとの詳細な比較が必要である。

本研究により、日本近海にはクテンハナゴウナ属9種が生息することが明らかになった。