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Short communication

A New Record of Sea Star Genus *Nearchaster* (Asteroidea: Notomyotida: Benthopectinidae) from East Sea, Korea

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ABSTRACT

An asteroid specimen was collected in adjacent water of Gisamun, Gangwon-do in the East Sea, Korea at a depth of 170 m by fishing net at May 2013. It was identified as *Nearchaster* (*Nearchaster*) *pedicellaris* (Fisher, 1910) belonging to family Benthopectinidae of order Notomyotida, which was new to the Korean fauna. The genus, family, and order of this species were also new to Korean waters. The partial sequence of mitochodrial cytochrome *c* oxidase subunit 1 (CO1) was determined for the first time and registered at GenBank.

Keywords: taxonomy, COI sequence, sea star, *Nearchaster*, Benthopectinidae, Notomyotida, Korea

INTRODUCTION

Order Notomyotida Ludwig, 1910 has only one family, Benthopectinidae Verrill, 1899, which is superficially similar to family Astropectinidae Gray, 1840 of order Paxillosida Perrier, 1884 and has been variously evaluated since Fisher (1911) doubted the rank proposed by Ludwig (1910), until McKnight (1975) restored it. Family Benthopectinidae is primarily composed of deep-water species of eight genera, and many of its taxa can be expected to have wider range than can now be appreciated (Clark and Downey, 1992). Genus *Nearchaster* Fisher, 1911 comprises six species of two subgenera: *N.* (*Myaster*) *fisheri* Döderlein, 1921, *N.* (*Nearchaster*) *aciculosus* (Fisher, 1910), *N.* (*N.*) *musorstomi* Aziz and Jangoux, 1985, *N.* (*N.*) *pedicellaris* (Fisher, 1910), *N.* (*N.*) *variabilis* (Fisher, 1910), and *N.* (*N.*) *yodomiensis* (Goto, 1914).

A sea star was collected in adjacent water of Gisamun, Gangwon-do in the East Sea, Korea at a depth of 170 m by fishing net at May 2013 and was preserved in 95% ethyl alcohol. Its distinct morphological characteristics were photographed using stereo- and light-microscopes and a digital camera (Nikon SMZ1000, Nikon Eclipse 80i, Nikon 5000D; Nikon Co., Tokyo, Japan). Identification of specimen followed the taxonomies of Fisher (1911), Clark and Downey (1992), and Shin (2010).

Nowadays the identification of species on the basis of molecular analysis of gene is broadly put into use. DNA sequence data have served to expand the utility of molecular taxonomic tools and have led to their more mainstream use in species identification and discovery (Hebert et al., 2003). Until now, mitochondrial COI sequence of *N. aciculosus* and histone H3, mitochondrial 12S and 16S ribosomal RNA and sequences of t-RNA of *N. variabilis* among genus *Nearchaster* were reported in GenBank of NCBI (Mah and Foltz, 2011). For the molecular identification of our specimen, genomic DNA was extracted from the gonads by using a DNeasy blood and tissues kit (Qiagen, Hilden, Germany) based on the manufacturer's protocol. PCR amplification was carried out using the primers suggested by Folmer et al. (1994), and sequencing of the COI gene was performed according to methods of Lee and Shin (2011). All PCR products were purified with a QIAquick PCR purification Kit (Qiagen) and sequenced with an automated sequencer ABI 3100 (Perkin Eimer, Foster City, CA, USA). The specimen examined was deposited in the Marine Echinoderm Resource Bank of Korea (MERBK), Sahmyook University, Seoul, Korea.

SYSTEMATIC ACCOUNTS

Class Asteroidea de Blainville, 1830

[1]*Order Notomyotida Ludwig, 1910

Korean name: [1]*척근목 (신칭)

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Notomyota Ludwig, 1910; Fisher, 1911: 121; Mortensen, 1927: 70.
Myomata Verrill, 1914: 310.
Notomyotida McKnight, 1975: 15; Clark and Downey, 1992: 113; Mah, 2014: 123087.
Notomyotina Spencer and Wright, 1966: 48.

Dorsal side covered with spines and paxillae. Arms long, longitudinally flexible dorso-ventrally. Papulae usually restricted to proximal areas of dorsal side. Marginal plates well developed and spiniferous, tending to alternate longitudinally. Superambulacral plates absent. Adambulacral plates relatively large. Tube foot with a small sucking disk. Pedicellariae usually fasciculate or pectinate with numerous valves.

[1]*Family Benthopectinidae Verrill, 1894
Pararchasterinae Sladen, 1889: 4.
Benthopectininae Verrill, 1894: 245; 1914: 310.
Benthopectinidae Verrill, 1899: 200; 1914: 310; Fisher, 1911: 120; Mortensen, 1927: 71; Clark and Courtman-Stock, 1976: 56; Clark, 1981: 91; Clark and Downey, 1992: 113; Mah, 2014: 123126.

Disk moderately broad. Arms narrow and long, tapering toward end of arm. Interradial arcs angular or rounded. Dorsal plates thin and scale-like or paxilliform, often more or less isolated on arms, central ones on disk sometimes armed with conspicuous spines. Adambulacral plates with one or more enlarged spines and a fan of furrow spines.

[2]*Genus *Nearchaster* Fisher, 1911
Nearchaster Fisher, 1911: 91; Clark, 1981; 95; Mah, 2014: 370821.
Saraster Clark, 1916: 54; 1981; 95.

Type species: *Acantharchaster aciculosus* Fisher, 1910

Large primary plate bearing a long sharp spine on a low bump surrounded by a circle of accessory slender spinules, variable as to number and length. Two or three superomarginal spines and two to five inferomarginal spines present. Subambulacral spines long, one to three, usually two. Adamburacral spines one to seven. Oral plates large, with numerous marginal spines. Pectinate pedicellariae large, on any or all of dorsal, inferomarginal, and ventro-interbrachial areas.

[3]***Nearchaster* (*Nearchaster*) *pedicellaris* (Fisher, 1910) (Fig. 1)**
Acantharchaster variabilis pedicellaris Fisher, 1910: 550.
Nearchaster pedicellaris Fisher, 1911: 138; Ahearn, 1995: 4.
Nearchaster (*Nearchaster*) *pedicellaris*: Mah, 2014: 380818.

Material examined. 1 specimen, Gisamun, Gangwon-do, Korea, 26 May 2013, at 170 m deep with fishing net.

Description. Disk rather broad and large. Arms very long and slender. Dorsal plates strongly stellate, especially each of larger plates at dorsal surface of disk and base of arms equipped with a bump articulating a long pointed primary spine (2.65–3.02 mm) surrounded by a circle of pointed short secondary spinules (0.17–0.19 mm). Smaller dorsal plates only with a group of small spinules. Papulae distributed all over disk except for a narrow median interradius, extending along arm to 16th or 17th superomarginal plate. Pectinate pedicellariae (0.73–1.25×1.01–1.34 mm) with four to seven valves large, numerous, very abundant on dorsal side but also present at ventro-interbrachial area and inframarginal plates. Superomarginal plates usually with two or three large pointed spines (5.04–6.61 mm). Inferomarginal plates with three or four primary spines (3.43–4.60 mm). Both marginal plates having small and weak accessory spinules clustered about base of primary spines. Odd interradial superomarginal plates three to five. Adambulacral spines (3.18–3.53 mm) slender, proximally three in number, of which central spines blunt and longest. Usually seven furrow spines at proximal portion of arm, of which three or four central spines (1.23–1.56 mm) longest, roughly equal length but two side spines (0.56 mm) very short. Madroporite (2.34×2.33 mm) oval, convex with irregular striae to outside, located at three fourths of distance between center and margin of disk, and near central margin of one interradius.

Size. R=121 mm, r=17 mm, R/r=7.1.

Color. Body color is light brown in alcohol.

Distribution. Korea (East Sea), Okhotsk Sea, Alaska, Bering Sea.

Remarks. This species was reported at a depth of 504 m (Fisher, 1911). Our specimen was collected at a depth of 170 m at adjacent water of Gisamun in the East Sea, Korea. D'yakonov (1950) recorded subspecies *Nearchaster pedicellaris vagans* which was distinguished by the less distribution of the papulae along arms to 10th to 20th superomarginal plate from typical *N. pedicellaris* (Fisher, 1910) extending along arms to 19th to 35th superomarginal plate. Our specimen extending to 16th or 17th superomarginal plate seemed to belong to D'yakonov subspecies on the basis of this character. Pectinate pedicellariae are very abundant in this species but are very few in *N. variabilis* (Fisher, 1910) which belongs to the same genus and is usually distributed from southern Bering Sea to southeastern Alaska. Furrow spines are seven in this species but one to three in *N. aciculosus* (Fisher, 1910) which is distributed from the south

Korean name: [1]*깊은불가사리과 (신칭), [2]*유가시불가사리속 (신칭), [3]*차극유가시불가사리 (신칭)

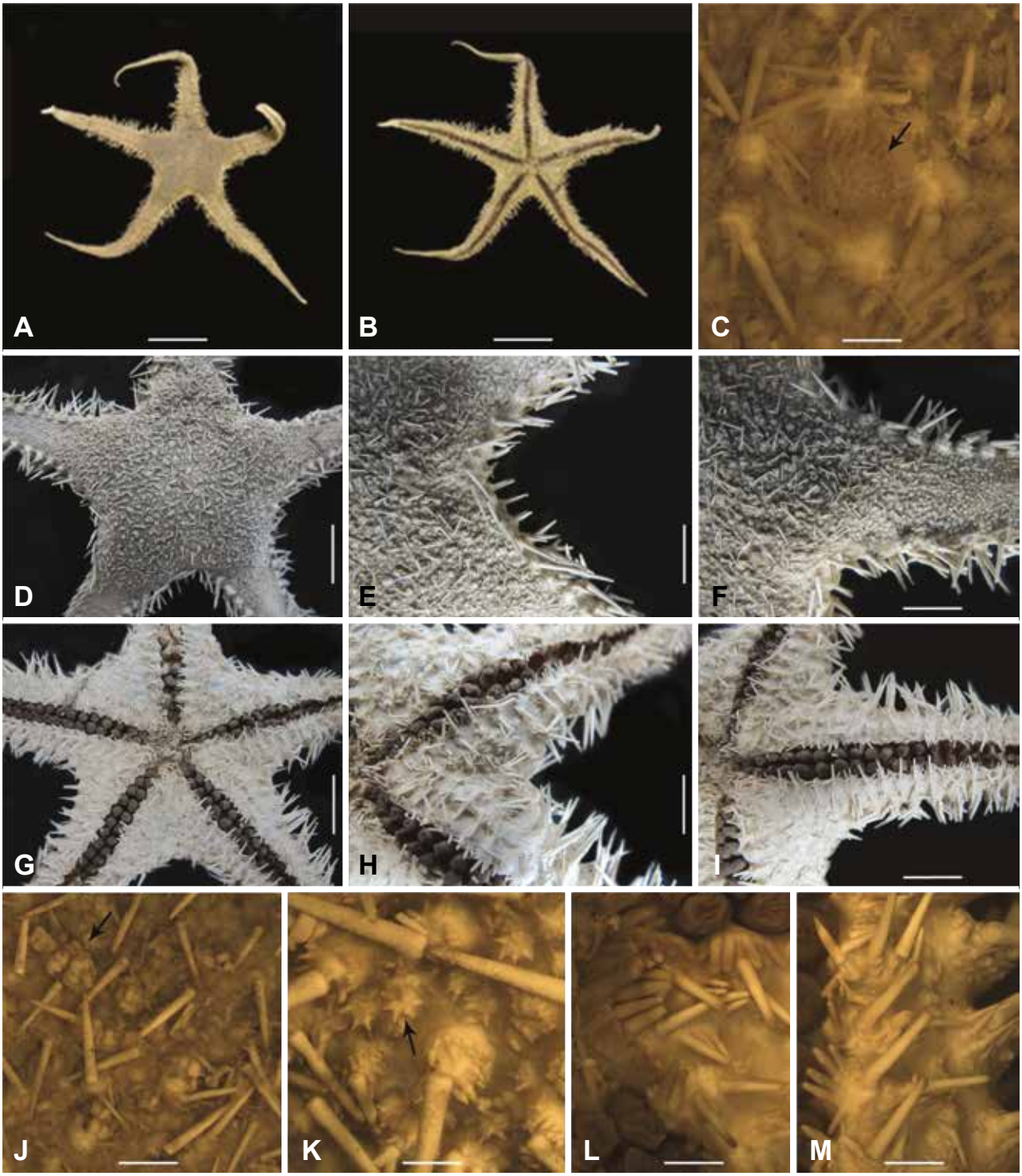

Fig. 1. *Nearchaster* (*Nearchaster*) *pedicellaris*. A, Dorsal side; B, Ventral side; C, Madreporite (arrow); D, Dorsal surface of disk and arm base; E, Dorsal interradius of disk; F, Dorsal radius of disk and arm base margined with superomarginal spines; G, Ventral surface of disk and arm base; H, Ventral interradius of disk; I, Ventral radius of disk and arm base margined with inferomarginal spines; J, Pectinate pedicellariae (arrow) and primary spines; K, A group of small spinules (arrow) and primary spine surrounded by a circle of secondary spinules; L, Oral spines and adambulacral spines; M, Furrow spines and adambulacral spines. Scale bars: A, B=4 cm, E, F, H, I=3 cm, D, G=1.5 cm, J=4 mm, C, K=2 mm, L, M=1 mm.

of the Alaska peninsula to northern lower California. The mitochondrial COI sequence of this species was deposited for the first time in GenBank under the relevant accession number (GenBank accession No. KP890295). The sequence was 564 bp in length and showed similarity to that of *N. aciculosus* (GenBank accession No. HM400307.1), which was only *Nearchater* species deposited in GenBank. This asteroid specimen was an unrecorded species examined in Korea, based on morphological and molecular evidence.

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REFERENCES

Ahearn CG, 1995. Catalog of the type specimens of seastars (Echinodermata: Asteroidea) in the National Museum of Natural History, Smithsonian Institution. Smithsonian Contributions to Zoology, 572:1-59.

Clark AH, 1916. Six new starfishes from the Gulf of California and adjacent waters. Proceedings of the Biological Society of Washington, 29:51-62.

Clark AM, 1981. Notes on Atlantic and other Asteroidea. 1. Family Benthopectinidae. Bulletin of the British Museum of Natural History (Zoology), 41:91-135.

Clark AM, Courtman-Stock J, 1976. The echinoderms of southern Africa. Publ. No. 766. British Museum (Natural History), London, pp. 1-277.

Clark AM, Downey ME, 1992. Starfishes of the Atlantic. Chapman & Hall Identification Guides, 3. Chapman & Hall, London, pp. 1-794.

D'yakonov AM, 1950. Sea stars (Asteroids) of the USSR seas. No. 34. Zoological Institute of the Academy of Sciences of the USSR, Jerusalem, pp. 1-183.

Fisher WK, 1910. New starfishes from the North Pacific. I. Phanerozonia. II. Spinulosa. Zologischer Anzeiger, 35:545-553, 568-574.

Fisher WK, 1911. Asteroidea of the North Pacific and Adjacent waters. Pt. 1. Phanerozonia and Spinulosa. Bulletin of the US National Museum, 76:1-420.

Folmer O, Black M, Hoeh W, Lutz R, Vrijenhoek R, 1994. DNA primers for amplification of mitochondrial cytochrome *c* oxidase subunit I from diverse metazoan invertebrates. Molecular Marine Biology and Biotechnology, 3: 294-299.

Hebert PDN, Ratnasingham S, deWaard JR, 2003. Barcoding animal life: cytochrome *c* oxidase subunit 1 divergences among closely related species. Proceedings of the Royal Society of London B: Biological Sciences, 270:96-99.

Lee T, Shin S, 2011. A new record of sea urchin (Echinoidea: Camarodonta: Strongylocentrotidae) based on morphological and molecular analysis in Korea. Korean Journal of Systematic Zoology, 27:213-219.

Ludwig H, 1910. Notomyota, eine Neue Ordnung der Seesterne. Sitzungsberichte der Koniglich Preussischen Akademie der Wissenschaften, 23:435-466.

Mah C, 2014. *Nearchaster* (*Nearchaster*) *pedicellaris* (Fisher, 1910). In: Mah, C.L. (2014) World Asteroidea database [Internet]. World Register of Marine Species, Accessed 8 Jan 2015, <http://www.marinespecies.org/aphia.php?p=taxdetails&id=380818>.

Mah C, Foltz D, 2011. Molecular phylogeny of the Valvatacea (Asteroidea: Echinodermata). Zoological Journal of the Linnean Society, 161:769-788.

McKnight DG, 1975. Classification of somasteroids and asteroids (Asterozoa: Echinodermata). Journal of the Royal Society of New Zealand, 5:13-19.

Mortensen T, 1927. Handbook of the echinoderms of the British Isles. Oxford University Press, London, pp. 1-471.

Shin S, 2010. Invertebrate fauna of Korea. Echinodermata: Asterozoa: Asteoidea Sea stars. Vol. 32. National Institute of Biological Resources, Incheon, pp. 1-150.

Sladen WP, 1889. Report on the Asteroidea. Report on the Scientific Results of the Voyage of H.M.S. Challenger during the years 1873−1876, Zoology, 30:1-893.

Spencer WK, Wright CW, 1966. Asterozoans. In: Treatise on Invertebrate Paleontology, Part U. Echinodermata 3, Vol. 1 (Ed., Moore RC). Geological Society of America and University of Kansas Press, New York, pp. 4-107.

Verrill AE, 1894. Description of new species of starfish and ophiurans. Proceedings of the United States National Museum, 17:245-297.

Verrill AE, 1899. Revision of certain genera and species of starfishes, with descriptions of new forms. Transactions of the Connecticut Academy of Arts and Sciences, 10:145-234.

Verrill AE, 1914. Monograph of the shallow-water starfishes of the North Pacific coast from the Arctic Ocean to California. Harriman Alaska series 14. Smithsonian Institution, Washington, DC, pp. 1-408.

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