

A New Record of Sea Urchin (Echinoidea: Stomopneustoida: Glyptocidaridae) from the Yellow Sea, Korea

Taekjun Lee¹, Sook Shin^{2,*}

¹College of Life Sciences and Biotechnology, Korea University, Seoul 136-701, Korea

²Department of Life Science, Sahmyook University, Seoul 139-742, Korea

ABSTRACT

Sea urchins were collected from waters adjacent to Daludo Island and Mohang harbor in the Yellow Sea, and were identified into *Glyptocidaris crenularis* A. Agassiz, 1864, of the family Stomopneustidae within the order Stomopneustoida, based on morphological characteristics. This species has two unique morphological characteristics: the ambulacral plate is composed of three primary plates and two demi-plates, and a valve of globiferous pedicellaria consists of with a well-developed long terminal hook and a unique stalk equipped with one to six long lateral processes covering membranes, resembling fins. It is newly recorded in Korea and is described with photographs. This brings the total number of sea urchins reported from the Yellow Sea, Korea, to seven.

Keywords: *Glyptocidaris crenularis*, sea urchin, taxonomy, morphology, Yellow Sea, Korea

INTRODUCTION

Sea urchins are familiar marine benthic species which are classified into two subclasses: Cidaroida and Euechinoidea. Euechinoidea includes 11 orders (Kroh and Mooi, 2013). Of them, the order Stomopneustoida comprises only two species of two families: *Glyptocidaris crenularis* A. Agassiz, 1864, of family Glyptocidaridae, and *Stomopneustes variolaris* L. Agassiz, 1841, of family Stomopneustidae (Kroh and Smith, 2010; Kroh and Mooi, 2013). These stomopneustoids had never been reported among Korea. Six Korean echinoids were reported in the Yellow Sea (Shin, 2011): *Microscyphus olivaceus* (Döderlein, 1885), *Temnopleurus hardwickii* (Gray, 1855) and *T. toreumaticus* (Leske, 1778) of family Temnopleuridae, *Hemicentrotus pulcherrimus* (A. Agassiz, 1863) and *Mesocentrotus nudus* (A. Agassiz, 1863) of family Strongylocentrotidae belonging to order Camarodonta, and *Echinocardium cordatum* (Pennant, 1777) of family Loveniidae of order Spatangoida.

Sea urchins were collected from adjacent waters of Daludo Island and Mohang harbor of the Yellow Sea between June 2008 and June 2012. These were preserved in above 95%

ethyl alcohol and their important morphological characters were photographed using a digital camera (D7000; Nikon, Tokyo, Japan), stereo- and light-microscopes (Nikon SMZ 1000; Nikon Eclipse 80i) and scanning electron microscope (JSM-6510; JEOL, Tokyo, Japan). The specimens were identified on the basis of morphological characters and described with photographs. Specimens were deposited in the Marine Echinoderm Resource Bank of Korea (MERBK), Sahmyook University, Seoul, Korea.

SYSTEMATIC ACCOUNTS

Class Echinoidea Leske, 1778

Subclass Euechinoidea Bronn, 1860

Key to the orders of subclass Euechinoidea in Korea

1. Periproct located in apical system 2
– Periproct not located in apical system 5
2. Teeth with grooved inner surface Diadematoidea
– Teeth with keeled inner surface 3
3. Epiphyses joining over teeth Camarodonta

© This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

*To whom correspondence should be addressed

Tel: 82-2-3399-1717, Fax: 82-2-3399-1729

E-mail: shins@syu.ac.kr

- Epiphyses not joining over teeth 4
- 4. Amburacral plate consisting of a primary plate and two demi-plates Arbacioida
- Amburacral plate consisting of three primary plates and two demi-plates Stomopneustoida
- 5. Test of discoid shape, with dental apparatus Clypeasteroida
- Test of heart shape, without dental apparatus Spatangoida

1*Order Stomopneustoida Kroh and Smith, 2010

Stomopneustoida Kroh and Smith, 2010: 170; Kroh and Mooi, 2013: 510530.

2*Family Glyptocidaridae Jensen, 1982

Glyptocidaridae Jensen, 1982: 90; Kroh and Mooi, 2013: 510741.

3*Genus Glyptocidaris A. Agassiz, 1864

Glyptocidaris A Agassiz, 1864: 356; HL Clark, 1912: 228; Mortensen, 1935: 480; D'yakonov, 1969: 170; Kroh and Mooi, 2013: 512516.

Type species: *Glyptocidaris crenularis* A. Agassiz, 1864.

4Glyptocidaris crenularis* A. Agassiz, 1864 (Fig. 1)**

Glyptocidaris crenularis A Agassiz, 1864: 356; Döderlein, 1906: 520; HL Clark, 1912: 228; Mortensen, 1935: 480; Utinomi, 1960: 339; D'yakonov, 1969: 170; Kroh and Mooi, 2013: 513284.

Material examined. 1 specimen by SCUBA diving, Daludo Island, 1 Jun 2008; 3 dried specimens by fish trap, Mohang harbor, 11 Aug 2010; 4 dried specimens by fish trap, Mohang, 4 Sep 2011; 8 specimens by fish trap, Mohang, 3 Jun 2012; 37 specimens by fish trap, Mohang, 24 Jun 2012.

Description. Test moderately sized, slightly flattened or low hemispherical form, rather roundly pentagonal outline, with distinctly flattened ventral side (Fig. 1A-F). Ambulacrum nearly half as broad as interambulacrum (Fig. 1F). Narrow median lines on ambulacral and interambulacral rows remain bare from apical system almost to ambitus. Ambulacral pore-pairs usually five in number, arranged in a slightly horizontal row closer to apical system on dorsal side but towards ventral side begin to curved-oblique alternating rows (Fig. 1D, E). Pore zone on ventral side not wide near peristome (Fig. 1E). Ambulacral plates with five elements composing three primary plates and two demi-plates (Fig. 1J). All primary tubercles distinctly and deeply crenulated, rapidly decreasing in size towards apical system on dorsal side. Large

secondary tubercles in adambulacral plates also crenulated, but other small ones on ambulacral and adambulacral plates not crenulated (Fig. 1G). Apical system broad, periproct consisting of miliary plates with tubercles. Genital and ocular plates covered with slightly crenulated or non-crenulated small tubercles. Genital plates uniform in width and roundly pentagonal (Fig. 1H, I). I ocular plate (Fig. 1H) or IV ocular plate (Fig. 1I) inserted between borders of genital plates and reaching periproct (Fig. 1H, I, respectively). Primary spines smooth, long, gradually tapered to tips (Fig. 1L, M), longest ones on ambitus reaching almost 75% length of test diameter, but rapidly decreased towards apical system. Secondary spines short, stout, thorny, and miliary spines very small. Globiferous, tridentate, ophiocephalous and triphyllous pedicellariae present (Fig. 1N-Q). Globiferous pedicellariae numerous, each valve with long stalk equipped with one to six, but usually four to six, long lateral processes covering membranes, resembling fins (Fig. 1K), or more rarely with short stalk without process, and with a well-developed long sharp terminal hook (Fig. 1N). Tridentate pedicellariae rare, variable in length, with porous paddle formed valves with slightly serrated distal parts (Fig. 1O). Ophiocephalous pedicellariae numerous on ventral side, oval shaped, with short broad thimble formed valves with slightly serrated distal parts (Fig. 1P). Triphyllous pedicellariae small, with slightly elongated valve with round distal part (Fig. 1Q). Spicules of tube feet straight or irregular bar shaped, with porous center, and with blunt tips (Fig. 1R).

Size. Test diameter 48.2–68.5 mm
 Test height 44.6–45.0% of test diameter 21.5–30.7 mm
 Peristome 35.2–35.8% of test diameter 17.1–24.5 mm

Color. Test and spines are light olive or olive, but the base of spine is dark violet.

Distribution. Korea (Yellow Sea), Japan (Tsugaru Strait, Mutsu Bay, Kinkasan, Sado Island), China (Dailian).

Remarks. *Glyptocidaris crenularis* is the first species of Stomopneustoida in Korea. This species has two unique morphological characteristics: the ambulacral plate is composed of three primary plates and two demi-plates, and the globiferous pedicellaria consists of a valve with a well-developed long terminal hook and a unique stalk equipped with one to six long lateral processes covering membranes, resembling fins. This species usually lives at sandy mud regions of the Yellow Sea and has been reported in the adjacent waters of northern Japan (Tsugaru Strait, Mutsu Bay, Kinkasan, Sado Island) (A. Agassiz, 1864, Döderlein, 1906, HL Clark, 1912, Mortensen, 1935, D'yakonov, 1969), and northern (Dailian, China) (Kroh and Mooi, 2013) and middle Yellow sea (Dal-

Korean name: 1*기공성계목 (신칭), 2*조각관성계과 (신칭), 3*조각관성계속 (신칭), 4*조각관성계 (신칭)

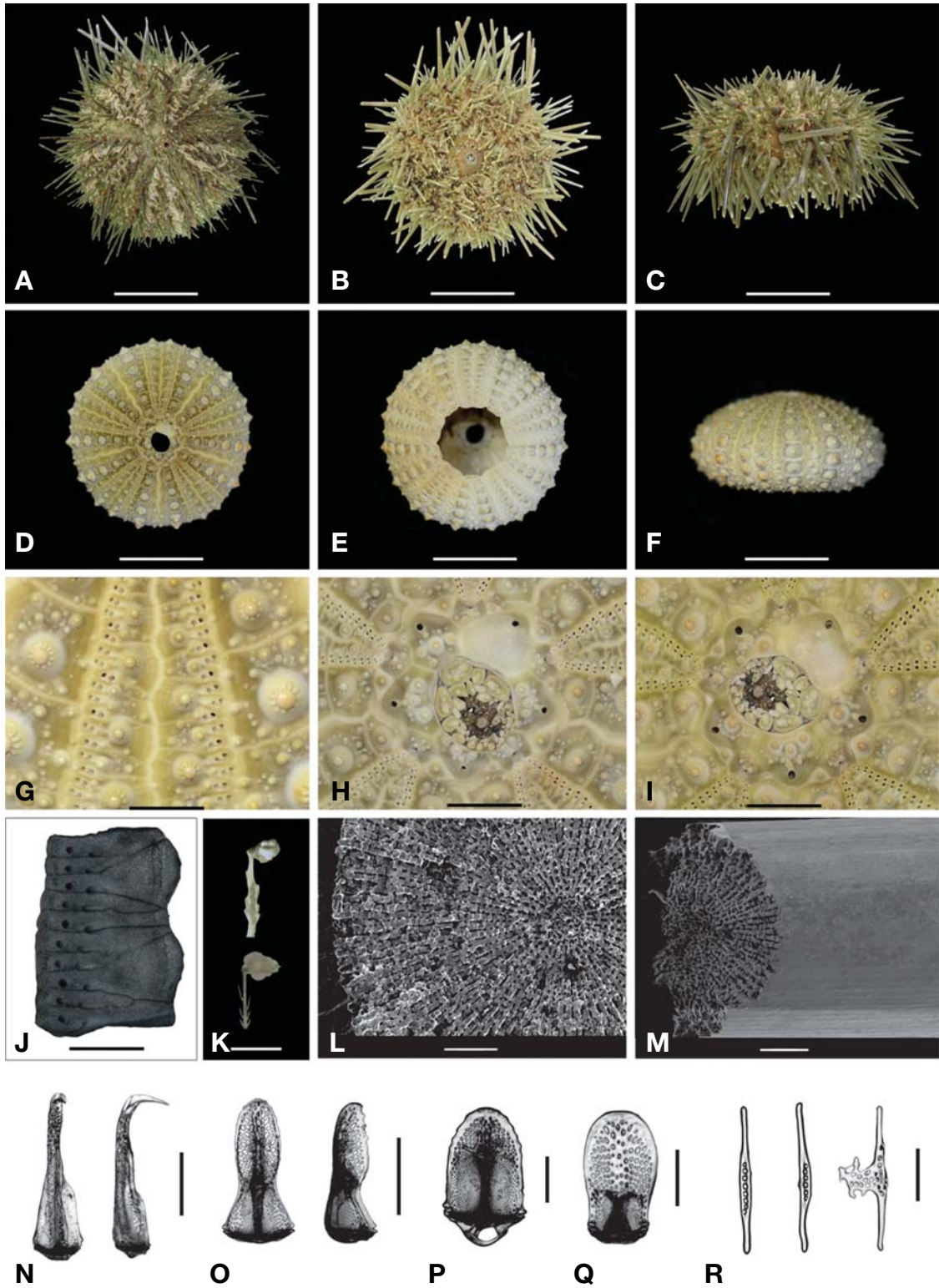


Fig. 1. *Glyptocidaris crenularis*. A, D, Dorsal side; B, E, Ventral side; C, F, Lateral side; G, Ambulacral plates; H, I, Apical system; J, Two ambulacral plates; K, Globiferous pedicellariae; L, Cross-section of a spine; M, Cross-section and surface of a spine; N, Valves of globiferous pedicellaria; O, Valves of tridentate pedicellaria; P, A valve of ophiocephalous pedicellaria; Q, A valve of triphyllous pedicellaria; R, Spicules of tube-feet. Scale bars: A–F=2.5 cm, G–I=2.5 mm, J, K=1 mm, L=200 μ m, M=100 μ m, N, O=300 μ m, P, Q=100 μ m, R=50 μ m.

do Island and Mohang harbor, in this study). Further surveying is required in order to establish the true extent of this species which has not yet been observed in the East Sea of Korea and the Korea Strait.

ACKNOWLEDGMENTS

This study was supported by Sahmyook University Research Fund and by the Project of the Survey of Korean Indigenous Species, NIBR, and a grant from Marine Biotechnology Program Funded by Ministry of Oceans and Fisheries, Korea.

REFERENCES

- Agassiz A, 1864. Synopsis of the echinoids collected by Dr. W. Stimpson on the North Pacific exploring expedition under the command of captains Ringgold and Rodgers. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 15:352-360.
- Clark HL, 1912. Hawaiian and other Pacific echini: the Pediniidae, Phymosomatidae, Stomopneustidae, Echinidae, Temnopleuridae, Strongylocentrotidae, and Echinometridae. *Memoirs of the Museum of Comparative Zoölogy at Harvard College*, 34:1-383.
- Döderlein L, 1906. Die polyporen Echinoiden von Japan. *Zoologischer Anzeiger Leipzig*, 30:515-521.
- D'yakonov AM, 1969. Fauna of Russia and adjacent countries. Echinodermata, Vol. 1, Echinoidea, No. 1. Translated from Russian from Israel Program for Scientific Translations, Jerusalem, pp. 1-265.
- Jensen M, 1982. Morphology and classification of Euechinoidea Bronn, 1860: a cladistic analysis. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening*, 143:1-99.
- Kroh A, Mooi R, 2013. World Echinoidea Database [Internet]. The world register of marine species (WoRMS). World Echinoidea Database, Accessed 27 Apr 2012, <<http://www.marinespecies.org/echinoidea>>.
- Kroh A, Smith AB, 2010. The phylogeny and classification of post-Palaeozoic echinoids. *Journal of Systematic Palaeontology*, 8:147-212.
- Mortensen T, 1935. A Monograph of the Echinoidea. II. Bothriocidaroida, Melonechinoida, Lepidocentroida, and Stirodonta. CA Reitzel and Oxford University Press, Copenhagen and London, pp. 1-647.
- Shin S, 2011. Sea urchin: Echinodermata: Echinozoa, Echinoidea. In: *Invertebrate fauna of Korea*, Vol. 32 (Ed., National Institute of Biological Resources). National Institute of Biological Resources, Incheon, pp. 1-122.
- Utinomi H, 1960. Echinoids from Hokkaido and the neighbouring subarctic waters. *Publication of the Seto Marine Biological Laboratory*, 8:337-350.

Received June 3, 2013
Revised September 16, 2013
Accepted September 20, 2013