First Report of Two Diogenid Species of Hermit Crabs (Crustacea: Decapoda: Anomura) from Korea

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ABSTRACT

Two diogenid hermit crab species, Dardanus lagopodes and Diogenes deflectomanus, are newly reported from Korea. Dardanus lagopodes is distinguished from the other species of genus Dardanus in Korea by having setae with cream-colored tips on the cephalothorax and the following characteristics: ocular peduncles somewhat longer than antennular peduncles, and the pereopod without a longitudinal sulcus and scute-like projections. Diogenes deflectomanus is similar to D. nitidimanus but can be distinguished by having the fixed finger of the left cheliped bent slightly downwardly and the following characteristics: slightly shorter ocular peduncle, elongated left cheliped with small granules on the surface, right cheliped without calcareous teeth on the cutting edge of the dactylus, and the minute spine of post-median margin of the telson is not well developed. The geographical distributions of these two species are extended by the present study. In particular, D. deflectomanus in the current study is the first report outside Chinese waters. Now, 20 species of the family Diogenidae are known in Korean waters.

Keywords: new record, Dardanus lagopodes, Diogenes deflectomanus, Decapoda, hermit crab, Korea

INTRODUCTION

The family Diogenidae Ortmann, 1892 is one of the major taxa in the superfamily Paguroidea Latreille, 1802. Most genera of this family appear extensively near the equator in the Indo-Pacific region (McLaughlin et al., 2007). They are found in various habitats, from intertidal to slightly deep subtidal, and most species live in gastropod shells. Some species have formed a symbiotic relationship with anemones. Members of family Diogenidae are readily distinguished from other hermit crabs by their third maxillipeds, located close to each other in their bases. This family is also characterized by other characteristics: the left cheliped is generally larger than the right one, the antennular flagella terminating in a filament, no paired pleopods on the fourth and fifth abdominal somites, and the abdominal tergites mostly not well calcified (McLaughlin, 2003).

The family Diogenidae includes 20 genera and 429 species (McLaughlin et al., 2010). In Korea, only 6 genera and 18 species have been reported in this family: Areopaguristes japonicus (Miyake, 1961), A. nigroapiculus (Komai, 2009), Ciliopagurus striagatus (Herbst, 1804), C. krempfi (Forest, 1952), Clibanarius virescens (Krauss, 1843), Dardanus arrosor (Herbst, 1796), D. aspersus (Berthold, 1846), D. crassimanus (H. Milne Edwards, 1836), D. impressus (De Haan, 1849), D. pedunculatus (Herbst, 1804), Diogenes edwardsii (De Haan, 1849), D. nitidimanus Terao, 1913, D. penicillatus Stimpson, 1858, Paguristes acanthomerus Ortmann, 1892, P. digitalis Stimpson, 1858, P. ortmanni Miyake, 1978, P. seminudus Stimpson, 1858, and P. versus Komai, 2001 (Kim, 1973; Kim and Kim, 1997; Oh, 2001; Kim and Son, 2006; Lee and Ko, 2012). Two species, Dardanus lagopodes (Forskål, 1775) and Diogenes deflectomanus Wang and Tung, 1980 are newly reported as a result of ongoing systematic studies on Decapoda collected from Korean waters. Descriptions and figures of the two species are briefly provided.

MATERIALS AND METHODS

All specimens were preserved in 99% ethanol and observed with a stereomicroscope (Leica M28; Leica, Wetzlar, Germany). Figures were drawn with a camera lucida on a Nikon...
SMZ800 (Nikon, Tokyo, Japan). Photos were taken with a digital camera (D200; Nikon) and assessed with the Helicon Focus software. The terminology follows McLaughlin et al. (2007). The abbreviation ‘sl’ refers to the shield length, measured from the end of the rostrum to the middle of the posterior margin of the shield, with digital slide calipers (Mitutoyo CD6CSX; Mitutoyo, Kawasaki, Japan) to 0.01 mm. The specimens examined in this study were deposited in the Marine Arthropod Depository Bank of Korea, Seoul National University (MADBK).

SYSTEMATIC ACCOUNTS

Order Decapoda Latreille, 1803
Superfamily Paguroidea Latreille, 1802
Family Diogenidae Ortmann, 1892
Genus Dardanus Paul’son, 1875

1* Dardanus lagopodes (Forskål, 1775) (Figs. 1, 2)
Cancer lagopodes Forskål, 1775: 93.
Pagurus sanguinolentus Quoy and Gaimard, 1824: 532, Pl. 79, fig. 2.
Pagurus affinis H. Milne Edwards, 1836: 274.
Pagurus euopsis Dana, 1852: 452; Alcock, 1905: 86, Pl. 9, fig. 2.
Pagurus depressus Heller, 1861: 248.
Dardanus Hellerii Paul’son, 1875: 90, Pl. 12, fig. 4a–c.
Dardanus sanguinolentus: Miyake, 1965: 644, fig. 1081.
Dardanus lagopodes: Lewinsohn, 1969: 32, pl. 2, figs. 1, 2; McLaughlin et al., 2007: 91–93; 2010: 20 (list), fig. 8.

Material examined. 1♂ (sl 2.15 mm), Korea, Gyeongsangbuk-do, Ulleung-gun, Seo-meoyeon, Tonggumi, 15 Jul 2013, by SCUBA max 15 m, coll., Jung J, Park JH.

Description. Shield (Fig. 2A) almost as long as broad and with tufts of setae; rostrum almost absent. Lateral projection round, longer than rostrum. Ocular peduncle as long as shield; cornea somewhat dilated. Ocular acicle with 2 or 3 spines. Antennular peduncle not exceed distal corneal margin. Antennal peduncle shorter than ocular peduncle. Antennal acicle with several spines.

Left cheliped (Fig. 2B) not massive, slightly larger than right one, 2.3 times as long as shield; surface covered with long setae. Dorsal surface of chela with spines. Dactylus almost same length of palm measured along mesial margin; cutting edge with row of calcareous teeth, terminating in small conical claw. Dorsal surface of palm with numerous scattered spines. Carpus 0.5 times as long as chela; dorsal

Fig. 1. Dardanus lagopodes (Forskål, 1775) (male, sl 2.15 mm). sl, shield length.

surface with scattered spines. Merus slender. Right cheliped (Fig. 2C) 2.2 times as long as shield, similar to left cheliped.

Second and third pereopods slender and long, with tufts of long setae. Second pereopod (Fig. 2D) 1.4 times as long as left cheliped. Dactylus 1.1 times as long as propodus; lateral surface with median longitudinal groove. Propodus 1.9 times as long as carpus. Carpus 0.5 times as long as merus; dorsoproximal margin bearing 1 strong spine. Third pereopod (Fig. 2E) similar to second pereopod.

Abdomen twisted, male with 4 unpaired pleopods and 4 calcified abdomen plates.

Telson (Fig. 2F) separated by narrow median cleft, asymmetrical, left lobe larger than right one. Posterior margins of 2 lobes, each with 4 spines.

Coloration. Shield white and mottled brown with old copper patch anteriorly. Ocular peduncle yellowish-brown. Pereopods white and mottled brown. Carpi of second and third pereopods old copper. Setae with cream tips.

Distribution. East Africa; Red Sea; Indian Ocean; Southeast Asia; Australia; Polynesia; Taiwan; Japan; Korea (Ulleung Is.).

Habitat. Living in a gastropod shell.

Remarks. This species is reported from Korean waters for the first time. It has been recorded from near the equator in the Indo-Pacific region. The present study extends the known range of this species northwardly. The specimen in this study was found living in the shell of a cone snail, oc-
curring in the tropical area.

*Dardanus lagopodes* is distinguished from other hermit crabs of genus *Dardanus* in Korea by its setae with cream-colored tip and the following characteristics: ocular peduncles somewhat longer than antennular peduncles; pereopods without sulcus and scute-like projections (Mc-

**Fig. 2.** *Dardanus lagopodes* (Forskål, 1775), male. A, Shield and cephalic appendages; B, Left cheliped, dorsal view; C, Right cheliped, dorsal view; D, Right second pereopod, lateral view; E, Left third pereopod, lateral view; F, Telson, dorsal view. Scale bar: A–F=0.1 mm.
Laughlin et al. (2007) noted that this species has two color forms, “red-knee” form and “blue-knee” form, which originated in the color of the carpi of the second and third pereopods. They also mentioned that chelips of *D. lagopodes* are unequal, left not appreciably larger than right. And they make a remark that dactylus and propodus and carpus of left third pereopod of *D. lagopodes* covered with numerous strong spines. They also refer to the size range of *D. lagopodes* (sl 4.2–8.6 mm). Specimens of *D. lagopodes* collected from Malaysia in 2014 by the present authors also showed two color forms and those characteristics. And sl size range of those specimens is 7.9–11.8 mm. In the case of the current specimen of *D. lagopodes*, the color is “red-knee” form. But left and right chelips are almost same, and its left third pereopod is almost unarmed except 1 strong spine on dorsoproximal margin of carpus. According to those difference and size of current specimen, it regard as juvenile.

Genus *Diogenes* Dana, 1851

18 *Diogenes deflectomanus* Wang and Tung, 1980 (Figs. 3, 4)

*Diogenes deflectomanus* Wang and Tung, 1980: 35, fig. 1 (type locality: Yangan, Zhejiang, China, 22 m); McLaughlin et al. 2010: 21 (list); Komai et al. 2012: 1228, fig. 6–9.

**Material examined.** 1♂ (sl 4.81 mm), Korea, Gangwon-do, Gosung-gun, Oho-ri, 27 Jul 2011, by SCUBA max 19 m, coll., Lee S.

**Description.** Shield (Fig. 4A) subquadrate, almost as long as broad; dorsal surface with transverse ridges with spine and tuft of setae laterally. Rostral lobe rounded, lateral projection bearing terminal spine. Intercalary rostral process long and slender, with acute tip. Ocular peduncle stout, 0.6 times as long as shield. Ocular acicle unarmed. Ultimate segment of antennular peduncle almost exceeding ocular peduncle. Antennal peduncle overreaching distal corneal margin. Flagella with long setae.

Left cheliped (Fig. 4B) larger than right one, 4.5 times as long as shield; most of the surface covered with small granules. Chela 2.1 times as long as broad; dorsomesial margin with strong tubercles. Dactylus curved, sharp, slightly longer than palm measured along mesial margin; dorsal surface depressed; ventral margin with groove; cutting edge with row of calcareous granules. Palm elongate; dorsal surface with 2 rows of tubercles; lateral margin convex, edge slightly depressed. Carpus with spinulose tubercles on dorsal sur-

![Image](image-url)

**Fig. 3.** *Diogenes deflectomanus* Wang and Tung, 1980 (male, sl 4.81 mm). sl, shield length.
strong spines laterally, 2 small spines mesially; right lobe with 3 small spines mesially.

**Habitat.** Living in a gastropod shell.

**Distribution.** Chinese coast from Bohai Sea to Hainan Island; intertidal to 30 m; Korea (East Sea).

**Remarks.** This species is reported from Korean waters for
the first time. It has been only recorded in the Chinese coast, from Bohai Sea to Hainan Island (Wang and Tung, 1980; Komai et al., 2012). The present study extends the range of this species eastwardly.

*Diogenes deflectomanus* is similar to *D. nitidimanus* Ter- ao, 1913, reported in Korea. However, the slightly curved fixed finger of left cheliped and other characteristics distinguish *D. deflectomanus* from *D. nitidimanus*. These characteristics are the following: ocular peduncles slightly shorter; left cheliped elongated with surface bearing small granules; cutting edge of dactylus of right cheliped without calcareous teeth; minute spines of post-median margin of telson (Korn et al., 2008).

The examined specimen shows two slightly different characteristics compared with the description by Komai et al. (2012). The outer surface of fixed finger of left cheliped bears a row of tubercles on an elevated midline in their specimen, but the present specimen does not; ocular acicle is armed with four or five spines in their specimen but the present specimen does not. Because other characteristics agree with those of their description, such differences are regarded as individual variation.

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