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Littoral hermit crabs (Crustacea: Decapoda: Anomura) of Larak Island, Persian Gulf, Iran

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The hermit crab fauna of the Larak Island was investigated, which revealed seven species representing five genera and two families. The family Diogenidae represents six species namely *Areopaguristes perspicax* (Nobili, 1906), *Clibanarius signatus* Heller, 1861, *Dardanus lagopodes* (Forskål, 1775), *D. tinctor* (Forskål, 1775), *D. avarus* Heller, 1865, *D. tirmiziae* Siddiqui & McLaughlin, 2003, while the family Coenobitidae represents only one species, *Coenobita scaevola* (Forskål, 1775). Besides, information on habitat preferences, geographical distribution and the dominant occupied shells has also been covered.

Key words: Paguroidea, Persian Gulf, Diogenidae, Intertidal, Larak Island.

INTRODUCTION

The coastal areas present a variety of habitats. The kinds of habitats provide a variety of ecological niches for decapod crustaceans. Hermit crabs are decapod crustaceans that occupy empty gastropod shells to protect themselves from predation, osmotic pressure and physical shocks. Paguroids are important macrozoobenthic organisms inhabiting the supralittoral to deep zones throughout the world (Ayres-Press & Mantelatto, 2008). The superfamily Paguroidea contains 1117 species belonging to six families, of which the family Paguridae is the most diverse group with 542 species. (Mclaughlin et al., 2010).

Hermit crab fauna of the Persian Gulf -ecologically an important region- have been the subject of some surveys (Alcock, 1905; Nobili, 1905; Nobili, 1906; Motoh, 1975; Basson, 1977; Titgen, 1982; Jones, 1986a and b). Studies on the hermit crabs in the Persian Gulf have gained momentum in recent years (Apel, 2001; Moradmand, 2007; Kazmi et al., 2007; Hosseini, 2009; Kheirabadi, 2012; Naderloo et al., 2012; Naderloo & Türkay, 2012; Seyfabadi et al., 2013; Naderloo et al., 2013). Naderloo et al. (2012) have reported 31 species of Paguroidea from the Persian Gulf, of which 16 occur along the Iranian coasts. Despite these studies, they still remain largely unknown in the Larak Island. In this study, seven species in two families of Diogenidae and Coenobitidae are recorded from the Larak Island. The family Diogenidae is represented by four genera (*Clibanarius*, *Diogenes*, *Dardanus*, *Areopaguristes*) and Coenobitidae is represented only by one species,*Coenobita scaevola,* (Forskål, 1775). For each species, information about color pattern and habitat preference is given.

MATERIAL AND METHODS

Study site

Larak Island is located in the south of the Strait of Hormuz in the Persian Gulf (26° 51' N, 56° 21'E), covering an area of 49 km^2. Five stations in the intertidal region around the island were selected for

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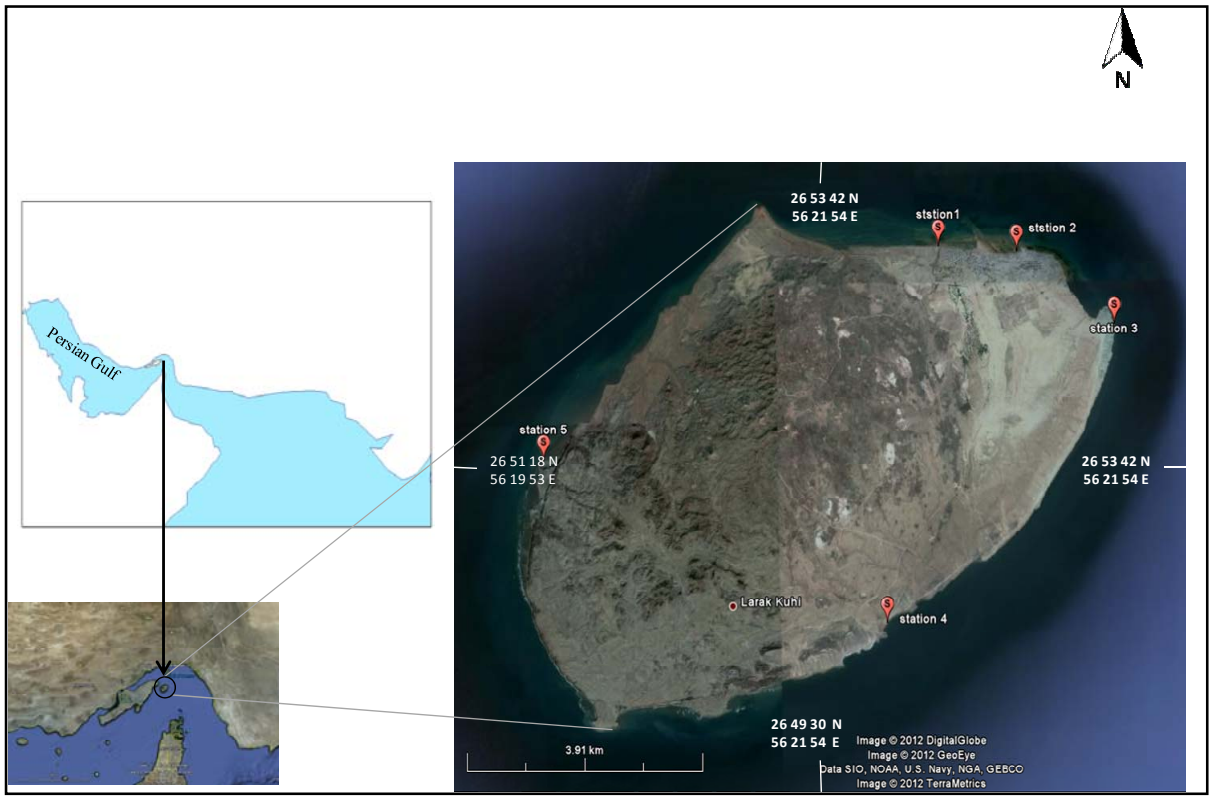

FIGURE 1. Sampling stations in the Larak Island (Persian Gulf, Iran).

this investigation covering representative of all coastal habitats in the island (Fig.1). Intertidal region was further vertically divided into high, mid and low intertidal zones.

Sampling

Sampling was performed seasonally in the three divisions of the intertidal zones of the five selected stations from September 2011 to June 2012 using random quadrate sampling. Hand picking of some rare species that did not fall within the quadrates was also performed. Night sampling was also performed for nocturnal species. Specimens were placed in special plastic packets and preserved in 70% ethanol for identification in the laboratory, which was done using Siddiqui et al., 2004 and Kazmi & Siddiqui (2006). Identity of the material was also confirmed by comaparing with the deposited material in the Zoological Museum, University of Tehran (ZUTC). The shells were indentified using Bosch et al. (1995).

RESULTS

According to the collected material, seven species were identified including *Coenobita scaevola* (Forskål, 1775), *Areopaguristes perspicax* (Nobili, 1906), *Clibanarius signatus* Heller, 1861, *Dardanus lagopodes* (Forskål, 1775), *D. tinctor* (Forskål, 1775), *Diogenes avarus* Heller, 1865, and *D. tirmiziae* Siddiqui & McLaughlin, 2003.

Coenobitidae Dana, 1851

***Coenobita* Laterile, 1829**

***Coenobita scaevola* (Forskål, 1775)**

Coenobita sp. — Basson et al., 1977: 140
Coenobita scaevola — Apel, 2001: 28; Moradmand & Sari, 2007: 26; Mirbagheri, 2010: 44; Kheirabadi, 2012: 52; Asgari et al., 2012: 3; Naderloo et al., 2012: 68; Naderloo & Türkay, 2012: 23; Seyfabadi et al., 2013: 59, Naderloo et al., 2013: 4.
Material examined- 2 males, 2 females, 1 juvenile (ZUTC Anom: 1097)., Station 1 (26° 53' N, 56° 22' E), Station 3 (26° 52' N, 56° 23' E), Station 4 (26° 50' N, 56° 22' E), Station 5 (26° 51' N, 56° 19' E)., 08.09.2011, 01.06.2012., M. M. Zamani. Jamshidi; 2 males, 2 females (ZUTC Anom.1008), Tang (Gulf of Oman), 25° 21' N, 59° 53' E, 17.11.2005, M. Moradmand.
Diagnosis- Rostrum reduced; eyestalks laterally flattened; eyes usually held subparallel to each other; antennular peduncles longer than carapace.
Coloration- Color is basically white or pale pink (mainly in juveniles) with gray patches at the anterior part of the shield and proximal part of each periopodal segment; after preservation, the gray patches become partially faded.
Habitat- This is the only hermit crab of the supralittoral zone of sandy beaches. They hide themselves in aggregations under the moist sand often at shadow of the cliffs and halophytes in the daytime, possibly in order to avoid dehydration. They are active nocturnal scavengers.
Shells- The juveniles and small land hermit crabs, select *Cerithium caeruleum* shell and the adults go for *Turbo radiatus* and *Nerita longii*.
World distribution- Northwestern Indian Ocean: Red Sea, Gulf of Aden, Somalia, Socotra Island, Dhofar, Pakistan, Gulf of Oman, Persian Gulf (Lewinsohn, 1969; Hogarth, 1988 & 1989; Tirmizi & Siddiqui, 1982; Apel, 2001; Simões et al, 2001).

Diogenidae Ortmann, 1892
***Areopaguristes* (Dana, 1851)**
***Areopaguristes perspicax* (Nobili, 1906)**
Paguristes jousseamei var. Perspicax —— Nobili, 1906: 55
Paguristes perspicax — Titgen, 1982: 104; Jones, 1986a: 155; Apel 2001: 36
Areopaguristes perspicax — Mirbagheri, 2010: 67; Kheirabadi, 2012: 48; Asgari et al., 2012: 3; Naderloo et al., 2012: 68: Naderloo & Türkay, 2012: 24; Naderloo et al., 2013: 4.
Material examined - 1 male, 1 female (ZUTC Ano.: 1094)., station 1 (26° 53' N, 56° 22' E), station 2 (26° 53' N, 56° 23' E)., 02.12.2011, 02.06.2012., M. M. Zamani Jamshidi; 7 specimens (ZUTC Anom.1089), Hormuz Island (Persian Gulf), 27° 04' N, 56° 25' E, 28.06.2010, N. Kheirabadi.
Diagnosis- Paired first pleopods present; shield triangular; rostrum reduced; ocular peduncles shorter than antennular peduncles; ocular peduncles elongate with some prominent spines.
Coloration- In general, pale brown or pale cream, with blue ocular peduncles.
Habitat- Sandy-rocky shores.
Shells- Damaged and eroded shells of *Conumurex* spp. and *Conus* spp.
World distribution- Northwestern Indian Ocean: Red Sea, Gulf of Aden, Somalia, Socotra Island, Dhofar, Pakistan, Gulf of Oman, Persian Gulf (Kazmi & Siddiqui, 2006; Apel, 2001; Mirbagheri, 2010; Naderloo & Türkay, 2012).

***Clibanarius* (Dana, 1852)**
***Clibanarius signatus* Heller, 1861**
Clibanarius signatus— Nobili, 1906: 85; Titgen, 1982: 105; Hogarth, 1988: 1098; Hogarth, 1989: 109; Hornby, 1997: 14; Apel, 2001: 30; Moradmand & Sari, 2007: 29; Hosseini, 2009: 39; Mirbagheri,

2010: 46; Kheirabadi, 2012: 32; Asgari et al., 2012: 3; Naderloo et al., 2012: 68; Naderloo & Türkay, 2012: 25; Naderloo et al., 2013: 4.

Material examined- 11 males, 4 females (ZUTC Anom. 1091)., station 1 (26° 53' N, 56° 22' E), station 2 (26° 53' N, 56° 23' E), station 3 (26° 52' N, 56° 23' E), station 4 (26° 50' N, 56° 22' E), station 5 (26° 51' N, 56° 19' E), 07.09.2011, 02.12.2011, 04.03.2012, 01.06.2012, M.M. Zamani Jamshidi; 12 males, 4 females, 1 ovigerous female (ZUTC Anom.1007), Bahal-Jask (Gulf of Oman), 25° 41' N, 57° 53' E, 01.10.2005, M. Moradmand.

Diagnosis- Shield longer than broad; chelipeds subequal, right one slightly larger than left one; in pereiopods, dactylus shorter than propodus; antennules longer than ocular peduncles.

Coloration- Yellowish with orange to red longitudinal strips on the pereiopods and ocular peduncles.

Habitat- Abundant in gravel and rocky shores, sometimes in sandy shores.

Shells- *Cerithium caeraleum*, *Lunella coronate, Planaxis sulcatus, Conumurex persicus, Semiricinula konkanensis, Priotrochus kotschyi, Nassarius* spp., *Nerita* spp., *Clypeomorus persica, Thais savignyi, Morula granulata*

World distribution- Northwestern Indian Ocean: Red Sea, Gulf of Aden, Socotra Island, Dhofar, Pakistan, Gulf of Oman, Persian Gulf (Lewinsohn, 1969; Tirmizi & Siddiqui, 1982; Hogarth, 1988 & 1989; Apel, 2001; Simões et al., 2001).

***Dardanus* Paul'son, 1851**

***Dardanus lagopodes* (Forskål, 1775)**

Pagurus euopsis — Nobili, 1906: 117.

Dardanus lagopodes— Thompson, 1943: 419; Titgen, 1982: 107; Apel, 2001: 31; Naderloo et al., 2012: 68; Naderloo & Türkay, 2012: 25.

Material examined- 1 female (ZUTC Anom. 1095), station 1 (26° 53' N, 56° 22' E), 01.06.2012, M. M. Zamani Jamshidi; 1 male (ZUTC Anom. 1048), Dayyer (Persian Gulf), 27° 530' N, 51° 56' E, 12.04.2006, M. Moradmand.

Diagnosis- shield depressed; ocular peduncles longer than antennular peduncles, decidedly broadened distally; corneas occupying no more than 0.2 of peduncular length; left cheliped broad, but not massive.

Coloration- Color is amethystine; shield amethystine with red spots; pereiopods amethystine with red bands and spots.

Habitat- Coral regions, rocky shores and hard substrates of the shallow sublittoral, but sometimes migrate to intertidal for feeding.

Shells- *Conus* sp.

World distribution- Indo-West Pacific: Madagascar, East African coast, Mauritius, Seychelles, Socotra Island, Red Sea, Pakistan, Dhofar, Gulf of Oman, Persian Gulf, India, Andaman Sea, Thailand, Malaysia, Maldives, Taiwan, New Guinea, Philippines, Australia, Japan, Samoa and French Polynesia (Monteforte, 1987; Morgan, 1987; Hogarth, 1988; Reay & Haig, 1990; Nomura, 1996; McLaughlin & Hogarth**,** 1998; Rahayu, 2000; Apel, 2001; Naderloo et al, 2012; Naderloo & Türkay, 2012).

***Dardanus tinctor* (Forskål, 1775)**

Pagurus tinctor — Nobili, 1905: 7; Nobili, 1906: 90.

Diogenes tinctor — Titgen, 1982: 109; Jones, 1986a: 155.

Dardanus tinctor— Lewinsohn, 1969: 120; Apel, 2001: 31; Kazmi et al., 2007: 95; Mirbagheri, 2010: 70; Kheirabadi, 2012: 46; Naderloo et al., 2012: 68; Naderloo & Türkay, 2012: 25.

Material examined- 1 male (ZUTC Anom. 1096), station 3 (26° 52' N, 56° 23' E), 04.12.2011, M. M. Zamani Jamshidi; 1 female (ZUTC Anom. 1088) (), Hormuz Island (Persian Gulf), 27° 04' N, 56° 25' E, 29.06.2010, N. Kheirabadi.

Diagnosis- Shield almost as long as breadth; anterior margin between rostrum and lateral projections gently concave; chelipeds unequal; ocular peduncles with colored latitudinal stripes on dorsal surface; ocular peduncles short, stout, slightly inflated distally; corneas dilated, not broader than peduncles; ocular acicles broad with several acute spines on their distolateral margins.

Coloration- Orange to bright brown with pallid brown latitudinal bands on the first and second pereiopods; left cheliped pink with brown spots.

Habitat- Mainly inhabit the subtidal, but sometimes migrate to intertidal for feeding.

Shells- *Conumurex persicus* and *Hexaplex kuesterianus*

World distribution- Western Indian Ocean: Red Sea, Mozambique, Socotra Island, Pakistan, Persian Gulf, Gulf of Oman, India, Sri Lanka, South China Sea, Malay Peninsula, Tosa Bay, Ryukyu Islands (Tirmiz & Sidiqui, 1981; Hogarth, 1988; Reay & Haig,1990; Apel, 2001; Rahayu, 2000; Kazmi et al, 2007; Naderloo et al, 2012; Naderloo & Türkay, 2012).

***Diogenes* Dana, 1851**

***Diogenes avarus* Heller, 1865**

Diogenes pugilator — Nobili, 1906.

Diogenes avarus — Jones, 1986a: 155; Jones, 1986b: 76; Hogarth, 1988: 1099; Hogarth, 1989: 114; Apel & Türkay, 1992: 197; Hornby, 1997: 14; Apel, 2001: 32; Moradmand & Sari, 2007: 27; Mirbagheri, 2010: 52; Kheirabadi, 2012: 36; Asgari et al., 2012: 4; Naderloo et al., 2012: 68; Naderloo & Türkay, 2012: 26; Naderloo et al., 2013: 4.

Material examined- 1 male (ZUTC Anom. 1092), .station 2 (26° 53' N, 56° 23' E)., 08.09.2011, 02.12.2011, 02.06.2012., M. M. Zamani Jamshidi; 30 specimens (ZUTC Anom.1022), Gwatr (Gulf of Oman), 25° 08' N, 61° 27' E, 19.11.2005, M. Moradmand.

Diagnosis: Shield longer than broad; rostrum developed; ocular acicles broad; left cheliped larger than right one; antennal acicles elongate, triangular or subtriangular; telson with obvious median cleft.

Colaration: Color is light cream or whitish with brownish spots on the pereiopods.

Habitat: sandy shores, usually occupy small gastropods.

Shells: *Mitrella blanda*, *Semiricinula konkanensis*, *Clypeomorus persica*, *Nassarius arcularia, Planaxis sulcatus*

World distribution- Indo-West Pacific: East African coast, Seychelles, Red Sea, Gulf of Aden, Socotra Island, Pakistan, Gulf of Oman, Persian Gulf, Andaman Sea, Gulf of Thailand, Vietnam, South China Sea, Philippines, Singapore, Indonesia, New Guinea and Northern Australia (Lewinsohn, 1969; Hogarth, 1988 & 1989; Tirmizi & Siddiqui, 1982; Morgan, 1990; Hornby, 1997; Rahayu & Forest, 1995; McLaughlin & Hogarth**,** 1998, Rahayu & Komai, 2000; Apel, 2001; Simões et al., 2001; Mclaughlin & Dworshack, 2001; McLaughlin, 2002; Naderloo & Türkay, 2012).

***Diogenes tirmiziae* Siddiqui & McLaughlin, 2003**

Diogenes tirmiziae — Mirbagheri, 2010: 65; Kheirabadi, 2012: 45; Asgari et al., 2012: 4; Naderloo et al., 2012: 68; Naderloo & Türkay, 2012: 28; Naderloo et al., 2013: 4.

Material examined- 1 female (ZUTC Anom. 1093), station 2 (26° 53' N, 56° 23' E), 02.06.2012, M. M. Zamani Jamshidi; 16 males, 22 females (ZUTC Anom.1049) , Moghdan-Parsian (Persian Gulf), 27° 06' N, 53° 03' E, 12.06.2006, M. Moradmand.
Diagnosis- Shield with very broadly rounded rostral lobe; rostrum developed; ocular acicles subtriangular; left cheliped larger than right one; antennal acicles short, subquadrate; telson with median cleft.
Coloration- Shield basically light orange with pale green and brownish spots; pereiopods with orange or pale brown bands.
Habitat- Sandy-rocky shores.
Shells- *Nassarius arcularia.*
World distribution- Northwetern Indian Ocean: Sindh coast of Pakistan, Gulf of Oman, Persian Gulf (Siddiqui & Kazmi, 2004; Mirbagheri, 2010; Naderloo et al., 2012).

DISCUSSION

Apart from *Coenobita scaevola*, which was reported by Seyfabadi et al. (2013), the diogenid hermit crabs fauna of the Larak Island had not been studied so far. In the present work, seven species belonging to two families were found in five intertidal stations of the Larak Island.
The dominant species was *Clibanarius signatus*, which was found in all the five stations, including sandy-rocky shores throughout the year. *Diogenes avarus* was found only in the north-eastern station in three seasons. *Diogenes tirmiziae* was found only in the north-eastern station in the spring. *Areopaguristes perspicax* was observed at two stations in two seasons. *Dardanus tinctor* was found only in one station, eastern station in the winter. *Dardanus lagopodes* was recorded in one station, northern station in the spring. *Coenobita scaevola* was found at all the stations, except station 2 (northeast), in two seasons.
According to Hogarth (1988), the anomuran fauna of the Persian Gulf have the large similarity to anomuran fauna along the coast of Pakistan. According to Ochiai Coefficient, the hermit crabs fauna of the Larak Island have the similarity to the Hormuz Island. The hermit crab fauna of the Hormuz Strait are affected by the environmental parameters (especially currents and salinity) that are specific to this region which is located between the Persian Gulf and the Gulf of Oman.

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