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Catalog of ophiuroidea from southeastern coast of Iran (Northern parts of Oman sea)

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Introduction

Chabahar Bay is located in southeastern coast of Iran and the northern part of the Oman Sea in the geographic area of 25°22′ 47″N and 60°39′ 90″E. This bay with a variety of coverings, such as, muddy, stone, sandy and rocky, has provided possibility of life for different taxa, such as, shellfish, mollusks, echinoderm (Nikouyan and Savari, 1999; Ghanbarifardi and Malek, 2009; Yazdani *et al*., 2009; Sadeghi and Loghmani, 2010; Khaleghi and Owfi, 2011; Fazeli *et al*., 2013; Attaran *et al*., 2014). Echinoderms with around 7,000 species can be found at every ocean depth of the marine ecosystems (Mirzaei *et al*., 2019). Ophiuroids are relatively small echinoderms that all live in marine habitats, such as, sandy, rocky, stony, muddy, on sponge and corals (Barnes *et al*., 2001). Ophiuroids, with more than 2,000 species, are one of the largest group of echinodermata that are distributed in all marine environments (from polar to equatorial regions and from the intertidal to subtidal zones) (Pawson, 2007).

Materials and methods

Ophiuroidea specimens have been collected from four stations of intertidal and subtidal areas located in eastern part of Chabahar Bay by grab, hand and scuba diving from October 2013 to July 2014 (Fig. 1). Sampling stations were selected according to the accessibility to the beach, geomorphological varieties and ecological diversities. The samples were placed into plastic jars contain seawater and transferred to the zoology laboratory of Chabahar Maritime and Marine Sciences University. All ophiuroids specimens were examined under microscope and photographed by Cannon camera model C-DS and also stereo-microscope equipped with a Cannon camera model T4AL250 V. Species identification to the species level was carried out by using the following sources: Clark (1953); Clark and Rowe (1971); Clark and Courtman-Stock (1976);

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Cherbonnier and Guille (1978); Price (1983); and Pomory (2007). Subsequent to the laboratory procedures, the specimens were stored in 4% buffered formalin and some frizzed for further analysis.

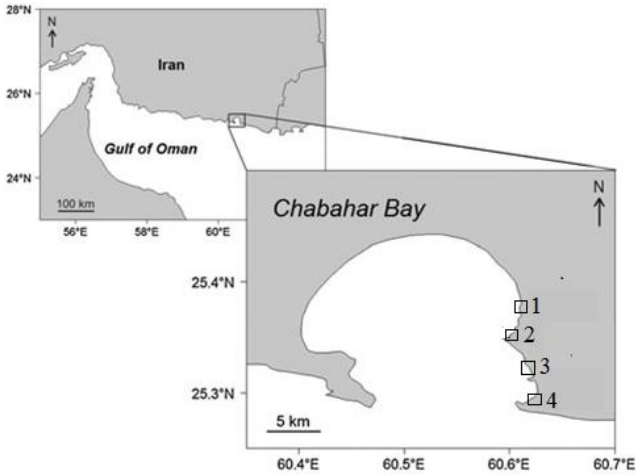

Figure 1: Geographical position of the study locations in Chabahar Bay; 1: Tis Port; 2: Lipar area; 3: Shahid Kalantary Port; 4: Shahid Beheshti Port.

Results and discussion

In the present study, 11 species of Brittle Star belonging to three families including Ophiotrichidae with nine species, Ophionereidae with one species and Amphiuridae with 1 species were identified from intertidal and subtidal zone of Chabahar Bay (Table 1).

Table 1: List of identified ophiuriodea species from Chabahar bay in different sites (1-Tis Port; 2: Lipar area; 3: Shahid Kalantary Port; 4: Shahid Beheshti Port, and S: Subtidal zone, I: Intertidal zone).

Ophiuriodea species	Sites	Figs no.	Comment and Substratum
Ophiotrichidae			
Ophiothela venusta (de Loriol, 1900)	2, 4; S	2-6	10 color pattern attached to the Gorgonians (class Anthozoa; Cnidaria)
Ophiothela tigris Lyman, 1871	2;S	7-8	2 color pattern ; attached to the Gorgonians
Ophiothela sp.	2; S	9	attached to the Gorgonians
Macrophiothrix sp_1.	3; S	10	between Gorgonians
Macrophiothrix sp_2.	1; I	11	stone
Macrophiothrix longipeda (Lamarck, 1816)	1; I	12	Under stone
Macrophiothrix elongata HL Clark, 1938	1; I	13	Under stone
Ophiothrix sp.	1; I	14	Under stone
Ophiothrix savignyi Müller and Troschel, 1842	1; I	15	Under stone
Ophioneredidae			
Ophionereis dubia Müller and Troschel, 1842	1; I	16	Under stone
Amphiuridae			
Amphipholis squamata (Delle Chiaje, 1829)	4; S	17	Collected by grab from sand

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Based on this research, seven brittle stars is recorded for the first time; *O. venusta* ،*O. tigris* ،*Ophiothela* sp. ، *Ophiothrix* sp. ،*Macrophiothrix* sp_1, *Macrophiothrix* sp_2. and *M. longipeda* from study locations. Morphology of identified species from Chabahar bay is shown in Figs. 2-17.

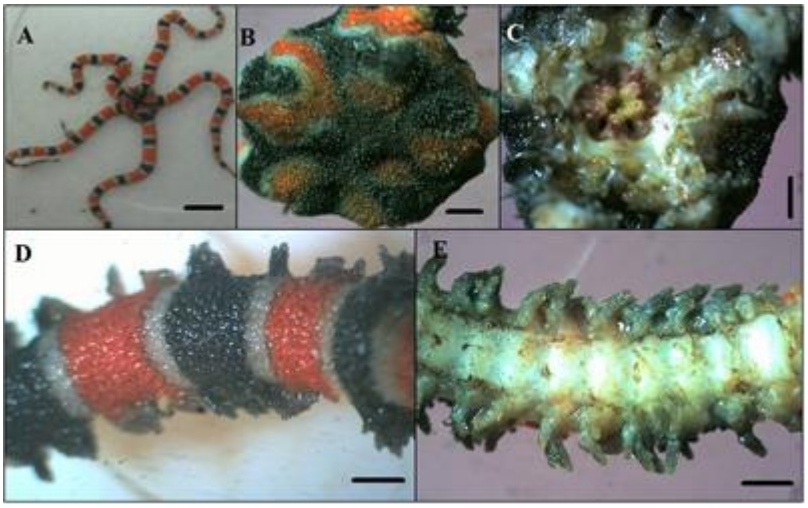

Figure 2: *Ophiothela venusta*; Chabahar Bay (North of Oman Sea, Iran). A: The full view B: dorsal view C: ventral view D: dorsal view of an arm E: ventral view of an arm with ventral arm plates. Scale bars = A 5 mm; B and E 400 µm.

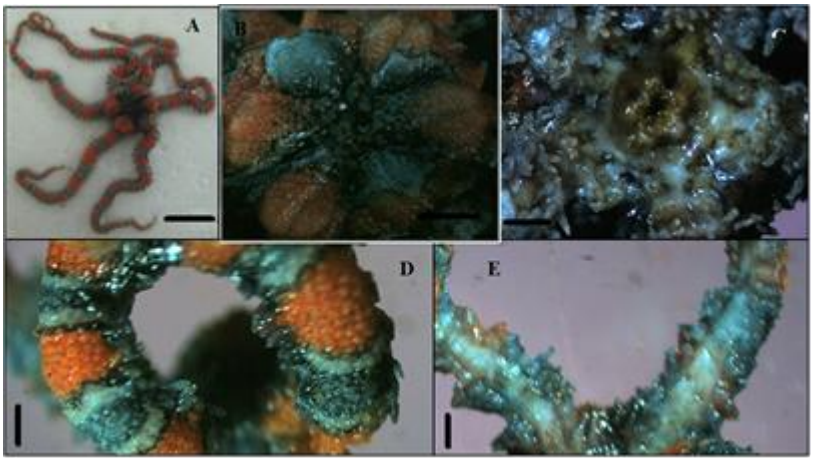

Figure 3: Ophiothela *venusta*, (showing color pattern), A: The full view with 6 arms B: dorsal view, detail of the radial shields C: ventral view D: dorsal view of an arm E: ventral view of an arm with ventral arm plates. Scale bars = A 5 mm; B 400 µm; C and E 200µm.

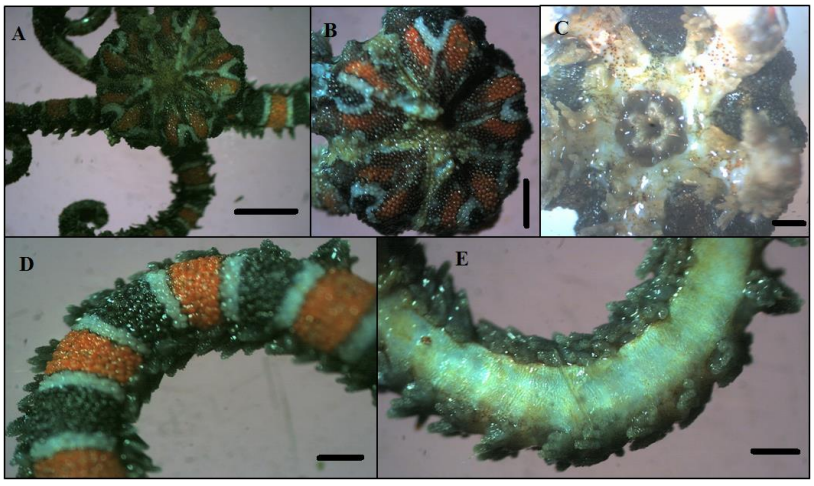

Figure 4: *Ophiothela venusta;* (showing color pattern), A: The full view B: dorsal view, detail of the radial shields C: ventral view D: dorsal view of an arm E: ventral view of an arm with ventral arm plates. Scale bars = A 2 mm; B and E 200µm

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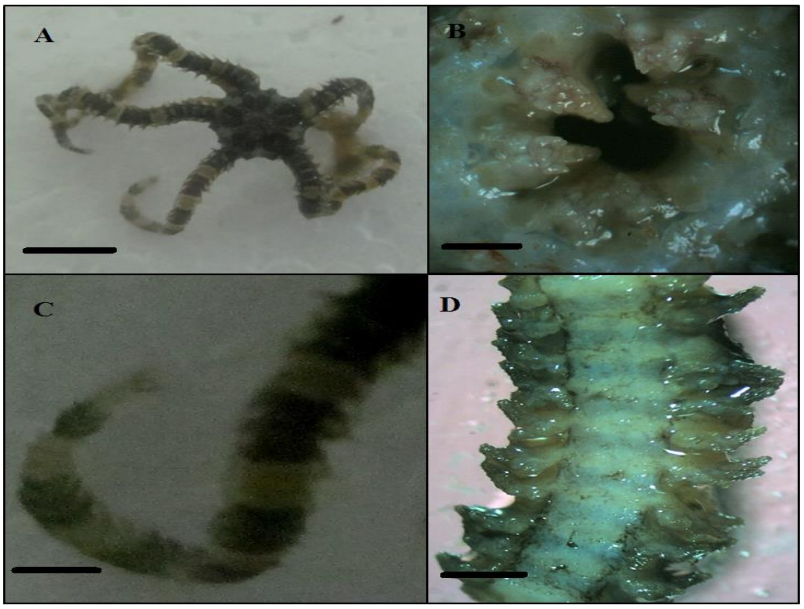

Figure 5: *Ophiothela venusta;* (showing color pattern), A: The full view B: ventral view C: dorsal view of an arm D: ventral view of an arm with ventral arm plates. Scale bars = A 5 mm; B and D 200µm.

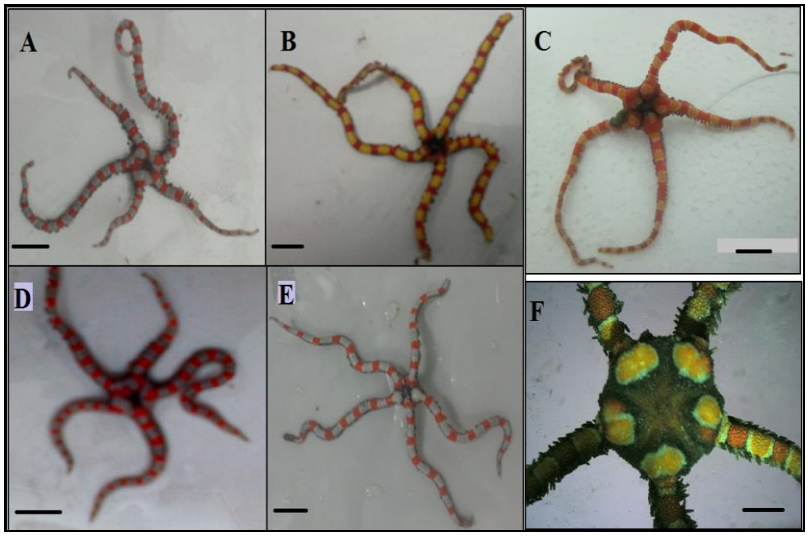

Figure 6: Other color patterns in *Ophiothela venusta* in Chabahar bay Scale Bars= A and E 5mm; F200µm

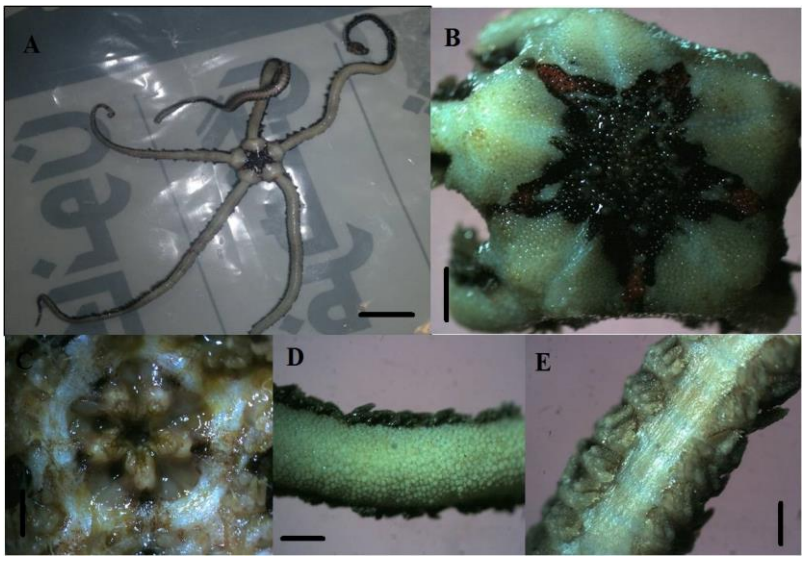

Figure 7: *Ophiothela tigris;* A: The full view B: dorsal view C: ventral view D: dorsal view of an arm E: ventral view of an arm with ventral arm plates. Scale bars = A 9 mm; B 600 µm; C and E 400 µm.

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Figure 8: *Ophiothela tigris* with dark color pattern. Scale bar= 9mm

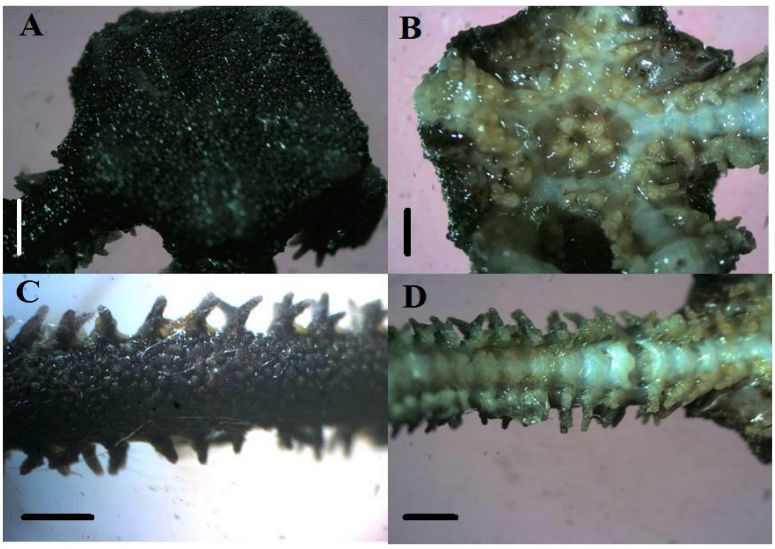

Figure 9: *Ophiothela* sp.; A: dorsal view, showing radial shields B: ventral view C: dorsal view of an arm D: ventral view of an arm with ventral arm plates. Scale bars = A 2mm; B 300 µm; C and D 200 µm.

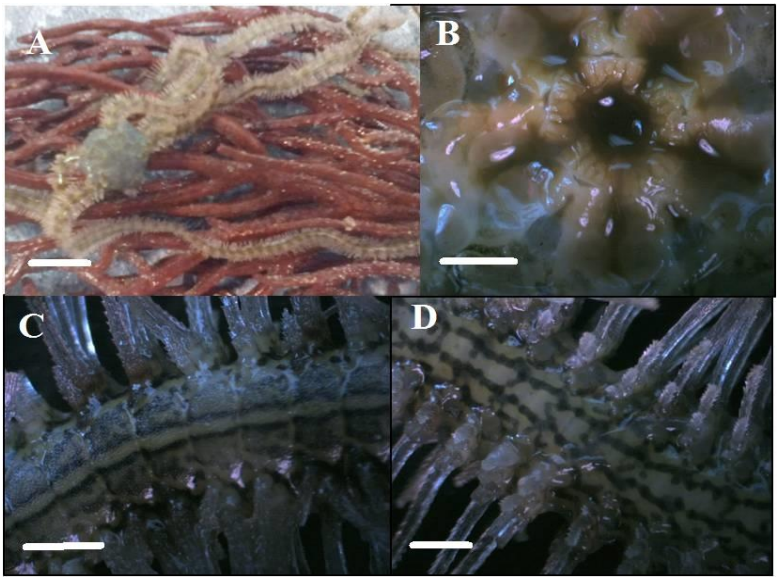

Figure10: *Macrophiothrix* sp1.; on *Gorgonian* A: dorsal view B: ventral view C: dorsal view of an arm with dorsal arm plates D: ventral view of an arm with ventral arm plates. Scale bar = A 20 mm; B and C 400µm ; D 200µm.

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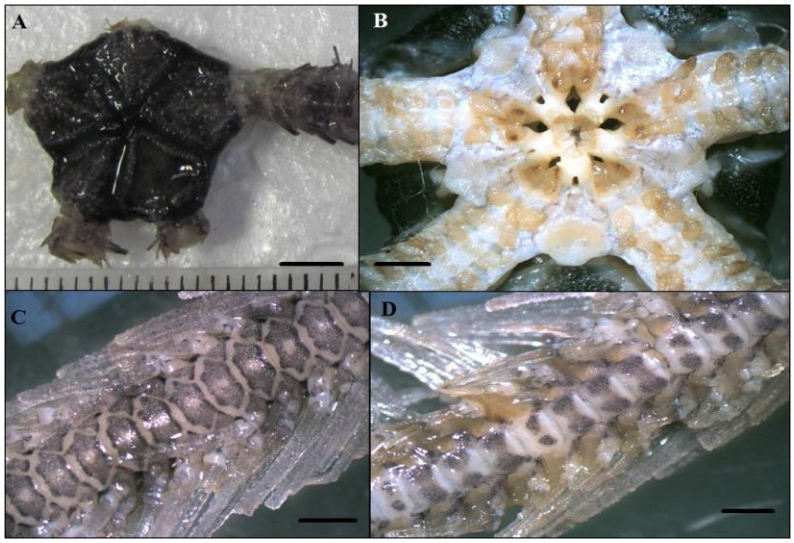

Figure11: *Macrophiothrix* sp2.; A: dorsal view B: ventral view C: dorsal view of an arm with dorsal arm plates D: ventral view of an arm with ventral arm plates. Scale bar = A 5 mm; B and D 400 µm.

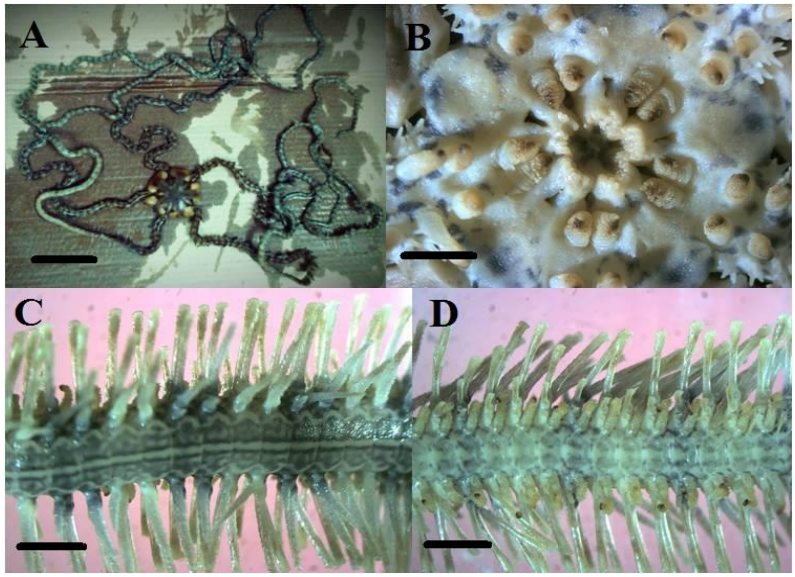

Figure 12: *Macrophiothrix longipeda*; A: dorsal view B: ventral view C: dorsal view of an arm with dorsal arm plates D: ventral view of an arm with ventral arm plates. Scale bar = A 2 cm; B 5 mm ; C and D 200 µm.

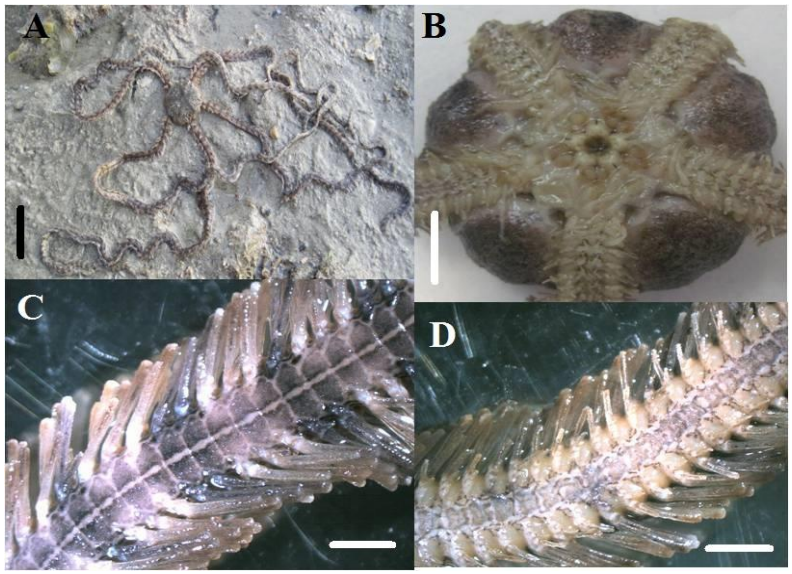

Figure 13: *Macrophiothrix elongate*; A: dorsal view, detail of the radial shield B: ventral view C: dorsal view of an arm with dorsal arm plates D: ventral view of an arm with ventral arm plates. Scale bar = A 20 mm; B 7 mm; C and D 400 µm.

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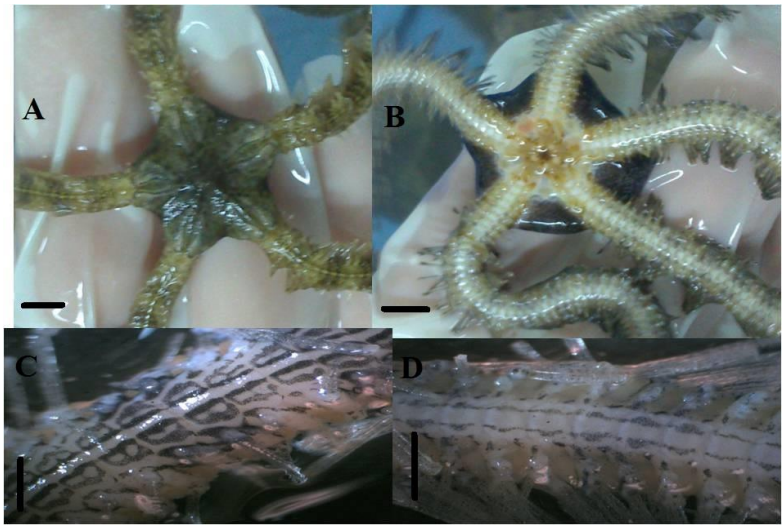

Figure 14: *Ophiothrix* sp.; A: dorsal view B: ventral view C: dorsal view of an arm with dorsal arm plates D: ventral view of an arm with ventral arm plates. Scale bar = A and B 5 mm; C and D 200 µm.

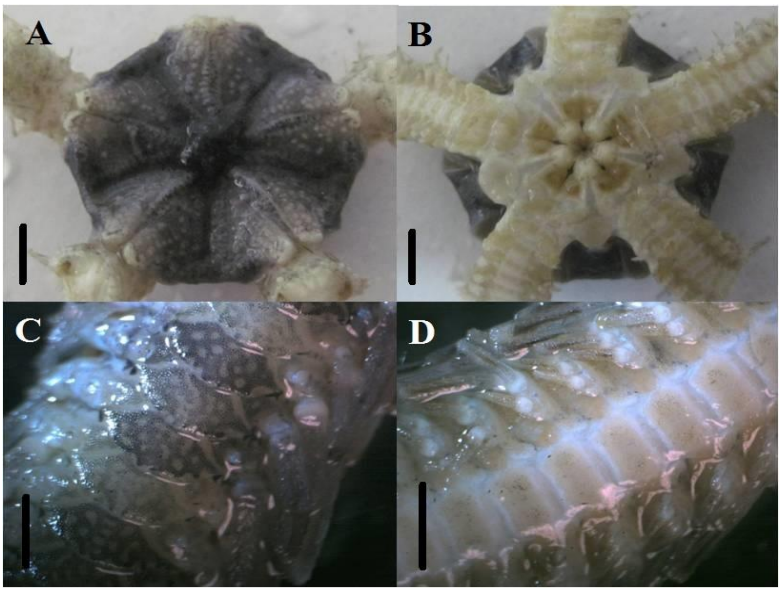

Figure 15: *Ophiothrix savigny*; A: dorsal view B: ventral view C: dorsal view of an arm with dorsal arm plates D: ventral view of an arm with ventral arm plates. Scale bar = A and B; 5 mm; C and D; 400 µm.

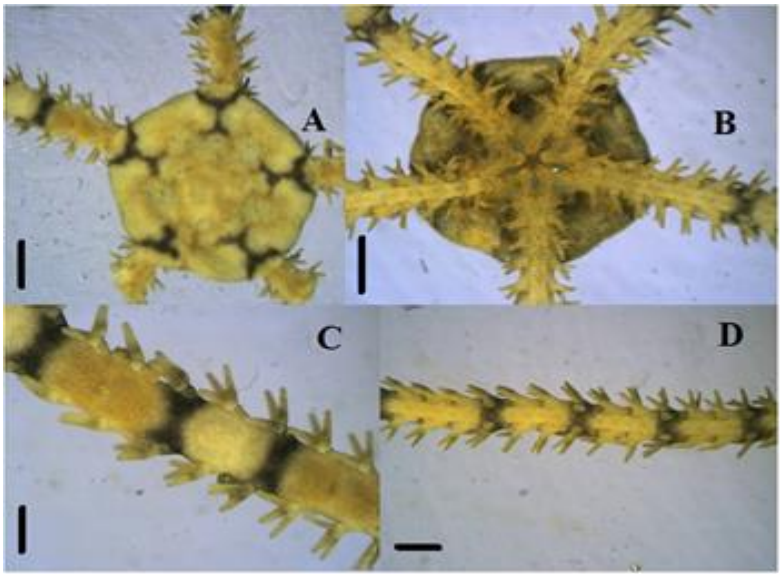

Figure16: *Ophionereis dubia*; A: dorsal view B: ventral view C: dorsal view of an arm with dorsal arm plates D: ventral view of an arm with ventral arm plates, tentacle scales and banded spines visible. Scale bars = A and B 1 mm; C 400 µm; D 250 µm

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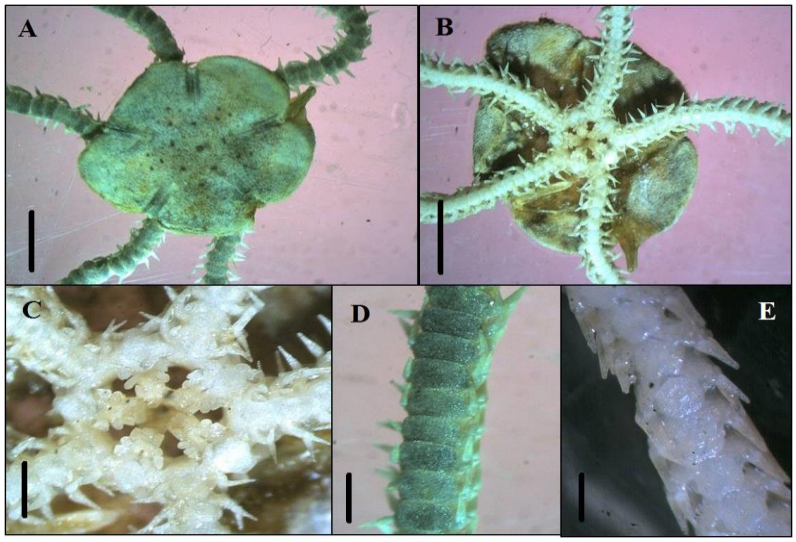

Figure 17: *Amphipholis squamata;* A: dorsal view, detail of the radial shields B: ventral view C: month frame D: dorsal view of an arm with dorsal arm plate E: ventral view of an arm with ventral arm plates. Scale bar = A-B 2 mm; C and E 100 µm.

Ophiuroids echinoderms are well distributed in the tropical regions. Price and Rowe (1996), reported 44 species of brittle stars from the Indian Ocean.

The identification of this species is not, generally, easy due to their similar morphological characteristics and their accurate identification based on morphological features need to be assessed in detail and carefully (Stöhr *et al*., 2012). In the present study 11 species of brittle star recorded from Chabahar Bay located in northern part of Oman Sea, which has been presented in this catalog. Of which *M. elongata* and *O. savignyi* reported for the first time by Khaleghi (2010), and subsequently by Khaleghi and Owfi (2011) from Chabahar Bay. Attaran-Fariman *et al*. (2014) recorded *O. dubia* from that area for the first time. *A. squamata* has also been documented from Chabahar Bay (Attaran-Fariman and Beygmoradi, 2016). *Ophiothrix* and *Macrophiothrix* genera occupy dominantly the shallow habitats of the tropical zones (Stöhr *et al*., 2012). Price (1981) encountered *O. venusta* between Gorgonians of Persian Gulf. in the present study this species also found on the gorginans (coral; order: Alcyonacea) bed in sutida zones of hotel Lipar and Shahid Behashti stations. This is the first record of *O. venusta* for this location. In the Chabahar Bay *Ophiothela* species were found with multiple color patterns and morphological variety. Generally *O. venusta* has been reported with 5 arms, however, is rarely observed with 6 arms (Price, 1981). In this study, a specimen was found with 6-arms (Fig. 3A) from the subtidal zone of hotel Lipar (site 2). Since all the species belonging to the genus *Ophiothela* recorded from Chabahar Bay (during the present study) were collected from gorgonians substratum, it seems that gorgonians could be an appropriate and sustainable habitat for them. Due to the position of Chabahar Bay along the Oman Sea and open waters of the Indian Ocean and also presence of the variety of biological substrates, such as sandy,

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muddy, stone, rocky, coral and spongy for distribution of Ophiuroids, findings a variety of ophiuroids in Chabahar Bay would not be so surprising and unexpected.

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