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The first report of *Amphipholis squamata* (Delle Chiaje, 1829) (Echinodermata: Ophiuroidea) from Chabahar Bay – northern Oman Sea

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Introduction

Amphipholis squamata is an important Ophiuroid species belonging to the family Amphiuridae which is widely used in biotechnological and molecular studies. It is a cosmopolitan species and capable to inhabit a wide variety of habitats except the polar regions, from subtidal zone to the depth of 2000 meters (Hendler, 1995). According to Fell (1962) its widespread distribution all over the world is the result of its costal migration. *A. squamata* is characterized by its small body size, hermaphroditic reproduction, lack of larval phase, (Nisolle, 1990) and brood protection properties. It is an omnivorous species filtering sediment food particles and planktons (Emson and Whitfield, 1989). Variety in coloration patterns are reported among the cognates of this species (Deheyn and Jangoux, 1999). Also, this species is one of the most important echinoderms in terms of bioluminescence (Deheyn *et al*., 1997). Bioluminescence echinoderms were identified about two centuries ago (Viviani, 1805), consisting 4 out of 5 class of Echinodermata (Herring, 1987). The only class without bioluminescence ability is Echinoidea (Herring, 1987).

In the present study, *Amphipholis squamata* was reported for the first time from the subtidal zone of Chabahar Bay in northern part of the Oman Sea. This paper also provides information about the taxonomy and morphology of this group of aquatic taxa dwelling in the marine waters of the Iranian coasts of Chabahar Bay and the Oman Sea.

Materials and methods

This study was carried out in March 2014. Sediment samples were collected by grab from the subtidal zone at Shahid Beheshti Port in Chabahar Bay (Fig. 1). Brittle stars was sorted in situ and put in a jar including sea water. Specimens were transferred to Laboratory of Chabahar Maritime University and living specimens were maintained in the well aerated aquariums. Dimensions, radial shields, form and color of disc and arms' length were measured in all of the specimens. Photographs were taken by streo microscope (model C-DS) equipped with the camera (model T4AL250 V (21 V 150 W)). Identification keys used in this study were from Clark and Rowe (1971); Price (1983) and Pomory (2007). Specimens (n=3) are currently fixed and preserved in 4% formaline and maintained in the same laboratory and are ready for scientific demands.

Results and discussion

A. squamata was recorded for the first time during this study.

Systematic

Order OPHIURIDA Müller and Troschel, 1840

Suborder OPHIURINA Müller and Troschel, 1840

Family AMPHIURIDAE Ljungman, 1867

Genus *Amphipholis* Ljungman, 1866

Amphipholis squamata (DelleChiaje, 1829)

Redescription

Generally trunk brownish gray carrying small circular disk with black speckles (ca. 5 mm) and arms (6 cm). Dorsally, disk covered by small and irregular scales overlapping partially. Radial shields with elongated, thin, connective, rounded outer margins and straight inner margin (Fig. 2A). Coloration and coverage in ventral part similar to dorsal side. Bursa slits elongated. Oral shield pentagonal with an enlarged distal margin and convex, somewhat longer than wide. Dorsal shield large and united proximally. Two oral papilla present on each corner of jaw. infradental papillae present in pair (Fig. 2B). Dorsal arm plate oval with smooth distal margin (Fig. 2C). Ventral arm plate pentagonal (Fig. 2D). 3arm spines conic, transparent, erected, serrated at tip, 2 small tentacle scales, thin and elongated (Fig. 2E).

Ophiuroidea have a widespread distribution in the tropics. Totally 651 Echinodermata species have been reported from the Indian Ocean so far, 152 of which are belonging to Ophiuroidea. Chabahar Bay includes a variety of substrate such as, sandy, muddy and rocks. This geomorphological variation makes this region qulified to be habitable for various groups of animals (Sharifi, 2004).

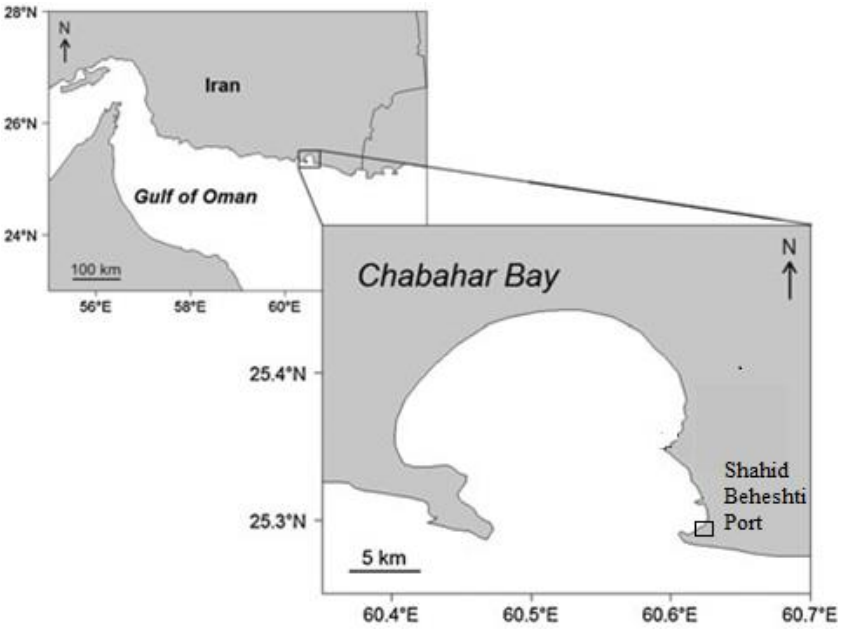

Figure 1: Geographical location of the study area at Shahid Beheshti Port in Chabahar Bay, and its position at the Iranian coast of the Oman Sea.

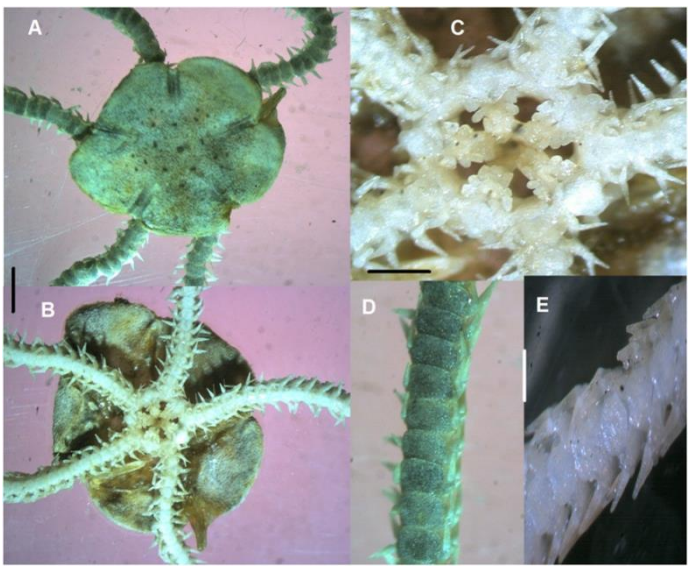

Figure 2: Species of the family Amphiuridae. *Amphipholis squamata* A dorsal view, detail of the radial shields B ventral view C jaw D dorsal view of the arms E ventral view of the arms. Scale bar = A and B 2 mm; C, D and E 100 µm.

However, the Ophiuroid species which were reported from this area so far are: *Macrophiothrix elongata* (H.L. Clark, 1938) and *Ophiothrix savigny* (Müller and Troschel, 1842) belonging to family Ophiotrichidae (Ljungman, 1867) (Khaleghi and Owfi, 2011) and *Ophionereis dubia* (Müller and Troschel, 1842) belonging to the family Ophionereididae Ljungman, 1867 (Attaran-Fariman *et al*., 2014). During the present study, *A. squamata* was reported for the first time. Specimens were collected from the depth of 10 m with a muddy substrate. *A. squamata* have a diversity of genetic, color and bioluminiscence features through the world (Sponer *et al*., 1999). For instance, 11 differnet color patterns of this species were reported till now (Mallefet and Jangoux, 2000). Therefore, variation in color and brightness could proof the presence of correlation between polychromatism and genetics of native populations. Because of its brightening feature, *A. squamata* had previously been nominated as *Asterias noctiluca* (Viviani, 1805). Presence of dark and light pigments on the body give it a noctilucent feature while bioluminiscence is controled by nervous system (Deheyn *et al*., 1994). Bioluminiscence mechanism in these taxa is utilized for avoiding predation and also, scaring the predators (Grober, 1990). Tortonese (1932) showed the presence of various coloration patterns in this species. Orange, beige, dark brown, gray, black polka dots are the colores that were reported between vareious populations of this species collected from inter tidal zone at 1971 by Binaux and Bocquet. Whereas, our species was brownish gray with polka dots. However, Clark (1987) proposed and fixed the name of this species as *Amphipholis squamata* instead of its previous name, *Ophiura elegans* (Leach, 1815). *A. squamata* is a very complicating species with very divergent mitochondrial lineages (Sponer, 2002). Unpublished data E. Boissinon mitochondrial DNA successive determination show that this species has a common lineage in equatorial regions (Stohr *et al*., 2008). This species has a spherical disc with 1.08 – 2.47 mm diameter. The disc is covered with enlarged scales irregularly. In some cases the central plate is appeared. The length of shield is longer than its width, connective with rounded external edge and smooth internal edge. Spaces between radials are covered by small scales. Bursa slits elongated and vast. Oral shield fan-shaped with an enlarged and convex distal margin, its length is longer than width. Dorsal shield large, standing in equal distance from its proximal edge. Two oral papilla with a long distal part present on both apical sides of jaw. Pair of infradental papilla is present as well. Ventral arm plate pentagonal, elongated with 3 conical straight arm spine and denticulate apex. There are 2 small, thin and elongated tentacle scale (Gondim *et al*., 2013). Our specimen is small with spherical disc 5mm in diameter. The

lengths of arms are as long as 6 times of the disc diameter bearing some short spines. The disc is covered by small scales while radial shields are visible. There are a colored area with different colors (such as, gray, white and Bluish gray) in different individuals. Present type has Gray polka dots. This species has recently been reported by Pomory (2007) with 5 mm disc diameter with arms as long as 3-4 times of disc diameter. However, we measured this rate 6 times as long as disc's diameter. Dorsal plate of arm is lunate with smooth distal edge. Radial shield is long, thin and is half time of radius of disc (Pomory, 2007). Although in some references the diameter of disc was reported longer than 5 mm its average length is 0.7 – 3 mm (Mortensen, 1927). Radial shields are small and connected to each other. Big species has 2 tentacle scales on proximal extremity of arm while small species normally has only 1 (Bartsch, 2008). Finding of this species from Chabahar Bay for the first time is not surprising because of its wide distribution through the world. According to the present literatures related to morphology and identification of *A. squamata* from different area our species demonstrates very close features with them. Therefore, due to the abtained results from this study and previously published data it would be concluded that this species has a invariable and monotonic morphological features all ove the world (Sponer *et al*., 1999).

A. squamata dwells in various substrates such as, under stones, btween alges and briozoas, rock pools, sandy bottom (Rodrigues *et al*., 2011) and also sea grasses, mangrove, estuaries and water with high salinity (Gondium *et al.*, 2013). It is mostly in relation with Corallina alge and briozoas (Fish and Fish, 2011). This cosmopolitan species could be found from intertidal zone to 1300 m depth of sea (Rodrigues *et al*., 2011).

A. squamata is distributed all over the world except to arctic and antarctic regions. This species has already been reported from west Alantic, United States of America, Mexico, Netherlands Antilles, Belize, Costa Rica, Panama, Colombia, Brazil, Uruguay, and Argentina's Santa Cruz Province (Benavides-Serrato *et al.*, 2011), South Carolina, Florida, Islands of South Florida, Texas, Antilles, Belize, Panama, Brazil (Alvarado *et al*., 2008), Persian Gulf (Price, 1983), eastern Atlantic along the periphery of Europe, the Mediterranean, the west coast of Africa, the eastern coast of South Africa and Madagascar (Alva and Vadon, 1989). This is the first report of *A. squamata* species from Chabahar Bay located at the North part of the Oman Sea.

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