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First Record of Siliceous and Calcareous Sponges from Larak Island, Persian Gulf - Iran

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Abstract: The Persian Gulf is the good bed for aquatic animals. The sponges play a critical role in marine ecosystems. But, there is little study to identify of sponges in Persian Gulf. This study was conducted to explore siliceous and calcareous sponge's variety in Larak Island, Persian Gulf-Iran. The samples were collected by scuba diving in January 2010 from tidal and subtidal habitats at depths between 0-20 m from Larak Island, located in the Hormoz strait mouth. The identification of samples was done based on scanning optical microscope on skeletal slides, dissociated calcareous and siliceous spicule mounts as well as tissue samples by the keys of Sponguide, John N. A. Hooper. The results have shown that the species in the studied area consist of *Haliclona* sp. (Family Chalinidae), *Agelas* sp. (Family Agelasidae), *Ircinia* sp. (Family Ircinidae) and *Niphates* sp. (Family Niphatidae). These are the first record of sponges from Larak Island in the Persian Gulf of Iran.

Key words: Sponge · Calcareous Spicule · Siliceous Spicule · Larak Island · Persian Gulf

INTRODUCTION

Marine fouling communities are typically highly diverse which about 100 taxa has been recognized [1, 2]. Sponges are a common group of marine benthos communities in many parts of the world. They are evolutionarily ancient metazoans that have existed for 700-800 million years [3]. Sponges are abundant in the tropical oceans; however, occur in temperate waters and even in freshwater [2]. They are simple multi-cellular invertebrates, without any tissues or organ, filter feeders, having numerous tiny pores on their surface, which allow water to enter and circulate through a series of canals where microorganisms and organic particles are filtered out and eaten [4, 5].

The phylum Porifera is subdivided in three classes; Calcarea, Hexactinellida and Demospongiae. The Demospongiae contain about 95% of living species with a described fauna already consisting of about 4500-5000 species and it estimated that total extant fauna be between 14000-15000 species worldwide. Within this class there are 3 subclasses, 13 orders (1 dubious), 71 families and 1005 nominal genera, although only 507 genera are presently considered to be valid. A total of 481 genera are marine species and 26 of them are freshwater species [6]. The number of recognized valid genera varies between different authors and the whole classification is not stable yet.

The Persian Gulf is an extension of the Indian Ocean. It is the home of many aquatic species. The sponges are the most primitive of multicellar animals. The sponges play an important role in marine ecosystems by comprise a significant proportion of the benthos biomass, forming complex structures on the sea floor, provide habitat for many fish and invertebrate species. But there is little study on sponge's species in the Persian Gulf. It seems

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that an essential need exist to document the distribution of sponge biodiversity to assist in management of sponge habitat. Therefore, this study was accomplished to investigate siliceous and calcareous sponges in Larak Island in the Persian Gulf of Iran.

MATERIALS AND METHODS

Sampling and Identification: The samples were collected by scuba diving from tidal and subtidal habitats at depths between 0-20 m from Larak Island, located in the Hormoz strait mouth on the Persian Gulf. The geographical situation of Larak Island was shown at Fig 1. Then after the sponges were frozen and transferred to the laboratory as soon as possible. Taxonomic designation was done based on scanning optical microscope, skeletal slides, dissociated spicule mounts and tissue samples.

Calcareous and Siliceous Spicules: Small fragments of tissue, both the surface and deeper parts of the sponge, were placed in Erlenmeyer flasks. A small quantity of active bleach (sodium hypochlorite) was added and after a short period the organic components dissolve and only the mineral skeleton was left. The bleach has been carefully diluted and tissues was eventually washed out of several times, was firstly replaced with water and then with ethanol. Finally, clean spicule suspensions were aspirated and pipetted onto a glass slide, the ethanol allowed to evaporate and mounted. The suspension should be left to settle for about 10-15 minutes during each stage of pipette wash to avoid accidental decanting of smaller spicules [6].

Fragments of sponges were placed in flasks, directly on glass slides. Several drops of acid were placed on the fragments, gently heated over a flame until bubbling and repeated until all organic matter was digested. The heat-accelerated digestion process produces various oxides, including nitrous oxide and it was cautioned that these were noxious. Also, low heat is preferable due to acid evaporation. Then, mounted was immediately done without washing when samples were dry and cool. Siliceous spicules are bonded directly onto the substrate by this technique, which makes it be useful for both light and scanning electron microscopy [6].

Tissue Preparations: Sponges has been frozen immediately upon collection, which to a certain extent fixes the color, then they put in 5% concentration of buffered formaldehyde for 24 hours. Then, they put in ethanol for 5 hours and scanned with optical microscope [6].

RESULTS

The sponge species identification was performed by using morphologies (color, shape and size), spicules and tissues indices by key of Sponguide, John N. A. Hooper [6] as the bellow photos in this study. The first sample was thickly encrusting with blue color, it was soft and easily torn (Fig. 2). Its distribution was 5, 10 and 15 m depths. The siliceous spicules were identified, they were monoaxon and the length of spicules was varied between 15-90 µm (Fig. 3, all figure were Wet Mount, 1000 × Magnification, Optical Microscope).

Fig. 1: Geographical situation of Larak Island (Copyright by Google Earth, 2012)

Fig. 2*: Haliclona.* sp.

Fig. 3: Siliceous spicules of *Haliclona* sp.

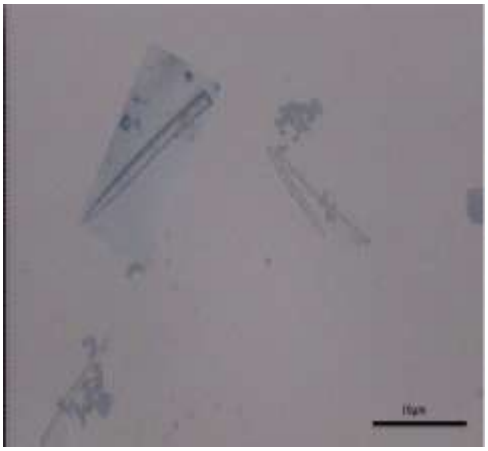

Fig. 4: Calcareous spicules of *Haliclona* sp.

Moreover, the calcareous spicules were identified, the megascleres were monoaxon, rhabd and the length was varied between 10-25 µm (Fig. 4).

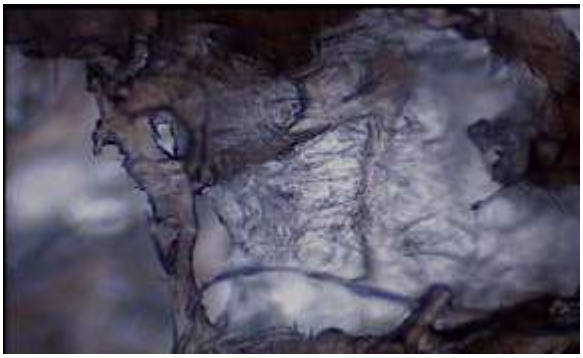

Fig. 5: Cellular tissue of *Haliclona* sp.

Fig. 6: *Agelas* sp.

The Keys for Species of the *Haliclona* sp

Class Demospongiae: Mineral skeleton composed of silica spicules and/or spongin fibres; *Order Haplosclerida*: Microscleres may be absent or include centrangulate sigmas, toxas or microxeas, megascleres diactinal usually producing well-formed structure (e.g. isodictyal-reticulate); *Family Chalinidae*: Microscleres, if present, include only sigmas or toxas; parenchymella larvae are incubated and are completely and uniformly ciliated or have a bare posterior cap fringed by longer cilia; and finally *Haliclona* sp.: The color frequently is blue to partial or green, uniaxes macrospicules that the length of them are sometimes 17 mm, with sigma microspicules [6]. The example of cellular tissue of *Haliclona* sp. is shown at Fig. 5.

The second sample was compressed and has fan shape (Fig. 6). The width, length and thickness were 7 -55, 12- 75 and 0.5 to 3 cm, respectively. The color was brown and the attached on the rocky surface. The calcareous spicules were diagnosed, the megascleres were monoaxon, rhabd, (Fig. 7) and the length was varied

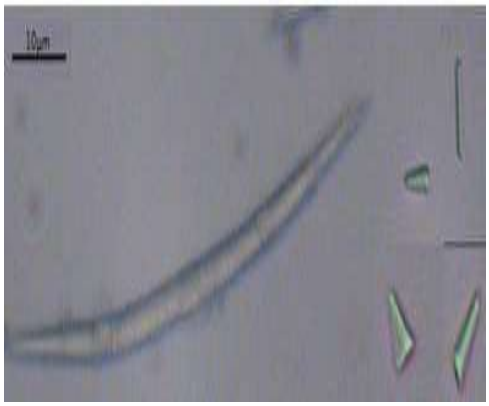

Fig. 7: Calcareous spicules of *Agelas* sp.

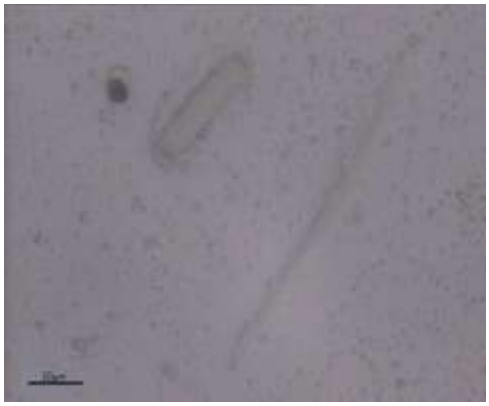

Fig. 8: Siliceous spicules of *Agelas* sp.

between 5-90 µm. Moreover, the siliceous spicules were recognized. They were monoaxon but in different shapes, rhabd and spiny spicules. The length of spiny spicules varied between 15-80 µm and rhabd spicules varied 20-90 µm (Fig. 8).

The Keys for Species of the *Agelas* sp.

Class Demospongiae: Mineral skeleton composed of silica spicules and/or spongin fibers; *Order Agelasida*: Main skeleton composed of well developed spongin fibers cored and/or echinated by short styles or oxeas with verticillate spines; *Family Agelasidae*: The color frequently orange or red, texture extremely tough but compressible reflecting high ratio of spongin fibers to spicule; skeletal structure homogeneous, reticulate, with well developed system of large spongin fibers often containing no primary coring spicules but echinated by unique styles with verticillate spines; and finally *Agelas* sp.: The siliceous and calacareous macrospicules with variety forms that they are flat or globular forms in some vertexes. The example of cellular tissue of *Agelas sp.* is shown at Fig. 9.

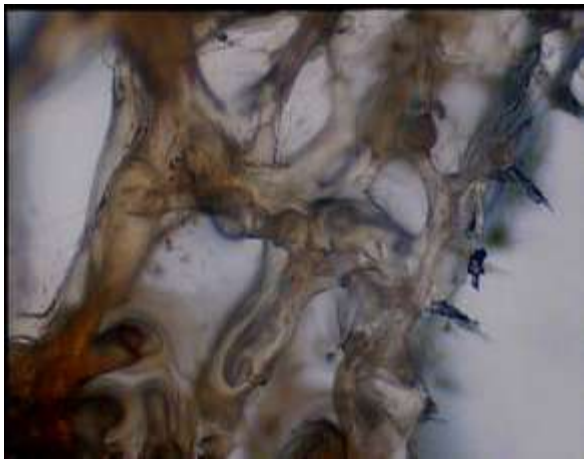

Fig. 9: Cellular tissue of *Agelas* sp.

Fig. 10: *Ircinia* sp.

The third sample was massive in shape and the color was yellow- brown (Fig 10). The calcareous spicules were recognized. The megascleres were monoaxon, rhabd (Fig. 11). The length varied between 20-75 µm. The siliceous spicules were identified but they were so tiny and low, they were monoaxon with length of 2-8 µm (Fig. 12). The distribution was on 15- 20 m.

The Keys for Species of the *Ircinia* sp.

Class Demospongiae: Mineral skeleton composed of silica spicules and/or spongin fibers; *Order Dictyoceratida*: Lacking mineral skeleton completely (although detritus and contaminating spicules often occur, confusing these with poecilosclerids), with well developed relatively homogeneous spongin fibers forming reticulate skeleton, typically with 2 or 3 different sized networks, consistency not collagenous;

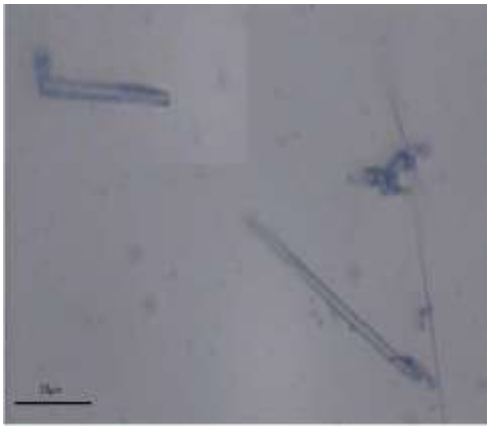

Fig. 11: Calcareous spicules of *Ircinia* sp.

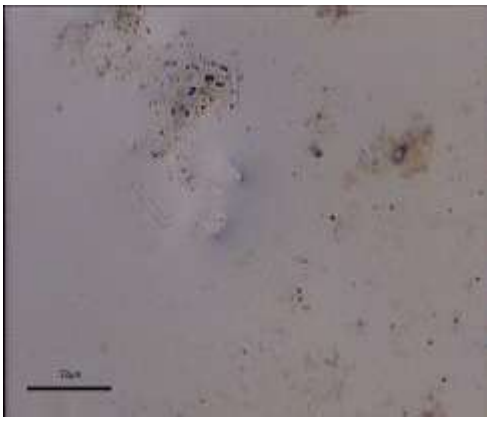

Fig. 12:Siliceous spicules of *Ircinia* sp.

Suborder Microcionina: Poecilosclerida with terminally microspined ectosomal megascleres and up to 5 categories of structural megascleres, most frequently monactinal. Microscleres are palmate chelae, diverse toxas, but sigmas never present; *Family Ircinidae*: Massive, lobate, spherical, digitate, cup shaped, encrusting growth forms, always with a conulose surface, except in forms with an organized superficial sand crust where conules may be reduced to mammiform protruberances, skeleton irregularly arranged, presence of filaments makes the sponge very tough, almost impossible to tear; and finally *Ircinia* sp.*:* A sponge which is rubbery, compressible but difficult to tear or cut may contain no or few spicules but a well developed spongin fibers system.

The forth sample was branching in shape and the color was dark brown (Fig. 13). The calcareous spicules were not identified, but the siliceous spicules were recognized. They were so gigantic and high. Also, they were monoaxon with length of 15-125 µm (Fig. 14). The distribution was on 10- 20 m.

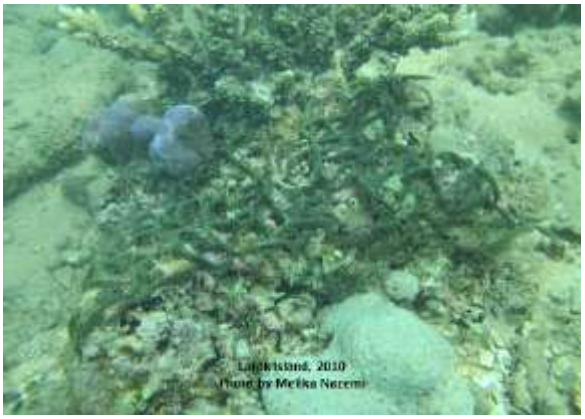

Fig. 13*: Niphates* sp.

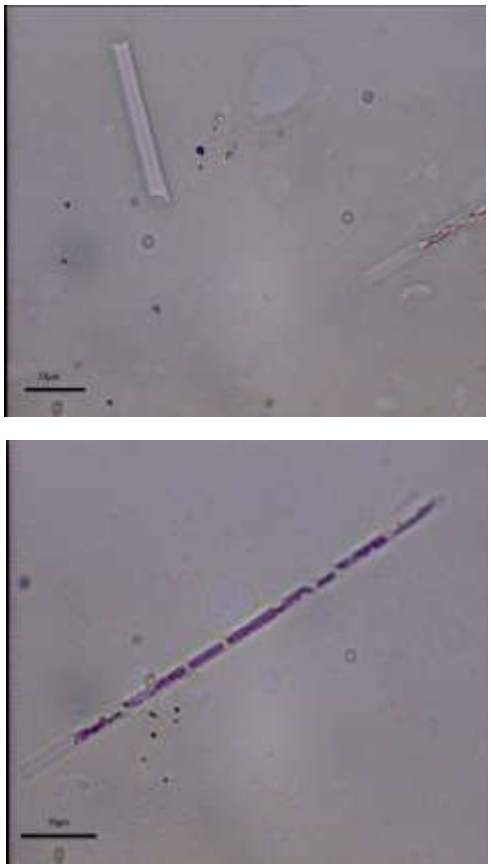

Fig. 14: Siliceous spicules of *Niphates* sp.

The Keys for Species of the *Niphates* sp.

Class Demospongiae: Mineral skeleton composed of silica spicules and/or spongin fibers; *Order Haplosclerida*: Microscleres may be absent or include centrangulate sigmas, toxas or microxeas, megascleres diactinal usually producing well-formed structure; *Family Ircinidae*: Encrusting, massive, vase-shaped and

Fig. 15: Cellular tissue of *Niphates* sp.

branching growth forms, often with chimney-like oscular processes; erect spicule brushes characteristically at the surface; choanosomal skeleton articulation of ascending and transverse-connecting spongin fibers, cored by multispicular tracts of oxeas; interstitial spicules also common; microscleres, if present, are sigmas or microxeas and finally *Niphates sp.:* Rough, conulose surface; spongin dominant; microscleres rare sigmas, siliceous megascleres. The example of cellular tissue of *Niphates* sp. is shown at Fig.15.

DISCUSSION

Persian Gulf is a rich source of marine organisms. The ecosystem of this area has good quality for living sponges. The sponges are an important component of benthic communities. Sponges are important members of coral reef ecosystems [7]. They filter water, cycle nutrients and provide a home to numerous cryptic organisms [4, 5]. Based on our knowledge the identification of sponges in Persian Gulf- Iran is the first time in this research. The recognition and classification of sponges was done based on various indices. Sponge morphology, special color and shape have been shown to be a useful qualitative estimate of sponge species [8].

Identification of sponges is not always straight forward as one species because even individuals of the same species can differ in their appearance and they can exist in various forms, [9]. Therefore, the best way to identify sponges is using differences between skeletal structures of them, which is comprised of spicules, they are scattered throughout the sponge's body [6].

Taxonomic designation was done based on scanning optical microscope, skeletal slides, dissociated spicule mounts and tissue samples in this investigate. The sponge species identification was performed by using morphologies (color, shape and size), spicules and tissues indices by key of Sponguide, John. N. A. Hooper [6]. Identified sponges in Larak Island was found to be belong to four species which be owned to Demospongia in this paper. The results have indicated that the species was consisting of *Haliclona* sp. (Family Chalinidae), *Agelas* sp. (Family Agelasidae), *Ircinia* sp. (Family Ircinidae) and *Niphates* sp. (Family Niphatidae). It must be noted that continuous research should be done in the other island because of important in ecology and ecochemistry [7]. Moreover, there are many semi-windows to open related to use of sponges secondary metabolites to drug applications [10]. The largest number of secondary metabolites isolated since 1965 have come from sponges [11] between marine organisms. Thus, it recommended that identification of sponges be continued because of the first step to discover drugs.

CONCLUSION

These are the first record of sponges from Larak Island in the Persian Gulf of Iran. The four species of sponges were recognized. The species was consisting of *Haliclona* sp., *Agelas* sp., *Ircinia* sp. and *Niphates* sp. The further investigations are suggested to the identification of sponges in other island and aquaculture ecosystem.

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