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Marine Sponge (Porifera: Demospongiae) *Liosina paradoxa* Thiele, 1899 from Sandspit backwater mangroves at Karachi coast, Pakistan

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Marine sponge *Liosina paradoxa* was recently collected from pneumatophore of *Avicennia marina* at Sandspit backwater (66°54'25" E, 24°49'20" N), Karachi coast in May 2015. Identification of specimen was based on the structure of siliceous spicules scattered irregularly in mesohyl observed under light microscope and scanning electron microscope. Spicules are megascleres, entirely smooth, strongyle (length = 310-451 ± 59.65 µm, width = 5-8 ± 1.8 µm), microscleres absent. The result has been shown that the species is *Liosina paradoxa* (Family Dictyonellidae) first time reported from coastal area of Pakistan.

[**Keywords*:*** Marine sponge; mangroves; Demospongiae; Bubarida; Dictyonellidae; *Liosina paradoxa*]

Introduction

Mangroves are salt tolerant vegetation that inhabits tropical and sub-tropical coastal regions and are considered among the world's most productive ecosystems[1], which provide food and shelter for a wide variety of organisms[2]. Fungi, algal (micro and macro) communities and many other invertebrates (sponges, polychaetes, bryozoans, barnacles and molluscs) are the most abundant epibionts of mangrove habitats[3-8]. Both sponges and mangrove are beneficial to each other and showed facultative mutualism with mangroves[2,9,10].

Demospongiae Sollas[11] is the largest class of phylum Porifera which is distinguished by siliceous skeletal composition and spongin fibers[12-16]. On the basis of reproductive features and larval forms it is divided into three sub-classes i.e. Heteroscleromorpha, Keratosa and Verongimorpha[14,17,18].

Within Heteroscleromorpha, order Bubarida has some incorporated characteristics such as, sinuous, flexuous or vermicular type of spicules (monactines and diactines) which may confine to axial or basal skeleton of sponges. Three families (Bubaridae, Desmanthidae and Dictyonellidae) and about 188 species retained in order Bubarida[18]. Family Dictyonellidae has some distinguishing features, as its fleshy surface lacks surface spicules but choanosomal skeleton and spicules directed towards the surface; spicules are mostly styles, strongyles, oxeas and its derivatives[16]. Most species of Dictyonellidae found in warm waters. The following ten genera have been included in this family; *Liosina*, *Acanthella*, *Rhaphoxya*, *Lipastrotethya*, *Tethyspira*, *Scopalina*, *Dictyonella*, *Phakettia*, *Svenzea* and *Stylissa*[16,18,19]. *Liosina* is massive, encrusting sponge with muddy appearance. Spicules may scatter irregularly near the surface in the form of bundles within spongin, mostly monactines and diactines[13,14].

Pakistan has 1050 km of coastline, which include 250 km of Sindh coastal region[20], where the Indus delta covers an area of 86,727 hectares dominated by black mangrove *Avicennia marina*. Sandspit backwater lies at the southwest of Karachi coast (Figure 1). In this area fewer studies have been done on mangroves biology, growth and ecology and its associated communities[1,9]. There is no data available on any aspect of sponge from Pakistan therefore, the objective of the present study is to focus on the sponge fauna associated with mangrove (*Avicennia marina*). This is the first report on the presence of sponge from Karachi coast. Further study is in process to highlight their importance in several aspects.

Materials and Methods

Sponge samples were collected from pneumatophores of *Avicennia marina* at Sandspit backwater (66°54'25" E, 24°49'20" N), photographed *in-situ* for habitat characterization, washed thoroughly

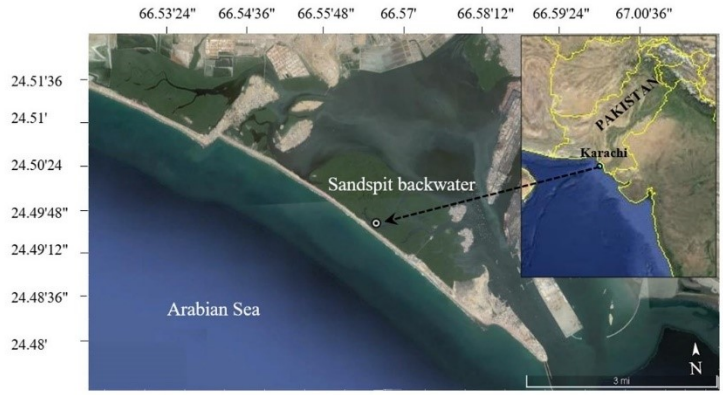

Fig. 1 —Map of Pakistan shows the collection site. Sandspit, Karachi (Google Earth Pro: 7.1.4.1529)

to remove all exotic substance and debris, fixed in 4% buffered formalin and transferred in 85% alcohol after 24 hours for preservation and identification.

Small fragments from the ectosomal and inner part of the preserved specimen were bleached for few minutes in 5% sodium hypochlorite (commercial bleach), washed with Milli-Q water and digested in 4:1 H_2SO_4/HNO_3 mixture for 24 hours. The residue washed repeatedly (3 times) with Milli-Q water, rinsed with ethanol and drops of the cleaned spicule suspension were placed on glass cover slips, the ethanol allowed to evaporate and mounted to observe under light microscope (Nikon Eclipse 50i) at different magnifications. For observing under Scanning Electron Microscope (Model: JEOL JSM-6380A, Japan), 2-3 drops of cleaned suspension fixed on a glass cover slip and vaporized the alcohol for few minutes. A layer of 300°A with gold coated on the sample by using auto ion sputtering coater (JEOL JFC-1500) for 5 minutes and scanned under microscope.

Most of the sponge taxonomy carried out by interpretation of foremost morphological features (shape, size, colour, skeletal and choanosomal structure, texture and consistency) of specimen, taken from 'Sponguide' by Hooper[13] and through the description of specimen given in the site of 'SpongeMaps'. Classification reviewed through the literature given for each species data for Porifera in 'World Porifera Database' (WPD)[21] and 'World Register for Marine Species' (WoRMS)[22].

Results

Systematic

Phylum -Porifera

Class -Demospongiae Sollas[11]

Order -Bubarida Morrow and Cardenas[18]

Family -Dictyonellidae Van Soest, Diaz and Pomponi[19]

Genus –*Liosina* Thiele[23]

Liosina paradoxa Thiele[23] (Figure 2)

Synonymy

Auletta bia de Laubenfels[24]

Migas porphyrion Sollas[25]

Milene porphyrion de Laubenfels[24]

Material description

Exposed, directly attached to substrate, thinly encrusting, soft, flexible, compressible, easily torn; brownish grey coloration, grey after preservation; unornamented surface. Ectosomal skeleton consists of thick pigmented granules; oscules small and distributed all over the surface, ostia not visible; choanosomal structure is of "halichondroid" type; siliceous spicules scattered irregularly in mesohyl. Spicules are megascleres, entirely smooth, strongyle (length = 310-451 ± 59.65 µm, width = 5-8 ± 1.8 µm), microscleres absent.

Ecology

Intertidal zone in muddy shallow water and found on pneumatophores of *Avicenna marina*.

Distribution

Liosina paradoxa Thiele[23] is widely spread in the western Indo-Pacific region, specifically reported from Delagoa, Seychelles, Sulawesi Sea, East African Coral Coast (Marine Ecoregion of the World), Coral Sea, Central and South Great Barrier Reef, Mozambique, Chumbe Island, Tanzania and Economic Exclusive Zones of Indonesia and Micronesia.

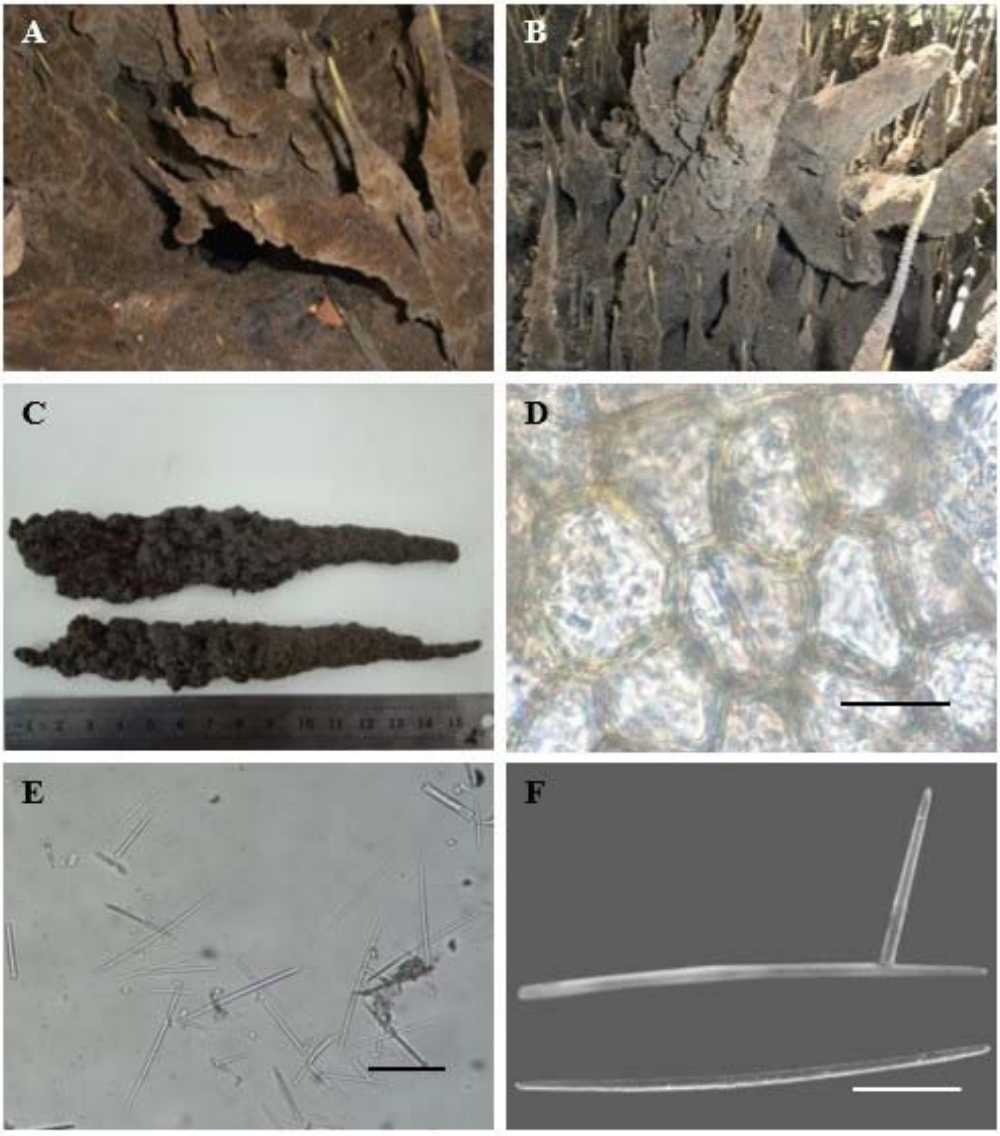

Fig. 2 — (A) and (B) Specimen (*Liosina paradoxa*) on pneumatophores of *Avicennia marina*, (C) Collected specimens of *Liosina paradoxa*, (D) Light microscopic image of ectosomal skeleton showing hexagonal surface structure (scale = 20 µm), (E) Light microscopic image of spicules (scale = 100 µm) and (F) Scanning electron microscopic image of spicules (scale = 50 µm)

Remarks

The outer surface of our specimen is rough, bushy, bears large amount of organic material, greyish beige in colour and well adapted to mangrove ecosystem, which is different from the appearance of *Auletta bia*[24] from Micronesia, that is orange in water and grey in exposed condition. Also grooves and linings are missing on the outer surface of sponge specimen of this study. Megascleres of *L. paradoxa* reported in the present study are distinctly smaller than the spicules of the holotype (size range: 360-900 × 8-20 µm) in oxeas and style form[14,26,27].

Discussion

Liosina paradoxa is being reported for the first time from the backwaters of Karachi, Pakistan, where it was found attached to pneumatophores of *Avicennia marina*. Genus *Liosina* contains four valid species (*L. arenosa*, *L. blastifera*, *L. granularis* and *L. paradoxa*)[13,14]. External surface of *L. arenosa* is greyish orange when alive and brown in alcohol preserved specimens. Circular and hexagonal pores occur with muddy appearance and about 5 mm thick with a soft texture consisting of choanosome beams, spicules are tylostyles about 625-1000 × 6-10 µm in

range[28]. *L. blastifera* is distinguished by its muddy surface with groove-like depressions, dichotomous and pale yellow in colour. Massive, encrusting, irregular lobate with cylindrical digitations about 30 mm in length and 5 mm thick and spicules are straight oxeas, rarely styles, 150-940 × 2-10 µm in size[27,29]. *Liosina granularis* is relatively similar to *L. paradoxa*: encrusting, massive, branching and foliose, ectosome is white whereas choanosome is orange-brown. Megascleres are strongyles with oxeote forms[30] in size range between 270-775 × 5-22 µm.

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References

1 Farooqui, Z., Shafique, S., Khan, K. L., Ali, A., Iqbal, P., Siddiqui, P. J., Assessment of litter production in semi-arid mangroves forests near active Indus River mouth (Hajambro creek) and Karachi backwaters, Pakistan. *Pak. J. Bot.*, 44 (5): (2012), 1763-1768.

2 Ellison, A. M., Fransworth, E. J. & Twilley, R.R., Facultative Mutualism Between Red Mangroves and Root-Fouling Sponges in Belizean Mangal. *Ecology*, 77 (8): (1996), 2431-2444.

3 Ruetzler, K., Low-Tide Exposure of Sponges in a Caribbean Mangrove Community. *Mar. Ecol.*, 16 (2): (1995), 165-179.

4 Wulff, J. L., Sponge predators may determine differences in sponge fauna between two sets of mangrove cays, Belize barrier reef. *Atoll Res. Bull.*, 477 (2): (2000), 51-263.

5 Wulff, J. L., Trade-offs in resistance to competitors and predators, and their effects on the diversity of tropical marine sponges. *J. Anim. Ecol.*, 74 (2): (2005), 313-321.

6 Engel, S. & Pawlik, J. R., Interactions among Florida sponges. II. Mangrove habitats. *Mar. Ecol. Prog. Ser.*, 303: (2005), 145-152.

7 Pawlik, J. R., McMurray, S.E. & Henkel, T.P., Abiotic factors control sponge ecology in Florida mangroves. *Mar. Ecol. Prog. Ser.*, 339: (2007), 93-98.

8 Nagelkerken, I., Blaber, S. J. M., Bouillon, S., Green, P., Haywood, M., Kirton, L.G., Somerfield, P. J., The habitat function of mangroves for terrestrial and marine fauna: a review. *Aquat. Bot.*, 89 (2): (2008), 155-185.

9 I.U.C.N., Mangroves of Pakistan: Status and Management. International Union for Conservation of Nature. Pakistan, (2005), pp. 1-107.

10 Duckworth, A. R. & Wolff, C. W., Population dynamics and growth of two coral reef sponges on rock and rubble substrates. *J. Exp. Mar. Biol. Ecol.*, 402 (1): (2011), 49-55.

11 Sollas, W. J., On the physical characters of calcareous and siliceous sponge-spicules and other structures. *Royal Dublin Society*, 4 (7): (1885), 374-392.

12 Hooper, J. N. & Levi, C., Biogeography of Indo-west pacific sponges: Microcionidae, Raspailiidae, Axinellidae. *Sponges in Time and Space*, (1994), 191-212.

13 Hooper, J. N. A., Sponguide: Guide to sponge collection and identification, Queensland Museum, South Brisbane, Australia., (2000), pp. 129.

14 Hooper, J. N. & Van Soest, R. W., Systema Porifera. A guide to the classification of sponges, Springer US, (2002), pp. 1-7.

15 Łukowiak, M. & Pisera, A., Bodily preserved Eocene non-lithistid demosponge fauna from southern Australia: taxonomy and affinities. *J. Syst. Palaeontol.*, (2016), 1-25.

16 Erpenbeck, D., Voigt, O., Al-Aidaroos, A. M., Berumen, M. L., Büttner, G., Catania, D., Wörheide, G., Molecular biodiversity of Red Sea demosponges. *Mar. Pollut. Bull.*, 105 (2): (2016), 507-514.

17 Cardenas, P., Perez, T. & Boury-Esnault, N., Sponge Systematics Facing New Challenges. *Adv. Mar. Biol.*, 61: (2012), 79-209.

18 Morrow, C. & Cardenas, P., Proposal for a revised classification of the Demospongiae (Porifera). *Front. Zool.*, 12 (1): (2015), 1-27.

19 Van Soest, R., Diaz, M. C. & Pomponi, S. A., Phylogenetic classification of the Halichondrids (Porifera, Demospongiae). *Beaufortia*, 40: (1990), 15-62.

20 Siddiqui, P. J., Farooq, S., Shafique, S., Farooqui, Z., Conservation and management of biodiversity in Pakistan through the establishment of marine protected areas. *Ocean Coast. Manag.*, 51 (5): (2008), 377-382.

21 WPD, World Porifera Database, http://www.marinespecies.org/porifera/ (2015).

22 WoRMS, World Register of Marine Species, http://www.marinespecies.org/ (2015).

23 Thiele, J., Studien über pazifische Spongien. II. Ueber einige Spongien von Celebes. Zoologica. Original-Abhandlungen aus dem Gesamtgebiete der Zoologie. *Stuttgart*, 24 (2): (1899), 1-33.

24 Laubenfels, M. W. de., The sponges of the west-central Pacific. Oregon State College, Corvallis, (1954), pp. 306.

25 Sollas, I. B. J., The inclusion of foreign bodies by sponges, with a description of a new genus and species of Monaxonida. *J. Nat. Hist.*, 1 (5): (1908), 395-401.

26 Hooper, J. N. A., Hall, K. A., Ekins, M., Erpenbeck, D., Worheide, G., Jolley-Rogers, G., Managing and sharing the escalating number of sponge "Unknowns": the SpongeMaps Project. *Integr. Comp. Biol.*, (2013), 1-9.

27 SpongeMaps, An online community for sponge taxonomy, http://www.spongemaps.org/ (2014).

28 Vacelet, J. & Vasseur, P., Éponges des récifscoralliens de Tuléar (Madagascar). Téthys, *Supplément*, 1: (1971), 51-126.

29 Vacelet, J., Bitar, G., Carteron, S., Zibrowius, H., Perez, T., Five new sponge species (Porifera: Demospongiae) of subtropical or tropical affinities from the coast of Lebanon (eastern Mediterranean). *J. Mar. Biol. Assoc. UK*, 87 (06): (2007), 1539-1552.

30 Kelly-Borges, M. & Bergquist, P. R., Success in a shallow reef environment: sponge recruitment by fragmentation through predation. *Proc. 6th Int. Coral Reef Symp.*, Australia 2: (1988), 757-762.