FIRST RECORDS OF SEA ANEMONES (CNIDARIA: ACTINIARIA) FROM THE COAST OF PAKISTAN (NORTHERN ARABIAN SEA)

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ABSTRACT

We report first records of five species of sea anemones: *Hormathianthus tuberculatus*, *Neoaiptasia commensali*, *Anthopleura waridi*, *Paracondylactis sinensis* and *Entacmaea quadricolor* from the coast of Pakistan. For the first three species, this is the first time that *in vivo* pictures are presented in the scientific literature. In addition, this study provides first distributional records of the first two species since their original descriptions. This study raises the number of Actiniaria species reported from Pakistan to nine.

Key words: Cnidaria, Actiniaria, Pakistan, Northern Arabian Sea, first records

INTRODUCTION

The phylum Cnidaria Verrill, 1865, is poorly studied in Pakistan (Northern Arabian Sea) (Gul *et al.*, 2015). Up to date order Actiniaria Hertwig, 1882, is represented by four species: *Metapeachia tropica* (Panikkar, 1938), *Anemonia indica* Parulekar, 1968, *Actinothoe modesta* Verrill, 1866, and *Phytocoetes gangeticus* Annandale, 1915, which were mentioned in a combined report on cnidarians of Bangladesh and Pakistan (Haque, 1977; see also Fautin, 2013). In the present study, five species of sea anemones: *Hormathianthus tuberculatus*, *Neoaiptasia commensali*, *Anthopleura waridi*, *Paracondylactis sinensis* and *Entacmaea quadricolor* are reported for the first time from Pakistani waters. This is the first time that *in vivo* pictures of *H. tuberculatus*, *N. commensali* and *A. waridi* are presented in the scientific literature and our findings present the first distributional records of *H. tuberculatus* and *N. commensali* since their original descriptions.

MATERIALS AND METHODS

Along the coast of Pakistan, the specimens were collected from two shores of Karachi: Manora (24°48′11.159″N, 66°57′34.616″E) and Clifton (24º48′34.739″N, 67º0′41.255″E), from trash in the landing area of Karachi Fish Harbour (trash was trawled off Karachi coast), and during snorkeling at Astola Island (25º7′20.81″N, 63º50′57.429″E). The living specimens were maintained in aquaria, observed, photographed and then fixed in 10% seawater formalin after relaxation with menthol crystals. Specimens were studied in detail through dissections under the stereomicroscope, squash preparations were made to check presence/absence of holotrich cnidae for the identification of acrorhagi. Systematics has been adapted from Rodríguez *et al.* (2014). Voucher specimens have been deposited in the Museum of Department of Zoology, Jamia Millia Government Degree College (MDZ JMGDC), Shah Faisal Town, Karachi, Pakistan.

RESULTS

Systematics

Order Actiniaria Hertwig, 1882

Suborder Enthemonae Rodriguez & Daly, 2014

Superfamily Metridioidea Carlgren, 1893

Family Hormathiidae Carlgren, 1932

Hormathianthus tuberculatus Carlgren, 1943

Fig. 1A-D

Material examined. Karachi Fish Harbour: 9 March 2015, 2 specimens from trash; Clifton: 22 February 2014, 2 specimens. MDZ JMGDC CN 27.

Description. Column *in vivo* 30-40 mm long, brownish, composed of scapus and scapulus. Scapus with numerous scattered minute blunt, brownish tubercles and dark bands lengthwise (Fig. 1A, B). Scapulus with twelve longitudinal ridges, each ending in two coronal tubercles; total twenty-four (Fig. 1C, D). Longitudinal ridges on scapulus corresponding with dark bands on scapus. Cuticle weak. Oral disc greenish-white with numerous fine, dark lines of mesenterial insertions; mouth whitish-green bearing two well developed siphonoglyphs; lips raised, divided into twelve round lobes (Fig. 1A). Tentacles conical, bearing minor to intense reddish-brown transverse pattern; hexamerously arranged in six cycles (about 192 in number) covering 2/3 of oral disc; length of inner ones approximately half the diameter of oral disc, outer ones considerably shorter than inner ones (Fig. 1A). Pedal disc in life with creamish mesenterial insertions visible and a row of tiny creamish spots (Fig. 1B).

Mesenteries 48 pairs in four cycles, first cycle perfect, two pairs of directives, fourth cycle bearing reproductive tissue; 96 pairs of mesenteries in the upper most part. Retractors diffuse and weak. Parietobasilar muscles very weak. Acontia greenish-white ejected from mouth when disturbed.

Habitat. Attached to gastropod shells inhabited by hermit crabs.

Distribution. Indian Ocean: Cambodia, Cochinchina, Poulo Condore and Vietnam (Carlgren, 1934: 34) and Pakistan.

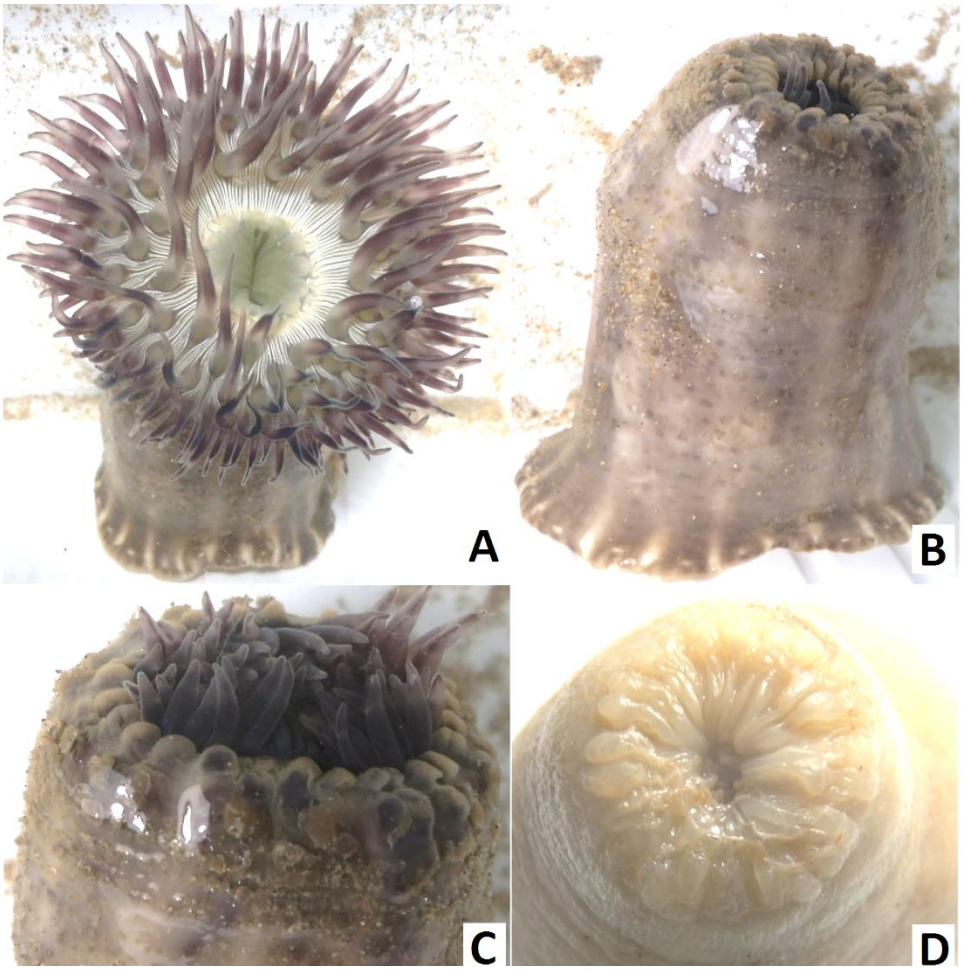

Fig. 1. *Hormathianthus tuberculatus* Carlgren, 1943, specimen dislodged from gastropod shell. A) expanded; B) contracted; C) close-up of distal region of column and margin; D) close-up of distal region (preserved); note twelve longitudinal ridges each ending into two coronal tubercles.

Superfamily Metridioidea Carlgren, 1893
Genus with unresolved taxonomic position sensu Grajales & Rodriguez (2015)
***Neoaiptasia commensali* Parulekar, 1969**
Fig. 2A-C

Material examined. Clifton: 2 December 2012, 4 specimens; 13 December 2012, 2 specimens; 3 December 2013, 2 specimens; 18 February 2014, 8 specimens. MDZ JMGDC CN 26.

Description. Column *in vivo* 15-25 mm long, yellowish-brown with minute irregular brown patches and six blackish bands lengthwise (Fig. 2A, B); pyramidal to flat in contraction (Fig. 2B, C); margin tentaculate. Longitudinal dark bands on column persistent and distinct in preserved specimens. Oral disc brownish with six peripheral blackish zones corresponding with six longitudinal bands on column; two siphonoglyphs (Fig. 2C). Tentacles transparent with dark brown transverse bands (Fig. 2A). Pedal disc irregular.

Four cycles of mesenteries; first two perfect, third and fourth with reproductive tissue. Acontia creamish, ejected from mouth.

Habitat. Attached to gastropod (*Babylonia spirata*) shells inhabited by hermit crabs; 2-3 specimens on each shell.

Distribution. Arabian Sea: west coast of India (Parulekar, 1969; 1990) and Pakistan.

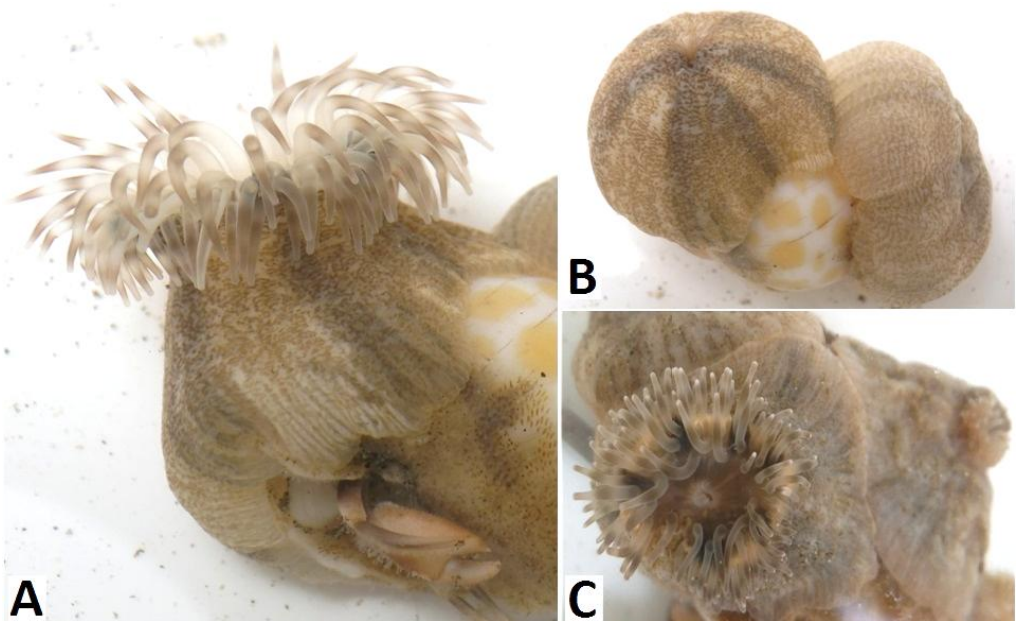

Fig. 2. *Neoaiptasia commensali* Parulekar, 1969, specimens attached to gastropod (*Babylonia spirata*) shells. A) expanded; B) contracted; C) close-up of oral disc.

Superfamily Actinioidea Rafinesque, 1815
Family Actiniidae Rafinesque, 1815
***Anthopleura waridi* (Carlgren, 1900)**
Fig. 3A-B

Material examined. Manora: 11 September 2012, 17 specimens; 24 June 2014, 11 specimens. MDZ JMGDC CN 24.

Description. Fully expanded, relaxed specimens *in vivo* up to 30 mm long. Column pale yellow to ochre, slightly longer than broad with up to 30 longitudinal rows of adhesive verrucae in upper 2/3 of column; additional small rows on uppermost area (Fig. 3A, B). Verrucae olive-green in uppermost part with crimson shade on apices to completely crimson verrucae on column (Fig. 3B). Each row of verrucae ends with one ovoid, olive-green spherule on distal most margin carrying a whitish, prolonged acrorhagus in deep fossa (Fig. 3B). Oral disc dark brown; mesenterial insertions visible as more or less distinct whitish lines; in some sections area between mesenteries whitish. Number of siphonoglyphs variable: specimens with two and four siphonoglyphs found. Tentacles dark olive green to brown, tapered; arranged in up to five cycles (Fig. 3A). Pedal disc broad, well developed and strongly adhesive.

Mesenteries irregularly arranged in four cycles, first two cycles perfect including two to four pairs of directives, fourth cycle comprises tiny mesenteries; reproductive tissue on all cycles.

Habitat. Found in the sand-filled holes and crevices of intertidal rocks of Manora.

Distribution. Western Indian Ocean: Zanzibar (Tanzania) (Carlgren, 1900, as *Bunodes waridi*), Aden (Yemen) and Mandapam Camp (southeast India) (England, 1987) and Pakistan.

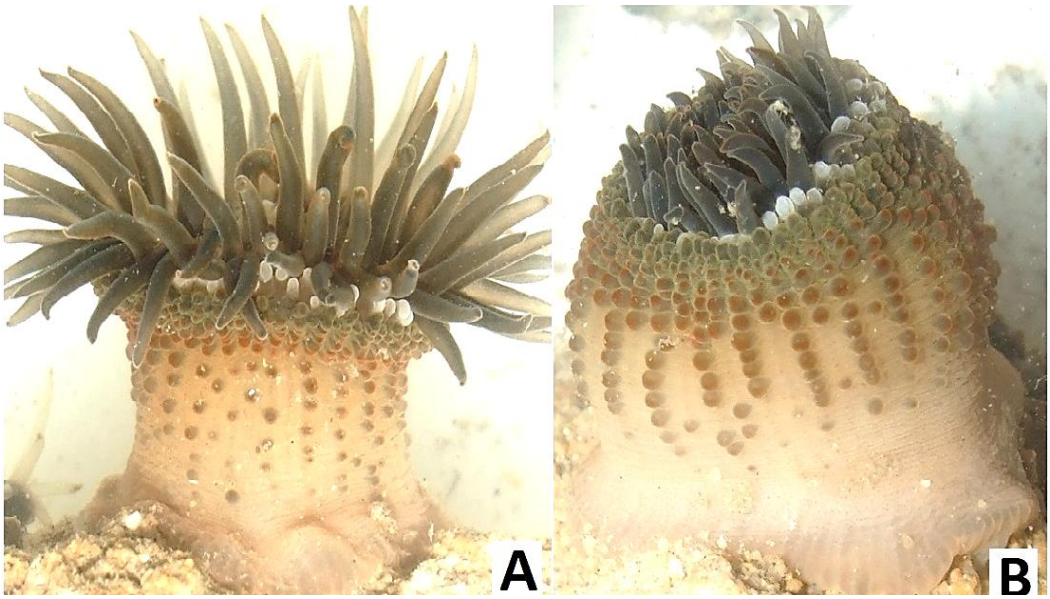

Fig. 3. *Anthopleura waridi* (Carlgren, 1900), specimen attached to rock. A) expanded; B) contracted; note the whitish acrorhagi.

***Paracondylactis sinensis* Carlgren, 1934**

Fig. 4A-B

Material examined. Clifton: 13 December 2012, 2 specimens; 22 February 2014, 3 specimens; 29 August 2015, 1 specimen. MDZ JMGDC CN 25.

Description. Column *in vivo* 120-140 mm long, smooth, elongated and gradually tapering towards base (Fig. 4A); bearing 48 small, perforated pseudospherules at distal most margin corresponding with endocoelic tentacles (Fig. 4B). Oral disc with mesenterial insertions visible as dark lines; mouth with two siphonoglyphs. Tentacles arranged in five cycles (96 in number). Living and preserved specimens beige coloured with slight grayish shade on tentacles and oral disc.

Mesenteries 48 pairs in four cycles, first three cycles perfect, fourth cycle only in distal region; reproductive tissue on first three cycles except directives.

Habitat. Burrowed deeply in intertidal muddy-sand shore of Clifton with oral disc held at the sand surface.

Distribution. Tropical Indo-Pacific (Fautin *et al*., 2015). Arabian Sea: west coast of India (as *Paracondylactis* cf. *sinensis,* den Hartog and Vennam, 1993) and Pakistan.

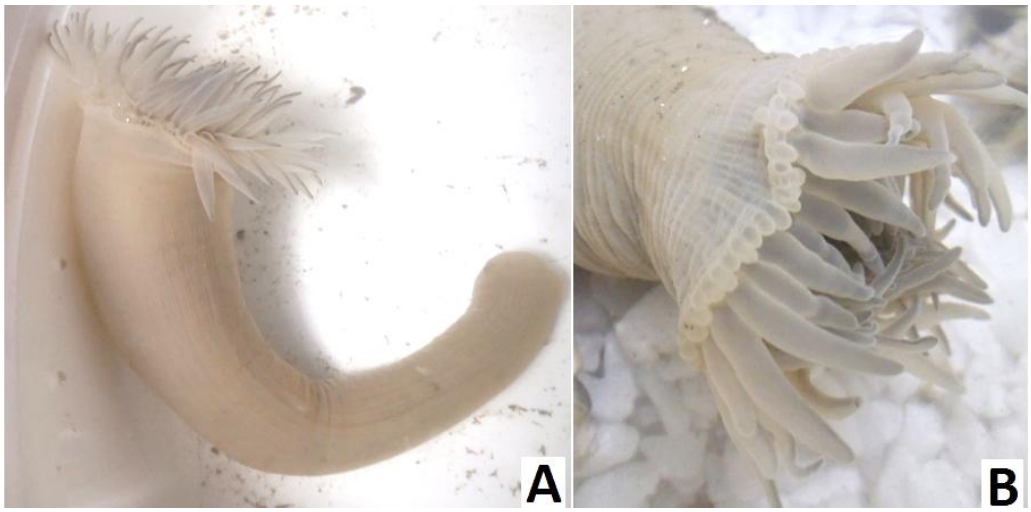

Fig. 4. *Paracondylactis sinensis* Carlgren, 1934. A) expanded specimen; B) close-up of distal region; note the row of pseudospherules at the distal most margin of column.

***Entacmaea quadricolor* (Leuckart in Rüppell & Leuckart, 1828)**
Fig. 5

Material examined. Astola Island: February 2010, 1 specimen; 27 March 2016, 1 specimen. MDZ JMGDC CN 28.
Description. Oral disc *in vivo* 100-150 mm wider. Column wider to flared at distal end, brownish and smooth. Tentacles light-greenish and globose near ends; inner tentacles longer than outer. Expanded bulbs with fine longitudinal lines and a white ring at upper end of each bulb. Subterminal bulbs with variably small nipple-like ends lacking any pigmentation on tips. For detail description, see Dunn (1981: 17-23).
Habitat. Shallow to deep waters; column hidden in holes or crevices of rocks with only tentacles visible.
Distribution. Red Sea to western Pacific, southern Japan and Lord Howe Island (Dunn, 1981; Fautin and Allen, 1992; Fautin *et al*., 2009) and Pakistan.

Fig. 5. *Entacmaea quadricolor* (Leuckart in Rüppell & Leuckart, 1828) between rocks at Astola Island. Photographed by Indus-Scuba.

DISCUSSION

In Pakistan, sea anemones are unknown for the last four decades. So far, only four species are on the record documented briefly in a single paper by Haque (1977) (Gul *et al*., 2015). From the near-by coasts of Pakistan, sea anemones are known from the west coast of India (Parulekar, 1990; England, 1987, 1990; den Hartog and Vennam 1993, Mitra and Pattanayak, 2010, 2013; Choudhury *et al*., 2015), Aden (England, 1987) and Sea of Oman (Attaran-Fariman and Javid, 2015) with several species documented including new taxa. Since Parulekar (1990), fourty species of sea anemones were recorded from India, mostly from the Arabian coast adjacent to Pakistan. However, the taxonomic studies on the group remained poor from Pakistani coast (Northern Arabian Sea) with little information on Actiniaria exists currently. Among the four previous records by Haque (1977), mentioned earlier, one is *Metapeachia tropica* (Panikkar, 1938) which is recently reported and redescribed from Singapore (Yap *et al*., 2014) while one, *Actinothoe modesta* Verrill, 1866, is possibly a doubtful record based upon erroneous identification; this species occurs only in the northwest Atlantic (Fautin, 2015).

In this study, five new records of sea anemones are presented from Pakistan. The first one belongs to a little known monotypic genus *Hormathianthus* Carlgren (1943) which is mainly characterized by having both, tentacles and mesenteries in the upper most part of column considerably more numerous than mesenteries (96 or 48 pairs) at the base (Carlgren, 1943: 33, 1949: 97). These are the features that also distinguish this genus from the closely related one, *Hormathia* Gosse, 1859. Carlgren's (1943) *H. tuberculatus* specimens had twelve longitudinal ridges (see, Carlgren, 1943, pl. II, fig. 3) and the number of coronal tubercles as mentioned by him was twelve to variably more by division of one ridge into two. Our specimens have twelve longitudinal ridges and twenty-four coronal tubercles i.e. each ridge is dividing into two. We also observed a row of tiny creamish spots close to the oral disc in live specimens of *H. tuberculatus* not mentioned by Carlgren (1943). *H. tuberculatus* has questionable synonyms (Carlgren, 1943: 33, 1949: 97; Fautin, 2013). Otherwise, this species together with *N. commensali* which is so far known from the type localities, present first distributional records from Pakistani waters whereas, *E. quadricolor* is possibly new to the Arabian Sea. This report also provides first *in vivo* pictures of *H. tuberculatus*, *N. commensali*, and *A. waridi*.

The literature from adjacent countries of Pakistan and some recent studies (Fautin *et al*., 2009, 2015) suggest the presence of additional species in this area.

REFERENCES

Attaran-Fariman, G., P. Javid and A. Shakouri (2015). Morphology and phylogeny of the sea anemone *Stichodactyla haddoni* (Cnidaria: Anthozoa: Actiniaria) from Chabahar Bay, Iran. *Turkish Journal of Zoology*, 39: 1-6.

Carlgren, O. (1943). East-Asiatic Corallimorpharia and Actiniaria. *Kungliga Svenska Vetenskapsakademiens Handlingar*, 6: 1-43.

Carlgren, O. (1949). A survey of the Ptychodactiaria, Corallimorpharia and Actiniaria. *Kungliga Svenska Vetenskapsakadamiens Handlingar*, 1: 1-121.

Choudhury, S., C. Raghunathan, R. Raghuraman and K. Venkatraman (2015). *Actiniarian Sea Anemone diversity in Andaman and Nicobar Islands*. Uttar Pradesh State Biodiversity Board, pp. 58-66.

den Hartog, J.C. and J. Vennam (1993). Some Actiniaria (Cnidaria: Anthozoa) from the west coast of India. *Zoologische Mededelingen*, 67 (42): 601-637.

Dunn, D. F. (1981). The clownfish sea anemones: Stichodactylidae (Coelenterata: Actiniaria) and other sea anemones symbiotic with pomacentrid fishes. *Transactions of the American Philosophical Society*, 71: 1-115.

England, K.W. (1987). Certain Actiniaria (Cnidaria, Anthozoa) from the Red Sea and tropical Indo-Pacific Ocean. *Bulletin of the British Museum of Natural History* (*Zoology*), 53: 205-292.

England, K.W. (1990). Description of two new mud-dwelling actiniids from Maharashtra, India: *Edwardsia athalyei* sp. nov. and *Acontiactis* gen. nov. *gokhalae* sp. nov., and a note on *Edwardsioides mammillata* (Bourne, 1916) (Cnidaria: Actiniaria). *Indo-Malayan Zoology*, 6: 141-158.

Fautin, D.G. (2013). Hexacorallians of the World. http://geoportal. kgs.ku.edu/hexacoral/anemone2/index.cfm

Fautin, D.G. (2015). *Actinothoe modesta* (Verrill, 1866). In: Fautin, D.G. (2013). Hexacorallians of the World. Accessed through: World Register of Marine Species at http://www.marinespecies.org/aphia.php?p= taxdetails&id = 158219 on 2016-04-10.

Fautin, D.G. and G.R. Allen (1992). *Field guide to anemone fishes and their host sea anemones*. Western Australian Museum, Perth, pp. 160.

Fautin, D.G., S.H. Tan and R. Tan (2009). Sea anemones (Cnidaria: Actiniaria) of Singapore: abundant and well-known shallow-water species. *Raffles Bulletin of Zoology*, 22: 121-143.

Fautin, D.G., R. Tan, W.L.N. Yap, S.H. Tan, A. Crowther, R. Goodwill, K. Sanpanich and Y.C. Tay. (2015). Sea anemones (Cnidaria: Actiniaria) of Singapore: shallow-water species known also from the Indian subcontinent. *Raffles Bulletin of Zoology*, 31: 44-59.

Gul, S., A.C. Morandini, V. Häussermann and U. Pörschmann (2015). Checklist of cnidarians from Pakistani waters. *Check List*, 11 (1609): 1-8.

Haque, M.M. (1977). Some littoral coelenterates of Bangladesh and Pakistan coasts. *Bangladesh Journal of Zoology*, 5: 33-40.

Mitra, S. and J.G. Pattanayak (2010). First record of two species of Sea anemones *Edwardsia Jonesii* and *Paracondylactis indicus* from Karnataka, India. *Records of the Zoological Survey of India*, 110: 77-79.

Mitra, S. and J.G. Pattanayak (2013). Diversity and distribution of sea anemones (Cnidaria: Actiniaria) in the estuaries and mangroves of Odisha, India. *Records of the Zoological Survey of India*, 3: 113-118.

Panikkar, N.K. (1938). Studies on *Peachia* from Madras. *Proceedings of the Indian Academy of Sciences*, 7 (4): 182-205.

Parulekar, A.H. (1968). Sea anemones (Actiniaria) of Bombay. *Journal of the Bombay Natural History Society*, 65: 138-147.

Parulekar, A. (1990). Actinarian sea anemone fauna of India. In: *Proceedings of marine biodeterioration with reference to power plant cooling systems, IGCAR, Kalpakkam, 26-28 April 1989*. National Institute of Oceanography, Goa, India, pp. 218-228.

Rodríguez, E., M.S. Barbeitos, M.S. Brugler, L.M. Crowley, A. Grajales, L.C. Gusmão, V. Häussermann, A. Reft and M. Daly (2014). Hidden among Sea Anemones: the first comprehensive phylogenetic reconstruction of the order Actiniaria (Cnidaria: Anthozoa: Hexacorallia) reveals a novel group of hexacorals. *PLOS ONE*, 9 (5): 1-17.

Yap, N.W.L., D.G. Fautin, D.A. Ramos and R. Tan (2014). Sea anemones of Singapore: *Synpeachia temasek* new genus, new species, and redescription of *Metapeachia tropica* (Cnidaria: Actiniaria: Haloclavidae). *Proceedings of the Biological Society of Washington*, 127 (3): 439-454.

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