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New record of sea anemones (Actiniaria: Actiniidae) from Andaman and Nicobar Islands

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Short Communication

Abstract

The intertidal zone is a challenging environment for organisms to live in because they are exposed to terrestrial and marine conditions, including changes in temperature, salinity, and wave action. The present study is comprised of a collection of sea anemones from the intertidal region of different localities along the Andaman Coast. Three species, namely, *Paracondylactis sinensis* (Carlgren, 1949), *Anthopleura dixoniana* (Haddon and Shackleton, 1893) and *Anthopleura elegantissima* (Brandt, 1835), are new records for the Andaman and Nicobar Islands. For each recorded species, the habit and preferred habitat, size range, colouration, distinguishing external features, and distribution are given. Of the recorded species, *P. sinensis*, a sand-burrowing sea anemone, was found at the upper edge of the intertidal zone. While the most prevalent sea anemones, *A. dixoniana* and *A. elegantissima*, were found on the lower limits. These two sea anemones were seen to aggregate into large groups and form dense clusters on rocks or other surfaces in the intertidal zone. This aggregation happens for several purposes, including reproduction, feeding, or defence against predators.

Keywords: *Andaman Islands, actiniaria, actiniidae, intertidal habitat*

Introduction

Studies on Actiniarian sea anemones from Indian waters are sporadic. Carlgren (1928) paid attention to sea anemones taxon in Andaman and Nicobar Islands by describing *Bunodactis nikobarica* and *Parabunodactis inflexibilis*. Later, Parulekar (1990) included two more species from these islands. A perusal of the literature revealed that little or nothing was so far known about the taxonomy and distribution of sea anemone species from Andaman and Nicobar Islands except the few works of literature (Carlgren, 1928; Parulekar, 1990; Madhu and Madhu, 2007; Raghunathan *et al.,* 2014; Choudhury *et al.,* 2015; Choudhury and Raghunathan, 2018). Recently, Choudhury and Sivaperuman (2021) have summarized the data on the region-wise distribution of 28 sea anemones in the Andaman and Nicobar Islands.

Material and methods

The study area comprised the intertidal ecosystem of South Andaman. A comprehensive survey of the intertidal zone was conducted on two specific locations, *i.e.*, Kodiyaghat and Chatham, through direct searching and observation. This approach involves physically examining the area and visually observing the organisms present in the intertidal zone. Direct searching involves actively looking for organisms and their habitats, such as rock pools or crevices. The individuals of sea anemones were collected using a scalpel, hammer and chisel from the intertidal habitats including coral reefs, rocky shores and sandy mud areas. Photographs were taken *in situ* to comprehend the colour pattern of tentacles, oral disc and column, shape, habit and habitat using a digital camera (Canon Power Shot G15). The habits and habitat of the sea anemone were examined and photographed.

Species identification

Soon after collection the specimens were relaxed by the addition of magnesium chloride crystals with seawater in the field and later fixed in 10% phosphate-buffered formalin (PBF) and were then preserved in 70% ethyl alcohol in the laboratory. Measurements provided for the

pedal disc, column, oral disc and tentacles were obtained from living, relaxed and preserved specimens under a stereo-zoom microscope (Leica M205A) in the laboratory. All sea anemone specimens were identified to the species level following Brandt (1835), Carlgren (1949), Parulekar (1968), England (1992), Fautin *et al.* (2009, 2015), den Hartog and Vennam (1993).

Results

***Paracondylactis sinensis* (Carlgren, 1949)**

Synonyms

Gyrostoma sp.: Menon, 1927, p. 36–37.
Paracondylactis sinensis Carlgren, 1934, p. 26–28 (original description).
Paracondylactis dawydoffi Carlgren, 1943, p. 27–28 (original description).
Paracondylactis davydoffi [sic] Carlgren 1943: Carlgren, 1949, p. 55.
Paracondylactis indicus Parulekar, 1966, p. 38, 40.
Paracondylactis indicus Dave in Parulekar, 1968, p. 143, 145 (original description).
Paracondylactis sp.: Misra, 1975, p. 46.
Paraconodylactis [sic] indicus Dave: Haque, 1977, p. 36, 39.
Paracondylactis sagarensis Bhattacharya 1979: Parulekar, 1990, p. 219, 221, 223, 226.

Material Examined

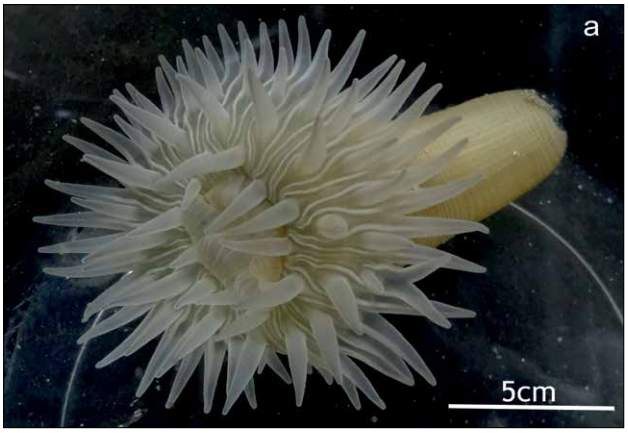
Ex: One individual; Chatham, Andaman Islands (Lat. 11°40.827'N; Long: 92°43.579'E); depth: 0.1 m; Coll. by Smitanjali Choudhury; 15 January 2021; Registration No. ZSI/ANRC/M/26921.

Description

The column is smooth, elongated, tapering and measuring 75 mm in length in a stressed condition. It is flared at the distal end. Mesenterial insertions are visible as light lines through the column. The oral disc is (60 mm) wider than the aboral region. About 48 pseudo spherules are present at the margin of the column. Presence of a distinctly flattened pedal disc. The coloured radial lines are visible in the oral disc. 96 tentacles arranged in 5 cycles. Tentacles and oral disc colourless. The mouth is ovoid; two symmetrical siphonoglyphs are visible at the ends. The column is flaxen yellow in colour (Fig. 1).

Habitat

The specimen was found at the foreshore, burrowing singly; only oral discs and tentacles were seen in sandy mud.



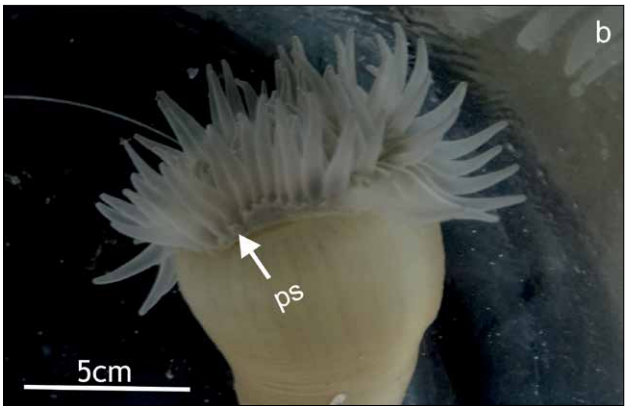


Fig. 1. External morphology of *P. sinensis* in the laboratory. (a) Tentacles and column; (b) Pseudo spherule

Distribution

India: East coast: Odisha (Mitra and Pattanayak, 2013), West Bengal (Bairagi, 1998); West coast: Maharastra (Dave, 1957; Parulekar, 1968) and Karnataka (Mitra and Pattanayak, 2010). The species was reported from South Andaman (Chatham).

Elsewhere: The species span the tropical Indian Ocean from Mozambique and the western North Pacific to Japan (den Hartog and Vennam, 1993) and Singapore (Fautin *et al.*, 2015).

Remarks

The species is a new record for the Andaman and Nicobar Islands. This specimen quite resembles the specimen reported from Singapore (Fautin *et al.*, 2015).

***Anthopleura dixoniana* (Haddon and Shackleton, 1893)**

Actinioides Dixoniana Haddon & Shackleton, 1893, p. 117, 126 (original description).

Actinoides [sic] dixoniana Haddon & Shackleton: Carlgren, 1896, p. 174.
Actinioides Papuensis Haddon, 1898, p. 398, 415, 424, 425, 426–428 (original description).
Actinoides [sic] *Dixoniana* H. & S.: Carlgren, 1900, p. 43 [63].
Actinoides [sic] *papuensis* H.: Carlgren, 1900, p. 43 [63].
Actinioides dixoniana Hadd. & Shackl.: Pax, 1907, p. 77.

Actinioides papuensis Hadd.: Pax, 1907, p. 77.
Anthopleura dixoniana (Haddon and Shackleton 1893): Carlgren, 1949, p. 54.
Actiniogeton papuensis (Haddon 1898): Carlgren, 1949, p. 62.

Material Examined

Ex: five individuals; Neil Island, Andaman Islands (Lat. 11°50.517'N; Long: 93°01.363'E); depth: 0.2 m; Coll. by Smitanjali Choudhury; 20 August 2015; Registration No. ZSI/ANRC–12497. Ex: five individuals; Chatham, Andaman Islands (Lat. 11°40.827'N; Long: 92°43.579'E); depth: 0.1 m; Coll. by Smitanjali Choudhury; 15 January 2021; Registration No. ZSI/ANRC/M/ 27212.

Description

The body is short and strong with a well-developed pedal disc. The inner tentacles are long, tapering with banded pattern. The oral disc is flat and its tentacles are expanded when submerged; has a distinctive pale dark chequer-board pattern. The mouth is projected outwards. The column is wrinkled in preserved condition; about 10 mm long with prominent verrucae to which debris or molluscs are attached. After preservation, the tentacles are short and stubby. The tentacles are present at the margin of the oral disc, irregularly arranged in three cycles (6+12+24= 42). The length of tentacles is about 4-5 mm in preserved condition. The tentacles are retracted immediately when disturbed. The acrorhagi are present on the marginal end of the oral disc. The mouth is about 6 mm in diameter with prominent two siphonoglyphs. The lips are regularly arranged at the border of the mouth. The aboral end is about 6 mm in diameter. The transverse section of the specimen was done in mid-column. Verrucae was prominent at the column about 0.227 mm in width. The same number of mesenteries distally and proximally arranged. The mesenteries are arranged in three cycles. The longitudinal muscles are meso ectodermal. Retractors of mesenteries are strong, long mesogloea lamellae branched and Parietobasilar muscle is more prominent. The primary and secondary mesenteries show fertile diffused (Fig. 2 a-f).

Colour

The column is dark grey at the distal end, and shades to beige at the base. The oral disc has white or brown patches present between the mouth and the base of tentacles. The tentacles are brownish-grey in colour with solid cream spots or bands on its oral face. The colour of acrorhagi is Tuscany yellow. After preservation, the oral disc is dark grey in colour; lips and siphonoglyphs are creams in colour.

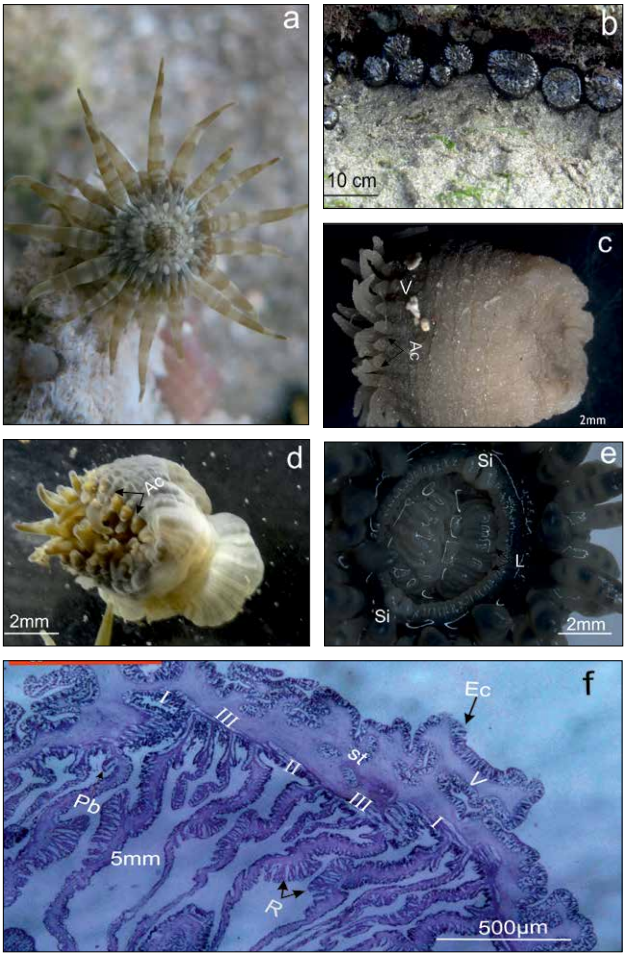


Fig. 2. External morphology and histological section of *A. dixoniana.* a. *In situ*; b. Habitat of specimen; c. Microscopic view of column, verrucae and acrohagi; d. Acrohagi; e. Mouth; f. Transverse section and arrangement of mesenteries. Ac. Acrorhagi; Ec. Ectoderm; I. First order cycle; II. Second order cycle; III. Third order cycle; L. Lips; Si. Siphonoglyphs; St. Stomata; Pb. Parietobasilar muscle; R. Retractor muscles; V. Verrucae

Habitat

The specimens were found in holes in granite boulders and dead corals. Also, it was found in stones and rocks; many specimens were aggregating in small areas, but not close to each other. The specimen was found between 0 and 1 m in depth.

Distribution

India: West coast: Gujarat (Shah *et al.*, 2017). The species was recorded from South Andaman (Chatham and Neil Island) .

Elsewhere: Singapore, Australia (Torres Straits), Changi Creek, Hong Kong, and the Maldives, Malaysia (England, 1992; Fautin *et al.,* 2009).

Remarks

Anthopleura dixoniana is a new distributional record to Andaman and Nicobar Islands. Shah *et al.* (2017) have not illustrated and provided the morphological details of the sea anemones. The reported species *A. dixoniana* differs from its congener species *A. elegantissima* in having a pale dark chequer-board pattern in the oral disc and white spots or bands along the length of tentacles whereas; the oral disc of *A. elegantissima* is having radiating lines and the tentacles having short, pointed with pink-tipped. Previously *Anthopleura handi* was reported from Andaman and Nicobar Islands (Raghunathan *et al.*, 2014). Compared to this newly reported species, *A. handi* differs in having inconspicuous verrucae. While *A. dixoniana* has verrucae at the distal part of the column.

***Anthopleura elegantissima* (Brandt, 1835)**

Synonyms

Actinia elegantissima Brandt, 1835, p. 13 (original description).
Actinia elegantissima [no author]: Andres, 1883, p. 594. species delendae
Cribrina elegantissima (Brandt): McMurrich, 1901, p. 18–23, 25, 37–38.
Bunodactis elegantissima (Brandt 1835): Carlgren, 1949, p. 66.
Anthopleura elegantissima (Brandt): Carlgren, 1952, p. 382–384.
[non] *Anthopleura elegantissima* solitary [no author]: Potts & Smith, 1987, p. 538–544.
Anthopleura elegantissima clonal [no author]: Potts & Smith, 1987, p. 538–544.

Material Examined

Ex: Eight individuals; Kodiyaghat, Andaman Islands (Lat.11°31.880'N; Long: 92° 43.455 'E); depth: 0.1m; Coll. by Smitanjali Choudhury; 11 February 2021; Registration No. ZSI/ANRC/M/ 27213.

Description

The illustrated specimen was 20 mm high. The average diameter is about 15–35 mm. The tentacles are tipped with lavender. The column is green at the distal end, and shades white at the base. The collar is green and acrorhagi are white to yellow. The oral disc is wider than the aboral region. This species has acrorhagi, just outside their ring of tentacles. The tentacles are numerous, thick, and pointed. The entire column is covered with

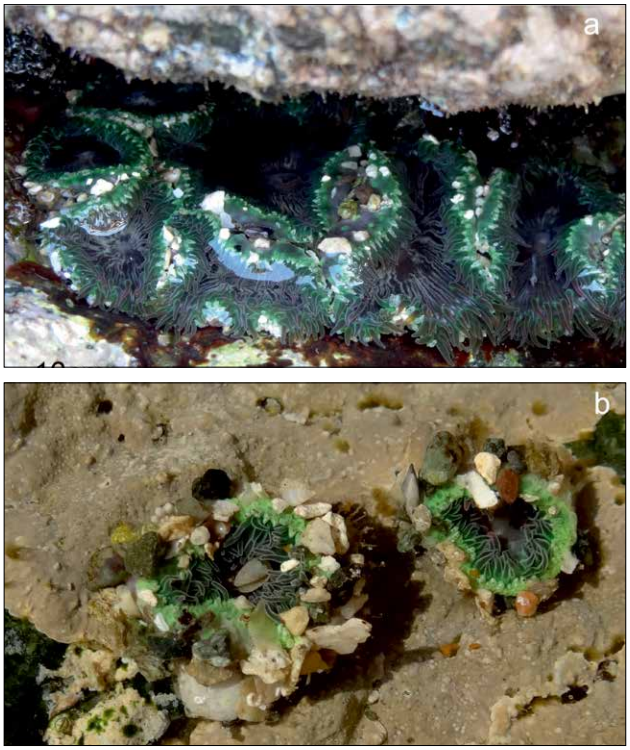


Fig. 3. *A. elegantissima* (a) *in situ* at rocky habitat; (b) Debris and dead shell attached with column

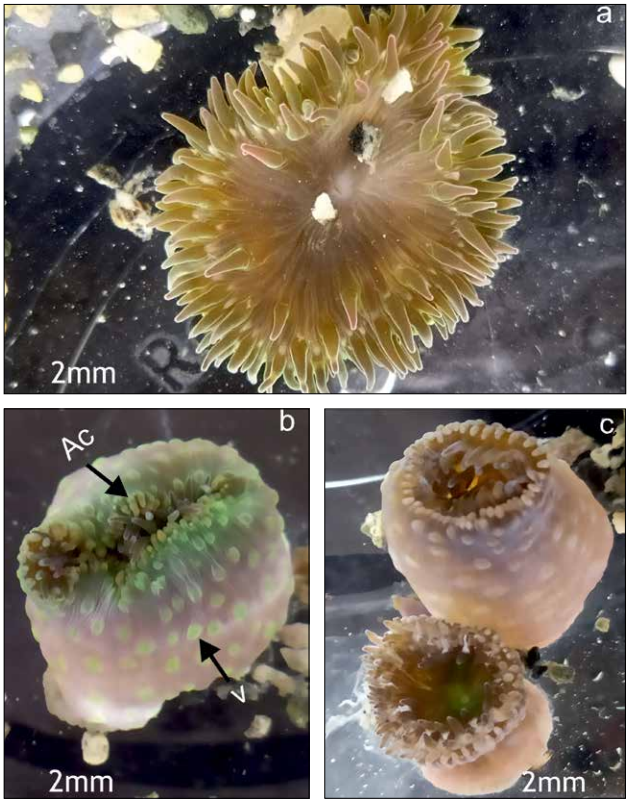


Fig. 4. External morphology of *A. elegantissima*. (a) oral disc at relaxed stage In laboratory; (b) column of the specimen;

round adhesive tubercles or verrucae in longitudinal rows. The parapet is strong, with a well-developed fosse. The oral disc is a large central area (30 mm diameter) without tentacles. It is broad and flat, with radiating lines (mesenterial insertions). The mouth is in the centre of the oral disc, and the lips are flat with the surface of the disc and are not ribbed. The tentacles are pointed, and about 1/4 as long as the diameter of the disc. There is no oral inner ring of tentacles (Fig. 3-4).

Habitat

The specimens were found at the mid-littoral rocky shore, attached to the rock wall. The specimens were aggregating in a small area, close to each other. They were especially predominant in rocky habitats and fully exposed to full sun. The debris, dead shell and sand particles were attached to the column to prevent the desiccation of the specimens.

Distribution

India: West coast: Gujarat (Shah *et al.,* 2017). Recently, this species was recorded from South Andaman (Kodiyaghat).

Elsewhere: This species spans the Northern-east Pacific coast: Alaska to Baja California (Brandt, 1835; Morris *et al.,* 1980).

Remarks

This species is a new record for the Andaman and Nicobar Islands. It was observed that the habitat of these specimens was covered with algae mats which provided moist habitats for the aggregations. When *A. elegantissima* loses its algae, it becomes aposymbiotic. Shah *et al.* (2017) have not illustrated and provided the morphological details of this species. *Anthopleura elegantissima* harbors zooxanthellae.

Discussion

Sea anemones are fascinating marine invertebrates that can be found in intertidal regions, which are the areas of the shore that are covered and uncovered by tides. One of the most remarkable things about sea anemones is their ability to survive in harsh intertidal environments. They are adapted to withstand both the pounding waves and exposure to air during low tide. Some species can even tolerate extreme temperatures and salinity levels.

A pursuit of existing published literature revealed a total of 75 species of Actiniarian sea anemones under 47 genera and 22 families in Indian waters (Annadale, 1907, 1915; Carlgren, 1925, 1928; Seshaiya and Curtress, 1969; Parulekar, 1990; England, 1990; den Hartog and Vennam, 1993; Raghunathan *et al.,* 2014; Choudhury *et al.,* 2015; Raghunathan and Choudhury, 2017; Shah *et al.,* 2017; Choudhury and Raghunathan, 2018). The marine faunal communities of Andaman and Nicobar Islands have been studied relatively little in comparison to the coasts of India. In 1928, Carlgren described two species of sea anemones, *Bunodactis nikobarica* and *Parabunodactis inflexibilis*, which he collected from an abyssal depth of 296 m off Great Nicobar Island, located in the eastern Indian Ocean. Both species are still recognized as valid species today and are included in the family Actiniidae. Later, Parulekar (1990) included two more species *Anthopleura panikkarii* and *Metridium dianthus* from Andaman and Nicobar Islands.

Among the families, Actiniidae is the best representative family with 14 genera and 26 species in Indian water. Of these, only nine species are recorded from Andaman and Nicobar Islands. One of the most widely recognized genera of sea anemones is *Anthopleura* Duchassaing de Fonbressin and Michelotti, 1860, which is a member of the Actiniidae family Rafinesque, 1815. There are currently 47 known species within the genus *Anthopleura* (Daly and Fautin, 2019). Members of *Anthopleura* are recognized by the occurrence of acrorhagi and verrucae in their columns (Carlgren, 1949). *Anthopleura panikkarii*, described by Parulekar in 1968 from the coast of Maharashtra, and *Anthopleura anjunae*, described by den Hartog and Vennam in 1993 from Goa, have made significant contributions to the taxonomic study of actiniarian fauna. So far, nine species of *Anthopleura* have been reported from the west coast of India: *Anthopleura waridi* (Carlgren, 1900); *A. nigrescens* (Verrill, 1928); *A. asiatica* Uchida and Muramatsu, 1958; *A. anjunae* den Hartog and Vennam, 1993; *A. panikkarii* Parulekar, 1968; *A. buddemeieri* Fautin 2005; *A. elegantissima* (Brandt, 1835); *A. sola* Pearse and Francis, 2000; *A. dixoniana* (Haddon and Shackleton, 1893) (den Hartog and Vennam, 1993; Parulekar, 1968, 1969, 1990; England, 1987; Biju Kumar *et al.,* 2015; Shah *et al.,* 2017). Previously, only two species *Anthopleura panikkarii* and *A. handi* Dunn, 1978 have been reported from Andaman and Nicobar Islands (Parulekar, 1990; Raghunathan *et al*., 2014). Of the ten recorded species of *Anthopleura* from Indian water, *A. elegantissima*, *A. sola, A. nigrescens, A. anjunae* and *A. asiatica* have conspicuous verrucae, arranged in longitudinal rows from the margin to the limbus (den Hartog and Vennam, 1993; Parulekar, 1968, 1990; England, 1987; Shah *et al.,* 2017). The verrucae of *Anthopleura waridi, A. buddemeieri, A. dixoniana,* and *A. panikkarii,* however, do not spread to the limbus (Biju Kumar *et al.,* 2015; Parulekar, 1969; England, 1987) and are not conspicuously arranged in *A. handi* (Raghunathan *et al*., 2014). Moreover, Choudhury and Raghunathan (2019) studied the internal brooding and larval development of *Anthopleura handi* in India. However, only *A. elegantissima* and *A. nigrescens* engage in asexual reproduction by longitudinal fission (Daly, 2004) and asexual

reproduction is not observed in *A. anjunae* and *A. sola* (den Hartog and Vennam, 1993; Pearse and Francis, 2000). *Anthopleura elegantissima, A. sola, A. buddemeieri,* and *A. dixoniana* all have zooxanthellae (Fautin *et al.,* 2009; Pearse and Francis, 2000), whereas *A. handi, A. anjunae,* and *A. nigrescens* lack all these traits (Fautin *et al.,* 2009; den Hartog and Vennam, 1993) and are not mentioned in *A. panikkarii, A. waridi* and *A. asiatica.*

Members of the genus *Anthopleura* are the most important benthic invertebrates of intertidal habitats including coral reefs, rocky shores and sandy mud areas, residing abundantly in the northeast Pacific Ocean (Ricketts *et al.*, 1985). These sea anemones occupy significant amounts of the intertidal region (Dayton, 1971), preying on zooplankton and benthic invertebrates (Sebens, 198l), and displaying symbiotic associations with zooxanthellae (Fitt *et al.*, 1982). The current study further highlights that *Anthopleura dixoniana* and *A. elegantissima* are widespread and congregate into large groups in the rocky intertidal zone. Aggregating sea anemones from intertidal regions is a fascinating natural phenomenon that provides insight into the behaviour and ecology of these unique marine organisms. Feeding aggregation occurs when sea anemones come together to take advantage of an abundance of food. This often happens when there is a particularly large influx of planktonic organisms in the intertidal zone. Sea anemones aggregate for protection from predators. By clustering together in large numbers, the sea anemones can deter potential predators or make it more difficult for them to attack.

Paracondylactis sinensis demonstrates burrowing behaviour in a sandy habitat, according to the current study. One of the most important roles of burrowing sea anemones is in nutrient cycling. These animals are filter feeders, meaning they capture small food particles that drift by in the water. As they capture and consume these particles, they release waste products into the sediment. This waste material contains nutrients that are essential for the growth of other organisms in the sediment, such as bacteria and other microorganisms. In addition to nutrient cycling, burrowing sea anemones also play a role in the physical structure of sandy bottom ecosystems. Their burrows and tubes create small crevices and spaces within the sediment, which can provide refuge and shelter for other organisms, such as small fish and invertebrates. In the current investigation, crabs were shown to be sheltered in this sea anemone's burrow. Overall, burrowing sea anemones are an important part of sandy bottom ecosystems and contribute to the health and functioning of these environments.

The coastal waters of Andaman and Nicobar Islands are mostly unexplored for a thorough understanding of sea anemone diversity and distribution. Though the islands have a very rich biodiversity in the Indo-Pacific context, the numbers of sea anemone species reported from these oceanic islands are lesser than of species reported from the Indo-Pacific ecoregions. Further studies should be carried out to explore the intertidal zone, one of the most important bio-networks in the world because of its significant role in the marine environment and invertebrates. However, like many other marine organisms, sea anemones are threatened by human activities such as pollution, overfishing, and climate change. It is important to protect these creatures and their habitats so that they can continue to play their vital roles in the ecosystem.

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