



A note on the Sea anemones (Cnidaria: Anthozoa: Actiniaria) of Lakshadweep, Arabian Sea

T Mondal*^{a,b} & C Raghunathan^b

^aZoological Survey of India, Andaman and Nicobar Regional Centre, Port Blair, Andaman and Nicobar Islands – 744 102, India

^bZoological Survey of India, M-Block, New Alipore, Kolkata, West Bengal – 700 053, India

*[E-mail: t_genetics@yahoo.com]

Received 12 March 2022; revised 29 December 2023

Sea anemones are one of the ecologically significant faunal communities in coastal and marine ecosystems of the world along with their economic and biochemical prominence. Despite plentiful significance and roles, the studies on sea anemones are still not made profusely from Lakshadweep. A total of six species of sea anemones are recorded from Lakshadweep based on the present study (five species) and previous literature review, while three species such as *Nemanthus annamensis* Carlgren, 1943, *Phymanthus* sp. (genus level) and *Heteractis aurora* (Quoy and Gaimard, 1833) are reported as new records from these atolls. Morphological descriptions, along with their distributional ranges, are represented in this paper.

[**Keywords:** Atolls, Geographic range, Lakshadweep, New record, Sea anemones]

Introduction

Sea anemones are one of the notable, solitary, benthic cnidarians of reef ecosystems of the world and are found mostly in rocky, sandy, and muddy areas of marine ecosystems, while some are also reported from brackish waters^{1,2}. Sea anemones can be found in various marine habitats across the coastal regions, from shallow tidal pools to the depths of the ocean. These creatures usually cling to solid surfaces like rocks, coral reefs, and sunken shells. Sea anemones are typically found in tropical and temperate waters, certain species have managed to survive in colder, polar areas. They are distributed in all oceanic ecosystems of the world, including the Arctic and Antarctic, from the shallow inter-tidal regions to the greater depths up to the ultra-abyssal region³⁻⁷. They are present in various marine environments worldwide, spanning different latitudes and depths². These habitats include hydrothermal vents, oxygen minimum zones, areas with high turbidity and sedimentation, abyssal whale carcasses, ice shelves, reef habitats, mangroves, seagrasses, and anchialine caves⁸⁻¹⁴. These diploblastic faunal communities are devoid of the hard skeleton but the presence of a fluid-filled cavity defines their structural organization as a hydrostatic frame¹⁵. Being one of the major contributors of the reef ecosystem, sea anemones represent a prime role through ecological association with different sorts of organisms like clown

fishes, hermit crabs, shrimps, including zooxanthellae in terms of mutualism¹⁶. Sea anemones are taking significant roles in the development of economic sustainability due to their huge potentiality in the global aquarium trade¹⁷ while the presence of bio-active compounds in sea anemones encompasses substantial importance in pharmacological studies for the last few decades^{18,19}.

Not many studies on these faunal communities have been carried out in the Indian waters, though the first report of sea anemone was made by Stoliczka in 1869. Some scanty studies were conducted from the Indian waters, which are mostly restricted to the peninsular coastal areas and Andaman and Nicobar Islands²⁰⁻³⁶. Studies on the sea anemones of Lakshadweep were not carried out exclusively. In 1990, Parulekar recorded one species from Lakshadweep waters, while no other studies were made on sea anemones from this area²⁹. Ajith Kumar & Balasubramanian³⁷ reported a bleaching phenomenon from Lakshadweep where a bleaching event was recorded in one species of sea anemone, while Ajith Kumar *et al.*³⁸ and Ajith Kumar³⁹ mentioned two species of sea anemones from Lakshadweep as habitat provider for ornamental anemone shrimps. Present study deals with the reporting of occurrences of sea anemones in Lakshadweep while three species are new additions to this geographic region.

Material and Methods

Study site

Undersea studies were carried out at eleven islands of Lakshadweep from October 2019 to February 2020 (Fig. 1).

Survey and sampling

Surveys were conducted by employing SCUBA diving up to the depth limit of 40 m. The hand-picking method was applied to collect the specimens, while the scalpel was used to detach the foot from the substratum. *In-situ* photography was made using a Canon 1X Mark II camera with underwater housing.

Sample processing and identification

The collected specimens were narcotized by adding 5 % Magnesium chloride ($MgCl_2$) followed by fixation in 10 % Phosphate buffered formalin and preservation in 70 % alcohol⁴⁰. Identification was made in conjunction with available literature of Rodríguez *et al.*², England³⁰, Carlgren⁴¹, Dunn⁴², and Fautin *et al.*^{43,44}.

Results

Five species of sea anemones were identified during the survey period. The morphometric details, along with their distributional ranges, are cited below.

Systematics

Phylum CNIDARIA Hatschek, 1888

Subphylum ANTHOZOA Ehrenberg, 1884

Class HEXACORALLIA Haeckel, 1896

Order ACTINIARIA Hertwig, 1882

Suborder ENTHEMONAE Rodríguez & Daly in Rodríguez *et al.*, 2014

Superfamily METRIDIOIDEA Carlgren, 1893

Family NEMANTHIDAE Carlgren, 1940

Genus *Nemanthus* Carlgren, 1940

1. *Nemanthus annamensis* Carlgren, 1943

Common name

Gorgonian wrapper.

Material examined

32 specimens, *host* - Gorgonian and Antipathirians, *location* - Bangaram Island (Lat.: 10°57'54.2935" N & Long.: 72°17'30.3399" E), Lakshadweep, *depth* - 28 m, *date* - 24.ii.2020, *collector* - Tamal Mondal (Fig. 1).

Description

Found along with the gorgonians and antipathirians as wrapped animals. Pedal disc strongly covered around substrates such as gorgonians and antipathirians. Diameter of the specimen (oral disc) ranged from 20 – 35 mm in live condition (Fig. 2a). Pedal disc wider than oral disc. Tentacles variable in size and shape like, conical, irregular but arranged

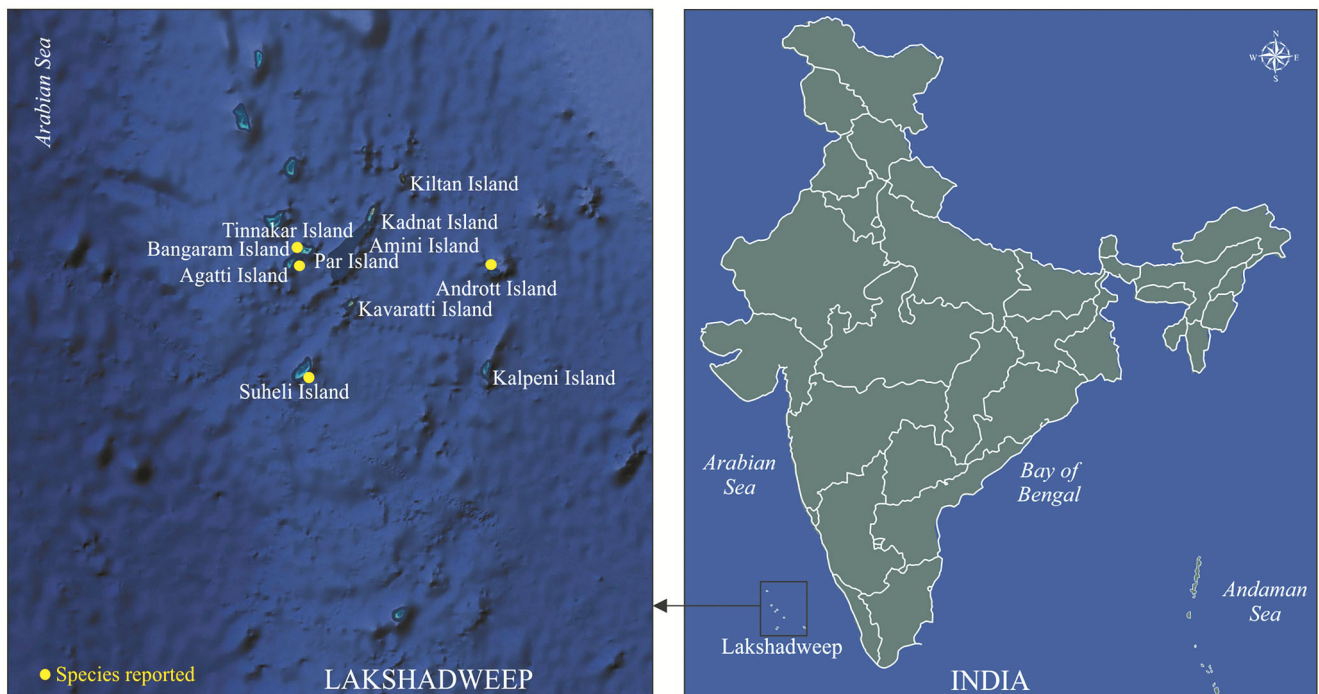


Fig. 1 — Study areas and species reporting sites

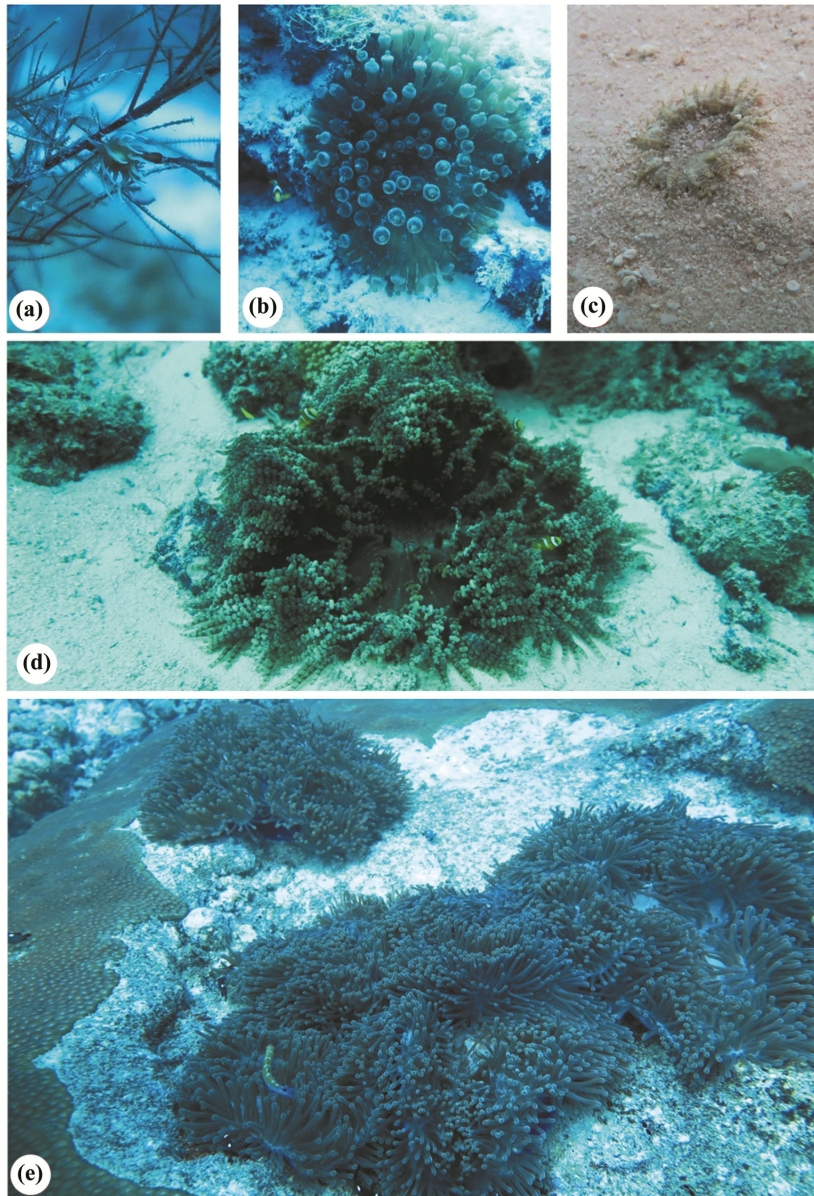


Fig. 2 — Sea anemones of Lakshadweep: a) *Nemanthus annamensis* Carlgren, 1943; b) *Entacmaea quadricolor* (Leuckart in Rüppell & Leuckart, 1828); c) *Phymanthus* sp.; d) *Heteractis aurora* (Quoy and Gaimard, 1833); and e) *Radianthus magnifica* (Quoy and Gaimard, 1833)

hexamerously. Length of the inner tentacles longer than the outer tentacles. Column prominent and smooth and spreading at the distal region. Mouth present in the central region and look like slit-shaped with two distinct siphonoglyphs. Radiating irregular lines in both exocoelic and endocoelic spaces are visible from the mouth to the tentacle base region. Presence of more individuals in a place provides a colony like structure. Animals are dark brown, while the oral disc is light yellow colored. Mouth region orange coloured, while the tentacles are creamy in colour.

Type locality

Gulf of Tonkin, South China⁴⁵.

Distribution

India-Andaman & Nicobar Islands³⁴ and Lakshadweep (present report); *Elsewhere*-Vietnam, Cambodia, Kenya, Seychelles, Maldives, Indonesia, Philippines and Palau^{46,47}.

Remarks

New distributional record to Lakshadweep.

Superfamily ACTINIOIDEA Rafinesque, 1815

Family ACTINIIDAE Rafinesque, 1815

Genus *Entacmaea* Ehrenberg, 1834

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

Synonyms

Entacmaea quadricolor (Leuckart in Rüppell & Leuckart, 1828); *Actinia (Entacmaea) quadricolor* Leuckart in Rüppell & Leuckart, 1828; *Actinia quadricolor* Leuckart in Rüppell & Leuckart, 1828; *Actinia vasa* Quoy & Gaimard: de Blainville, 1830; *Actinia (Entacmaea) adhaerens* Hemprich & Ehrenberg in Ehrenberg, 1834; *Actinia (Entacmaea) helianthus* Hemprich & Ehrenberg in Ehrenberg, 1834; *Actinia (Isacmaea) erythrosoma* Hemprich & Ehrenberg in Ehrenberg, 1834; *Condylactis erythrosoma* (Hemprich & Ehrenberg in Ehrenberg, 1834); *Gyrostoma helianthus* (Hemprich & Ehrenberg in Ehrenberg, 1834); *Isacmaea erythrosoma* (Hemprich & Ehrenberg in Ehrenberg, 1834); *Gyrostoma (Stoichactis) helianthus* (Hemprich & Ehrenberg in Ehrenberg, 1834); *Gyrostoma (Stoichactis) quadricolor*; *Gyrostoma adhaerens* (Hemprich & Ehrenberg); *Gyrostoma adherens* (Ehrenberg, 1834); *Gyrostoma erythrosoma* (Hemprich & Ehrenberg); *Actinia (Tristephanus) ehrenbergii* Brandt, 1835; *Actinia ehrenbergii* Brandt, 1835; *Gyrostoma erythrosoma* (Hemprich & Ehrenberg, 1851); *Actinia quadricolor*; *Actinia vas*; *Actinia vasum*; *Anemonia adhaerens* Ehrenberg; *Anemonia adherens*; *Anemonia erythrosoma* Ehrenberg; *Crambactis arabica* Haeckel, 1876; *Anemonia kwoiam* Haddon & Shackleton, 1893; *Physobranchia douglasi* Saville-Kent, 1893; *Gyrostoma hertwigi*; *Heteractis gelam* (Haddon & Shackleton, 1893); *Physobranchia ramsayi* (Haddon & Shackleton, 1893); *Gyrostoma helianthus*; *Gyrostoma kwoiam* (Haddon & Shackleton, 1893); *Radianthus gelam* (Haddon & Shackleton, 1893); *Entacmaea quadricolor*; *Entacmaea ramsayi* (Haddon & Shackleton, 1893); *Anemonia ramsayi* (Haddon & Shackleton, 1893); *Condylactis ramsayi* Haddon & Shackleton, 1893; *Gyrostoma hertwigi* Kwietniewski, 1897; *Gyrostoma stuhlmanni* Carlgren, 1900; *Cymbactis maxima* Wassilieff, 1908; *Antheopsis carlgreni* Lager, 1911; *Radianthus carlgreni* (Lager, 1911); *Gyrostoma sulcatum* Lager, 1911; *Aulactinia gelam* (Haddon & Shackleton); *Cereactis quadricolor* Leuckart; *Corynactis quadricolor* Leuckart; *Corynactis vas* Quoy & Gaimard; *Crambactis Arabica*; *Entacmaea (Parascyconis) actinostoloides*; *Entacmaea adhaerens* Hemprich & Ehrenberg; *Entacmaea quadricolor sol*;

Gyrostoma haddoni Lager, 1911; *Physobranchia ramsayi* Mariscal, 1970; *Gyrostoma quadricolor*; *Gyrostoma ramsayi* (Haddon & Shackleton); *Isactinia (Anemonia) kwoiam* (Hadd. & Shackl.); *Melactis vas*; *Metactis vas*; *Parascyconis maxima*; *Paractis adhaerens*; *Paractis ehrenbergii* Br.; *Paractis erythrosoma*; *Paractis helianthus*; *Psychobranchia douglasi*; *Ropalactis vas* Quoy & Gaimard (adapted from Daly & Fautin, 2020).

Common name

Bubble-tip anemone.

Material examined

One specimen, *substrate* - chain of buoy, *location* - Andrott Island (Lat.: 10°49'14.0083" N & Long.: 73°40'44.3815" E), Lakshadweep, *depth* - 25 m, *date* - 23.x.2019 (Fig. 2b); One specimen, *substrate* - dead reef, *location* - Bangaram Island (Lat.: 10°58'3.0377" N & Long.: 72°16'49.6098" E), Lakshadweep, *depth* - 22 m, *date*- 24.ii.2020 (Fig. 1).

Description

Column smooth and narrow in comparison with pedal disc as well as the oral disc (Fig. 2b). This species is found as a strong attachment with the substratum and showed a tendency as a hidden life form. Body colour reddish or greenish, while sometimes brown. Tentacles with reprinting bright colouration, which can be seen as sparking red, green, or brown with the reflection of light. Only tentacles are visible from the outside, while the columns are usually seen as hidden. The oval-shaped mouth is present at the centre of the flattened oral disc. Oral disc flat, broader than the pedal disc, so the column flares. Tentacles sometimes seen as bulbous at the tip with a terminal bud. A pigmented tip may be seen at the end of the tentacle bud. The tentacles of the inner region are 2 to 3 times longer than marginal tentacles.

Type locality

Suez, the Red Sea, Egypt; deposited at Senckenberg Museum [Catalog number 34 (SMF-34) 60 as *Actinia quadricolor*]^{42,43}.

Distribution

India-Andaman & Nicobar Islands²⁴ and Lakshadweep³⁰; Elsewhere-Micronesia, Melanesia, South Africa, Antigua and Barbuda, Madagascar, Kenya, Seychelles, Red Sea, Israel, Oman, Saudi Arabia, Egypt, Maldives, Australia, Guam, Fiji, New Caledonia, Tanzania, Myanmar, Indonesia, Malaysia, Hong Kong, Japan, Thailand, Philippines, Palau, Viet

Nam, Vanuatu, Solomon Island, Marshall Islands, Papua New Guinea, Cook Islands, American Samoa, Taiwan, Singapore and Sri Lanka^{42,44-48}.

Family PHYMANTHIDAE Andres, 1883

Genus *Phymanthus* Milne Edwards & Haime, 1851

3. *Phymanthus* sp.

Common name

Sea anemone of the sand.

Material examined

One specimen, *substrate*-sand (in embedded condition), *location* – Suheli Island (Lat.: 10°2'45.8742" N & Long.: 72°17'17.3785" E), Lakshadweep, *depth* - 1.5 m, *date*- 17.x.2019 (Fig. 1).

Description

Oral disc, along with tentacles, fully exposed in a shallow coastal area (Fig. 2c). Colour of the animal is light creamy orange, while the oral disc is whitish with light brown. Diameter of the oral disc is about 30 cm. This is a completely sessile form. Sometimes covered with a thin layer of sand. An adhesive disc can be seen in the inner solid layer of the sand bed. Many uneven radial rows of papillae or tubercles of several sizes cover the oral disc. Structural differentiation is seen among the tentacles, such as wart-like structures among the smaller forms and conical and papilliform for longer ones. Base of tentacles comparatively more reddish-brown than the terminal portion. Radial lines are present. Small mouth is present with two siphonoglyphs.

Remarks

New distributional record of the genus to Lakshadweep.

Family STICHODACTYLIDAE Andres, 1883

Genus *Heteractis* Milne Edwards, 1857

4. *Heteractis aurora* (Quoy and Gaimard, 1833)

Synonyms

Actinia aurora Quoy & Gaimard, 1833; *Antheopsis koseirensis* Klunzinger, 1877; *Bunodes koseirensis* Klunzinger, 1877; *Radianthus koseiriensis* (Klunzinger, 1877); *Ixalactis simplex* Haddon, 1898; *Radianthus (Antheopsis) koseirensis*; *Radianthus (Antheopsis) koseirensis conspersa*; *Radianthus (Antheopsis) koseirensis maculate*; *Radianthus koseirensis*; *Radianthus simplex* (Haddon & Shackleton) and *Antheopsis koseirensis var. maculata* Krempf, 1905 (adapted from Daly & Fautin, 2020).

Common name

Beaded sea anemone, Carpet anemone, Flat anemone, Corn anemone, etc.

Material examined

One specimen, *substrate* - sandy bottom, *location* - Agatti Island (Lat.: 10°52'25.449" N & Long.: 72°12'34.6068" E), Lakshadweep, *depth* – 19 m, *date* – 04.xi.2019 (Fig. 1).

Description

Greenish spread oral disc along with tentacles (Fig. 2d). Surface of the oral disc is seen with a wavy pattern based on the substratum surface structure. Diameter of the oral disc measured around 22 cm in in-situ condition. Base circular and orange in colour. Columns smooth in the lower region, while light-coloured verrucae are seen in the marginal areas. Tentacles are moniliform in structure and scattered in an arrangement in the oral disc and denser in marginal areas. These are dark green coloured at the base region of the oral disc. Frosted white-coloured beaded structures are arranged in a regular pattern while the gap region of the two beads is thin. Light cream or green-coloured radial stripes are visible on the oral disc. Presence of oval-shaped mouth with two even siphonoglyphs.

Type locality

Syntypes not found - New Guinea, Manokwari; syntypes not found - Papua New Guinea, New Ireland⁴⁹.

Distribution

India - Tamil Nadu and Andaman & Nicobar Islands^{23,24,42} and Lakshadweep (present report); *Elsewhere* - Micronesia, Melanesia, Mozambique, Egypt, Seychelles, Tanzania, Yemen, Saudi Arabia, Iran, Oman, Maldives, Red Sea, South Africa, Australia, Philippines, Hong Kong, Indonesia, Malaysia, Fiji, Palau, Japan and Ryukyu Island, Vanuatu, Guam, United States of America, Papua New Guinea, Solomon Islands, Viet Nam and Marshall Islands^{46,47}.

Remarks

New distributional record to Lakshadweep.

5. *Radianthus magnifica* (Quoy & Gaimard, 1833)

Synonyms

Actinia magnifica Quoy & Gaimard, 1833; *Corynactis magnifica* (Quoy & Gaimard, 1833); *Radianthus magnifica* (Quoy & Gaimard, 1833);

Ropalactis magnifica (Quoy & Gaimard, 1833); *Heteractis ritteri* (Kwietniewski, 1897); *Radianthus ritteri* (Kwietniewski, 1897); *Helianthopsis ritteri* Kwietniewski, 1898; *Helianthopsis mabrucki* Carlgren, 1900; *Radianthus mabrucki* (Carlgren, 1900); *Antheopsis ritteri* Kwietniewski; *Radianthus paumotensis* (Couthouy) (adapted from Daly & Fautin, 2020).

Common name

Magnificent sea anemone or Ritteri anemone.

Material examined

Five specimens, *substrate* - coral reefs, *location* - Agatti Island (Lat.: 10°49'33.4872" N & Long.: 72°10'59.6897" E), Lakshadweep, *depth* - 12 – 28 m, *date* - 22.ii.2020 (Fig. 1); 17 specimens, *substrate* - coral reefs, *location* - Bangaram Island (Lat.: 10°55'11.454" N & Long.: 72°16'7.7103" E), Lakshadweep, *depth* - 15 – 24 m, *date* - 23.ii.2020 (Fig. 1).

Description

Funnel-shaped in overall structure and round-shaped and brown-colored oral disc (Fig. 2e). Diameter of the oral disc range between 15 to 43 cm. Base of the animal is toughly adherent to the substratum (coral reefs) with a sticky foot, which is variable in colours like brown or rich brown or magenta or sky blue or purple, etc. Mouth comparatively large and oval-shaped and present at the centre of the oral disc. Presence of two symmetrical siphonoglyphs in the mouth. Presence of prominent verrucae. Tentacles digitiform, long and blunt, or somewhat bulb-shaped at the terminal region, which is fluorescent green, light brown, or white. Longitudinal stripes are visible. Exocoelic and endocoelic tentacles are identical.

Type locality

Vanikoro, Santa Cruz Islands, Solomon Islands; deposited at Museum National d'Histoire Naturelle^{50,51}.

Distribution

India - Tamil Nadu, Andaman & Nicobar Islands and Lakshadweep^{32,33,37,52}; *Elsewhere* - French Polynesia, Tanzania, Micronesia, Kenya, Mozambique, Seychelles, South Africa, Madagascar, Israel, Sudan, Egypt, South Africa, Mayotte, Maldives, Australia, Singapore, Malaysia, Indonesia, Denmark, Philippines, Fiji, Thailand, Viet Nam, Palau, Vanuatu, Cambodia, Comoros, Ryukyu Island,

Papua New Guinea, Marshall Islands, Solomon Islands, Japan, Sri Lanka, Guam, China, Chistmas Island, and American Samoa^{46,47}.

Remarks

Frequently recorded in Lakshadweep.

A total of six species of sea anemones are recorded from Lakshadweep based on the earlier literature studies and the present study. Among these six species, two species such as *Glyphoperidium bursa* Roule, 1909, *Entacmaea quadricolor* (Leuckart in Rüppell & Leuckart, 1828) and *Radianthus magnifica* (Quoy and Gaimard, 1833) were documented previously. No more records are available on the sea anemones from Lakshadweep. During the present study, five species of sea anemones are documented from Lakshadweep, which includes three species as the addition to the faunal diversity of the Lakshadweep as a new report to this Union Territory. The detailed list of sea anemones reported from Lakshadweep is represented in Table 1.

Discussion

The exploration of the actiniarian sea anemone fauna of Lakshadweep was first made by Parulekar (1990)²⁹ based on the report of *Glyphostylum calyx* Roule, 1909 which was synonymized and presently accepted as *Glyphoperidium bursa* Roule, 1909. After that, several studies were made on the reef ecosystems of Lakshadweep, but no studies were worth mentioning sea anemone species from this region. In 2008, George⁵³ carried out detailed studies on the community structure and abundance of the coral reefs of Lakshadweep based on the Line Intercept Transect (LIT) studies and stated the availability of sea anemones from the study areas without stating the species-level identification. In 2012, Ajith Kumar & Balasubramanian³⁷ carried out ecological studies on the bleaching event on the reef ecosystem of Agatti Island of Lakshadweep and found that 87.5 % bleaching took place among the coral reef-associated organisms like sea anemones. In this study, they only mentioned one species of sea anemone *i.e.* *Radianthus magnifica* (Quoy & Gaimard, 1833), as bleached colonies. Ajith Kumar *et al.*³⁸ successfully carried out hatchery production of a clownfish *i.e.* *Amphiprion nigripes*, which was collected from the *R. magnifica* of Agatti Island. In 2014, Ajith Kumar³⁹ represented images of two species of sea anemones such as *R. magnifica* and *Entacmaea quadricolor* (Leuckart in Rüppell & Leuckart, 1828), while discussing the

Table 1 — Occurrence of Sea anemones of Lakshadweep

Sl. No.	Species	Distribution in India	Reported during present study	Remarks
	Phylum CNIDARIA Verrill, 1865 Class ANTHOZOA Ehrenberg, 1884 Subclass HEXACORALLIA Haeckel, 1896 Order ACTINIARIA Hertwig, 1882 Suborder ENTHEMONAE Rodriguez & Daly in Rodriguez <i>et al.</i> , 2014 Family NEMANTHIDAE Carlgren, 1940 Genus <i>Nemanthus</i> Carlgren, 1940			
1	<i>Nemanthus annamensis</i> Carlgren, 1943		Yes	New record to Lakshadweep
	Family ACTINIIDAE Rafinesque, 1815 Genus <i>Entacmaea</i> Ehrenberg, 1834			
2	<i>Entacmaea quadricolor</i> (Leuckart in Rüppell & Leuckart, 1828)	A & N Islands (Raghunathan <i>et al.</i> ²⁴) and Lakshadweep (Ajith Kumar ³⁰)	Yes	
	Genus <i>Glyphoperidium</i> Roule, 1909			
3	<i>Glyphoperidium bursa</i> Roule, 1909	Kerala and Lakshadweep (Parulekar ²⁰)		
	Family PHYMANTHIDAE Andres, 1883 Genus <i>Phymanthus</i> Milne Edwards & Haime, 1851			
4	<i>Phymanthus</i> sp. (Andrès, 1883)	A & N Islands (Choudhury ²⁶) and Lakshadweep	Yes	New record to Lakshadweep
	Family STICHODACTYLIDAE Andres, 1883 Genus <i>Heteractis</i> Milne Edwards, 1857			
5	<i>Heteractis aurora</i> (Quoy & Gaimard, 1833)	A&N Islands (Madhu & Madhu ²³), Tamil Nadu (Bragadeeswaran <i>et al.</i> ⁴²) and Lakshadweep	Yes	New record to Lakshadweep
6	<i>Radianthus magnifica</i> (Quoy & Gaimard, 1833)	Tamil Nadu (Bragadeeswaran <i>et al.</i> ⁴²), Lakshadweep (Ajith Kumar & Balasubramanian ²⁸) and A&N Islands (Raghunathan <i>et al.</i> ²⁴)	Yes	

marine biodiversity of Lakshadweep along with the great potential and opportunity of ornamental fish and shrimp culture. The recent global database implies a total of 1174 species, and a total of 71 species are documented as valid and extant from Indian waters⁵⁴. India is endowed with two major island ecosystems viz. A&N Islands and Lakshadweep inhabiting two major types of reef habitats like fringing in A&N Islands and atolls in Lakshadweep. The thorough investigation of sea anemone studies revealed a total of 31 species from A&N Island, while Lakshadweep represents only six species, including the present study, which is extensively less in terms of species inventory. Comprehensive studies are required to document more species from this archipelago.

Conclusion

The studies on sea anemones have not profusely carried out in the coral reefs regions of Lakshadweep atoll till now, apart from some scanty reports with a maximum of three species. The extraordinary coloration, notable symbiotic

relationship in coral reef habitat, ecological contribution, presence of biochemical and pharmaceutical components, the high demand for aquarium trade, defines their significant role for extensive studies across the world. During the present study, a total of five species of sea anemones, such as *Nemanthus annamensis* Carlgren, 1943, *Entacmaea quadricolor* (Leuckart in Rüppell & Leuckart, 1828), *Phymanthus* sp., *Heteractis aurora* (Quoy and Gaimard, 1833), and *Radianthus magnifica* (Quoy and Gaimard, 1833) are documented from Lakshadweep atoll. Among these, three species viz., *N. annamensis*, *Phymanthus* sp. (genus level), and *H. aurora* are found as new distributional records to Lakshadweep.

Acknowledgements

The authors are thankful to the Director, Zoological Survey of India, Kolkata for her support and encouragements. The financial assistance provided by the Ministry of Environment, Forest and Climate Change, Government of India, and logistic support

extended by the Department of Environment and Forests, Lakshadweep administration is also duly acknowledged. The authors are thankful to the team member of the field survey of Lakshadweep for their support during undersea studies.

Conflict of Interest

There is no competing or conflict of interest for this research.

Ethical Statement

Not required.

Author Contribution

TM-Field survey, methodologies, sample collection, data accumulation and interpretation, writing and review of the manuscript; and CR-Data interpretation, writing and review of the manuscript.

References

- Barnes R D, *Invertebrate Zoology*, 4th Edn, (Saunders Collage Pub, Philadelphia), 1982, pp. 1089.
- Rodríguez E, Barbeitos M S, Brugler M R, Crowley L M, Grajales A, *et al.*, 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) (2014) p. e96998. <https://doi.org/10.1371/journal.pone.0096998>
- Lopez-Gonzalez P J, Rodríguez E, Gili J M & Segonzac M, New records on sea anemones (Anthozoa: Actiniaria) from hydrothermal vents and cold seeps, *Zool Verh Leiden*, 345 (2003) 215-243.
- Sanamyan N P & Sanamyan K E, Deep-water Actiniaria from East Pacific hydrothermal vents and cold seeps, *Invert Zool*, 4 (1) (2007) 83–102. <https://doi.org/10.15298/invertzool.04.1.07>
- Daly M & Gusmao L, The first sea anemone (Cnidaria: Anthozoa: Actiniaria) from a whale fall, *J Nat Hist*, 41 (1-4) (2007) 1-11. <https://doi.org/10.1080/00222930601121775>
- Fautin D G & Hand C, Actiniaria, In: *The Light and Smith Manual: Intertidal Invertebrates from Central California to Oregon*, edited by Carlton J T, 4th Edn, (University of California Press, Los Angeles, California), 2007, pp. 134–145.
- Eash-Loucks W E & Fautin D G, Taxonomy and distribution of sea anemones (Cnidaria: Actiniaria and Corallimorpharia) from deep water of the northeastern Pacific, *Zootaxa*, 3375 (1) (2012) 1-80. <https://doi.org/10.11646/zootaxa.3375.1.1>
- Daly M, Gusmao L C, Reft A J & Rodríguez E, Phylogenetic signal in mitochondrial and nuclear markers in sea anemones (Cnidaria, Actiniaria), *Integr Comp Biol*, 50 (3) (2010) 371-88. <https://doi.org/10.1093/icb/icq081>
- Daly M, Chaudhuri A, Gusmao L & Rodríguez E, Phylogenetic relationships among sea anemones (Cnidaria: Anthozoa: Actiniaria), *Mol Phylogenet Evol*, 48 (1) (2008) 292-301. <https://doi.org/10.1016/j.ympev.2008.02.022>
- Gusmao L C & Rodríguez E, Deep-sea anemones (Cnidaria: Anthozoa: Actiniaria) from the South Atlantic, *Bull Am Mus Nat Hist*, 444 (1) (2021) 1-69. <https://doi.org/10.1206/0003-0090.444.1.1>
- Rodríguez E & Daly M, Phylogenetic relationships among deep-sea and chemosynthetic sea anemones: Actinoscyphiidae and Actinostolidae (Actiniaria: Mesomyaria), *PLoS One* 5 (6) (2010) p. e10958. <https://doi.org/10.1371/journal.pone.0010958>
- Daly M, Brugler M R, Cartwright P, Collins A G, Dawson M N, *et al.*, The phylum Cnidaria: a review of phylogenetic patterns and diversity 300 years after Linnaeus, *Zootaxa*, 1668 (2007) 127–182.
- Durán-Fuentes J, Gracia A & González-Muñoz R, Sea anemones (Cnidaria, Anthozoa, Actiniaria) in high sedimentation environments influenced by the Magdalena River (Colombian Caribbean), *An Acad Bras Ciênc*, 94 (1) (2022) p. e20190862. <https://doi.org/10.1590/0001-3765202120190862>
- McFadden C S, Quattrini A M, Brugler M R, Cowman P F, Dueñas L F, *et al.*, Phylogenomics, origin, and diversification of Anthozoans (Phylum Cnidaria), *Syst Biol*, 70 (2021) 635-647. <https://doi.org/10.1093/sysbio/syaa103>
- Fautin D G & Mariscal R N, Cnidaria: Anthozoa, In: *Microscopic anatomy of invertebrates*, edited by Harrison F W & Westfall J A, (Wiley, New York), 1991, pp. 267–358.
- Fautin D G & Allen G R, *A field guide to anemonefishes and their host anemones*, (Western Australian Museum), 1992, pp. 65. https://eqzotica.ucoz.ru/_id/0/9_ANEMONES.pdf
- Chapman F A, Fitz-Coy S A, Thunberg E M & Adams C M, United States of America trade in ornamental fish, *J W Aquacul Soc*, 28 (1997) 1-10.
- Hamayeli H, Hassanshahian M & Askari Hesni M, The antibacterial and antibiofilm activity of sea anemone (*Stichodactyla haddoni*) against antibiotic-resistant bacteria and characterization of bioactive metabolites, *Int Aquat Res*, 11 (2019) 85-97. <https://doi.org/10.1007/s40071-019-0221-1>
- Bulati M, Longo A, Masullo T, Vlah S, Bennici C, *et al.*, Partially Purified Extracts of Sea Anemone *Anemonia viridis* Affect the Growth and Viability of Selected Tumour Cell Lines, *Biomed Res Int*, 2016 (2016) 1-12. <https://doi.org/10.1155/2016/3849897>
- Annandale N, The fauna of brackish ponds at Port Canning, Lower Bengal, P.1, *Rec Indian Mus*, 1 (1907) 45-74.
- Carlgren O, A revision of the Actiniaria of the Chilka Lake, *Ark Zool*, 17A (1925) 1-21.
- Panikkar N K, On two new halcampactid Actiniaria from Madras brackish waters, *Curr Sci*, 4 (1935) 177-178.
- Panikkar N K, Studies on the brackish-water anemone *Pelocoetes exul* Annandale, and on a new marine species from Madras, *Proc Zool Soc, London*, 108 B (1938) 669-688.
- Parulekar A H, Two new species of sea anemones (Actiniaria) from Maharashtra, *J Bom Nat Hist Soc*, 64 (1967) 524-529.
- Parulekar A H, Sea anemones (Actiniaria) of Bombay, *J Bom Nat Hist Soc*, 65 (1968) 138-147.
- Parulekar A H, *Neoaipiasia commensali* gen et sp nov: An actiniarian commensal of hermit crab, *J Bom Nat Hist Soc*, 66 (1969) 57-62.
- Parulekar A H, On a new species of sea anemone from Maharashtra, India, *J Bom Nat Hist Soc*, 66 (1969) 590-595.
- Parulekar A H, A new sea anemone, *Cribrinopsis robertii* (Endomyaria: Actiniidae) from Maharashtra and Goa coast, *J Bom Nat Hist Soc*, 68 (1971) 291-295.

- 29 Parulekar A H, Actiniarian sea anemone fauna of India, In: *Marine Bio fouling and Power Plants*, edited by Niltil K V K & Venegopalan V P, Proceeding of marine biodeterioration with reference to power plant cooling systems, IGCAR, Kalpakkam, 1990, pp. 218-228.
- 30 England K W, Redefinitions and systematics of *Heteractis aurora*, the genera *Heteractis* and *Radianthus*, and the family Heteractidae (Cnidaria: Actiniaria), *Indo-Malayan Zool*, 5 (1988) 45-55.
- 31 Den Hartog J C & Vennam J, Some Actiniaria (Cnidaria: Anthozoa) from the west coast of India, *Zool Med*, 67 (1993) 601-637.
- 32 Madhu R & Madhu K, Occurrence of anemone fishes and host sea anemones in Andaman and Nicobar Islands, *J Mar Biol Assoc India*, 49 (2007) 118-126.
- 33 Raghunathan C, Raghuraman R, Choudhury S & Venkataraman K, Diversity and distribution of sea anemones in India with special reference to Andaman and Nicobar Islands, *Rec Zool Surv India*, 114 (2014) 269-294.
- 34 Choudhury S, Raghunathan C & Venkataraman K, First record of black coral associated Sea anemone (*Nemanthus annamensis* Carlgren 1943; Family Nemanthidae) from India, *Rec Zool Surv India*, 115 (2015) 351-356.
- 35 Choudhury S, *Bionomics of Sea Anemones from Andaman Islands, India*, Ph.D. Thesis, Pondicherry University, 2017, pp. 1-391.
- 36 Choudhury S & Raghunathan C, New records of Actiniarian sea anemones in Andaman and Nicobar Islands, India, *Proc Int Acad Ecol Environ Sci*, 8 (2018) 83-98.
- 37 Ajith Kumar T T & Balasubramanian T, Bleaching of Corals in Agatti-Lakshadweep, India: A window view, In: *Proceedings of the 12th International Coral Reef Symposium, Cairns, Australia*, 9-13 July 2012, 9A Coral Bleaching and Climate change, 2012, pp. 1-4.
- 38 Ajith Kumar T T, Gopi M, Dhaneesh K V, Vinoth R, Ghosh S, *et al.*, Hatchery production of the clownfish *Amphiprion nigripes* at Agatti Island, Lakshadweep, India, *J Environ Biol*, 33 (2012) 623-628.
- 39 Ajith Kumar T T, Glimpses of Marine Biodiversity of Lakshadweep, In: *Proceedings of UP State Biodiversity Board: International Day for Biological Diversity (Island Biodiversity)*, 2014, pp. 1-8.
- 40 Hausserman V, Identification and taxonomy of soft-bodied hexacorals exemplified by Chilean sea anemones; including guidelines for sampling, preservation and examination, *J Mar Biol Assoc, UK*, 84 (2004) 931-936.
- 41 Carlgren O, East-Asiatic Corallimorpharia and Actiniaria, *Kongl Vetensk Acad Handl*, 20 (1943) 1-43.
- 42 Dunn D F, The clownfish sea anemones: Stichodactylidae (Coelenterata: Actiniaria) and other sea anemones symbiotic with pomacentrid fishes, *Trans Am Philos Soc*, 71 (1981) 1-115.
- 43 Fautin D G, Crowther A L & Wallace C C, Sea anemones (Cnidaria: Anthozoa: Actiniaria) of Moreton Bay, In: *Proceedings of the 13th International Marine Biological Workshop: The Marine Fauna and Flora of Moreton Bay, Queensland, Memoirs of the Queensland Museum - Nature*, edited by Davie P J F & Phillips J A, 54 (1) (2008) 35-64.
- 44 Fautin D G, Tan S H & Tan R, Sea anemones (Cnidaria: Actiniaria) of Singapore: Abundant and well-known shallow-water species, *Raff Bull Zool*, 22 (2009) 121-143.
- 45 Carlgren O, East-Asiatic Corallimorpharia and Actiniaria, *Kongl Vetensk Acad Handl*, 20 (1943) 1-43.
- 46 GBIF, *GBIF Home Page*, Available online at: <http://www.gbif.org>, (Accessed on 2023).
- 47 Palomares M L D & Pauly D (Eds), *SeaLifeBase*, World Wide Web electronic publication, Available online at: www.sealifebase.org, (Accessed on 2023).
- 48 GBIF, Senckenberg: Collection Cnidaria SMF, Retrieved on October 25, 2016, from <http://www.gbif.org/occurrence/207633496>, 2016.
- 49 Fautin D G, Catalog to families, genera, and species of orders Actiniaria and Corallimorpharia (Cnidaria: Anthozoa), *Zootaxa*, 4145 (2016) 1-449.
- 50 Quoy J R C & Gaimard P, Voyage de Découvertes de l'Astrolabe Exécuté par Ordre du Roi, Pendant les Années 1826-1829, Sous le Commandement de M, *J Dumont D'Urville*, 4 (1833) 1-390.
- 51 Wolstenholme J K & Wallace C C, Australian anemones final report accompanied by attribution database of Australian anemones on CD, Unpublished report to the Department of Environment and Heritage, *Mus Trop Queens, Townsville*, 2004.
- 52 Bragadeeswaran S, Sangappellai T, Prabhu K & Sophia Rani S R, Antifouling activity by sea anemone (*Heteractis magnifica* and *H. aurora*) extracts against marine biofilm bacteria, *Lat Am J Aquat Res*, 39 (2011) 385-389.
- 53 George A M, Abundance and community structure of reef building Corals in Lakshadweep Islands, India, *Atoll Res Bull No*, 563 (2008) 1-14.
- 54 Rodríguez E, Fautin D & Daly M, *World List of Actiniaria*, Available online at: <https://www.marinespecies.org/aphia.php?p=taxdetails&id=1360> (Accessed on January, 28 2024).