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RESEARCH ARTICLE

First record of *Calyptotheca alexandriensis* (Cheilostomatida, Lanceoporidae) from Ras Juddi (Pasni) Makran coast, Northern Arabian Sea

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ABSTRACT

The available information regarding bryozoans in coastal areas of Pakistan is limited. This research paper presents the first record of *Calyptotheca alexandriensis* from Ras Juddi (Pasni) along the Makran coast, and the second record globally of this species. This species was first reported in the Eastern Harbor of Alexandria, Egypt, as a distinctive deep orange erect foliaceous bryozoan and was observed abundantly on various hard substrates, such as rocks, ropes, metal pipes supporting marina piers, and ship hulls. The discovery adds a new record of the family, Lanceoporidae, and genus, *Calyptotheca*, to the bryozoan fauna of Pakistan, expanding its known distribution to the Northern Arabian Sea. The present specimens were collected during December 2021–October 2022 and subjected to detailed taxonomic analysis using light microscopy and scanning electron microscopy (SEM). This study contributes to the understanding of bryozoan biodiversity in the region and highlights the potential for further discoveries along the unexplored coastal areas of Pakistan.

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Introduction

Calyptotheca alexandriensis Abdel-Salam, Taylor & Dorgham, 2017 is a bryozoan belonging to the family Lanceoporidae within the order Cheilostomatida. Cheilostomes are the dominant order of living bryozoans, highly diverse, abundant and including species with a wide variety of colony-forms.

Family Lanceoporidae comprises 4 genera, of which *Calyptotheca* contains at least 61 living species according to Bock (2024) a fossil record extending back to the Oligocene (Guha & Gopikrishna, 2007) while Anonymous (2025) documented 58 living species and 4 fossil records. The genus *Calyptotheca* exhibits a global distribution, occurring in both tropical and temperate marine waters (Bock, 2025). These species are found in various regions, including the Mediterranean, the North Atlantic and the North Pacific, with a significant concentration in the Indo-West Pacific in which the most diverse area is Southeast Asia through Papua New Guinea and the Torres Strait, with thirteen species that are unknown elsewhere. (Cumming & Tilbrook, 2014; Bock, 2024).

Fourteen species of *Calyptotheca* have been recorded from the Indian Ocean, including *C. anceps* (MacGillivray, 1879), *C. australis* (Haswell, 1881), *C.hastingsae* (Harmer, 1957), *C. inclusa* (Thornely, 1906), *C. lata* (MacGillivray, 1883), *C. nivea* (Busk, 1884), *C.perpendiculata* (Tilbrook, 2006), *C.porelliformis* (Waters, 1918), *C. subimmersa* (MacGillivray, 1879), *C. triangula* (Hincks, 1881), *C. triangula* (Canu & Bassler, 1928), *C. triquetra* (Harmer, 1957), *C. variolosa* (MacGillivray, 1869), *C. wasinensis* (Waters, 1913) (Florence et al., 2007; Ostrovsky et al., 2011; Boonzaaier, 2017; Sanjay et al., 2021; National Oceanic & Atmospheric Administration, 2024; Anonymous, 2025).

Calyptotheca alexandriensis was first reported in the Eastern Harbor of Alexandria, the Mediterranean Sea, Egypt, as a distinctive deep orange erect foliaceous bryozoan by (Abdelsalam et al., 2017). It was abundantly observed on various hard substrates, such as rocks, ropes, metal pipes supporting marina piers, and ship hulls.

Available information regarding bryozoans in coastal areas of Pakistan is limited. Research on this group has primarily been conducted by Karim (1970), Menon (1973), Ahmed et al. (1978), Haq et al. (1978), Javed (1990), Javed & Tirmizi (1993), Javed & Mustaquim (1995), Ali (2006), Baig (2014), Aslam et al. (2019) and Kazmi et al. (2022). A total of 32 species, 21 genera and 17 bryozoan families have been recorded from the coast of Pakistan. The family Lanceoporidae has never been recorded in the coastal areas of Pakistan. The current study present the first record of *C. alexandriensis* found at Ras Juddi (Pasni) along the Makran coast, Balochistan. It expands the distribution of *C. alexandriensis* to the Northern Arabian Sea.

Material and Methods

Colonies of *Calyptotheca alexandriensis* were collected from the intertidal zone at Ras Juddi, Makran coast (25°13'25" N 63°30'15" E) (Figure 1) between December 2021 and October 2022.

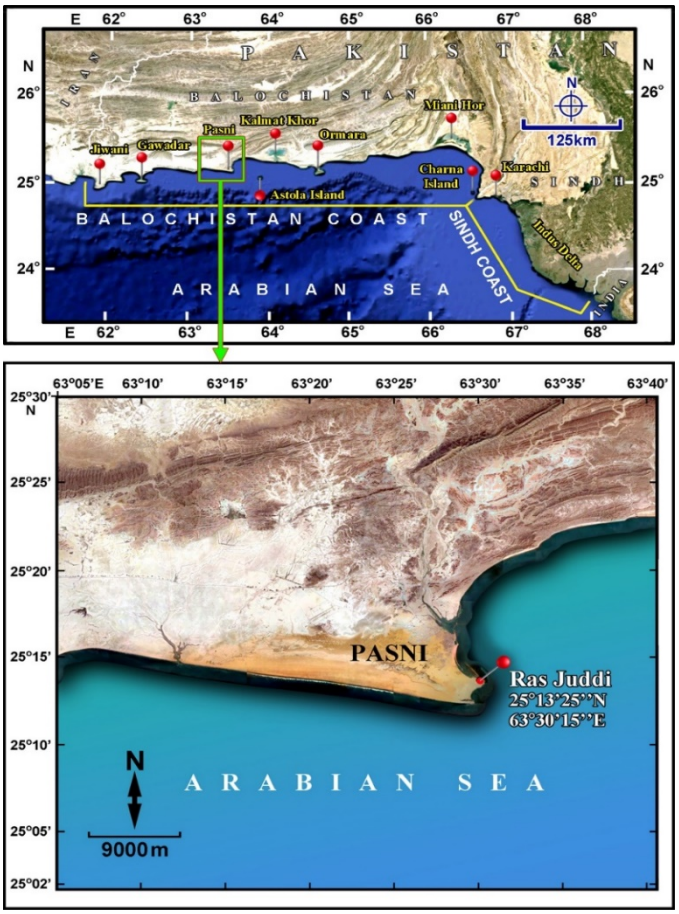

Figure 1. Map of the study area map, Ras Juddi, Makran coast (25°13'25" N 63°30'15" E)

The samples were initially preserved in situ using 5% formaldehyde solution in seawater and were subsequently transferred to 70% alcohol for further analysis. For taxonomic study, the specimens were cleaned and processed in a weak sodium hypochlorite (domestic bleach) solution to remove excess organic material, resulting in clearer images of the skeletal structures. They were rinsed with distilled water and dried. Microscopic observations and photographic imaging were performed using a stereo-zoom microscope (Wild 181300, Switzerland) at 10×50 magnification and along with an upright microscope (Nikon LABOPHOT-2) at 10x4 and 10x10 magnifications. Specimen fragments were imaged using a JSM

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6380A (JEOL Japan) at the Centralized Science Lab, University of Karachi, for Scanning Electron Microscopy (SEM). Morphometric measurements, such as length and width of zooids, orifices and ovicells, were made directly from digital SEM images. The specimens were cataloged (MRC&RC-UOK-BRY-14) and deposited in the Museum of the Marine Reference Collection and Resource Centre, University of Karachi.

Results

Systematics

Order Cheilostomatida Busk, 1852

Suborder Flustrina Smitt, 1868

Superfamily Smittinoidea Levinsen, 1909

Family Lanceoporidae Harmer, 1957

Genus Calyptotheca Harmer, 1957

Species Calyptotheca alexandriensis Abdel-Salam, Taylor & Dorgham, 2017 (Figures 2-3; Table 1)

Material examined: Catalogue no (MRC&RC-UOK-BRY-14) Ras Juddi, Pasni, Makran Coast, Balochistan (25°13'25" N 63°30'15" E), 6 specimens, December 4, 2021; January 31, 2022; April 18, 2022; August 12, 2022, and October 27, 2022, intertidal zone.

Description: Colonies erect, foliaceous, about 9-14 cm, live specimens with dark orange to red colonies, fading to light brown and yellow in alcohol (Figure 2A-C). Autozooids sub-rectangular, about twice longer than wide, separated by thin and well-defined furrows (Figure 2D, 3A-B). Frontal shield moderately convex, densely large subcircular, pseudopores; in center and decreasing toward the edge of the frontal shield; calcification around the pseudopores in the shape of a polygonal network. Marginal areolar pores not distinct from pseudopores. Zooids vary in size, measuring between 480–616 µm in length and 300–421 µm in width. Primary orifice subcircular to oval, wider than long with a broad U-shaped sinus marked by a pair of condyles (Figure 3C-D). Primary orifice measuring 150–207 µm long by 165–200 µm wide. Condyles are small, rounded, and non-serrated, projecting distomedially (Figure 3D). Some orifices are covered by closure plates, with an unevenly granular surface. Ovicells hyperstomial, globose, wider than long, with smaller, more closely spaced pseudopores (Figure 2D, 3E). Ooecium 427–576 µm long by 375–429 µm wide. Orificial dimorphism not distinctive. Suboral avicularia oriented disto-laterally (Figure 3C-D) and present almost all zooids, all avicularia facing the same direction on a frond, either left or right; plane of the avicularium steeply inclined to the colony frontal surface; small in size, about 52.2–92.7 µm long by 33.7–49.2 µm wide; opesia semicircular; pivotal bar complete, more or less straight, longer than opesia; rostrum arch-shaped, with a hook-like distal end.

Habitat: Colonies were found under the rocks, attached to hard substratum.

Distribution: Eastern Harbor, Alexandria (Mediterranean Egypt) and recently Pakistan (Northern Arabian Sea).

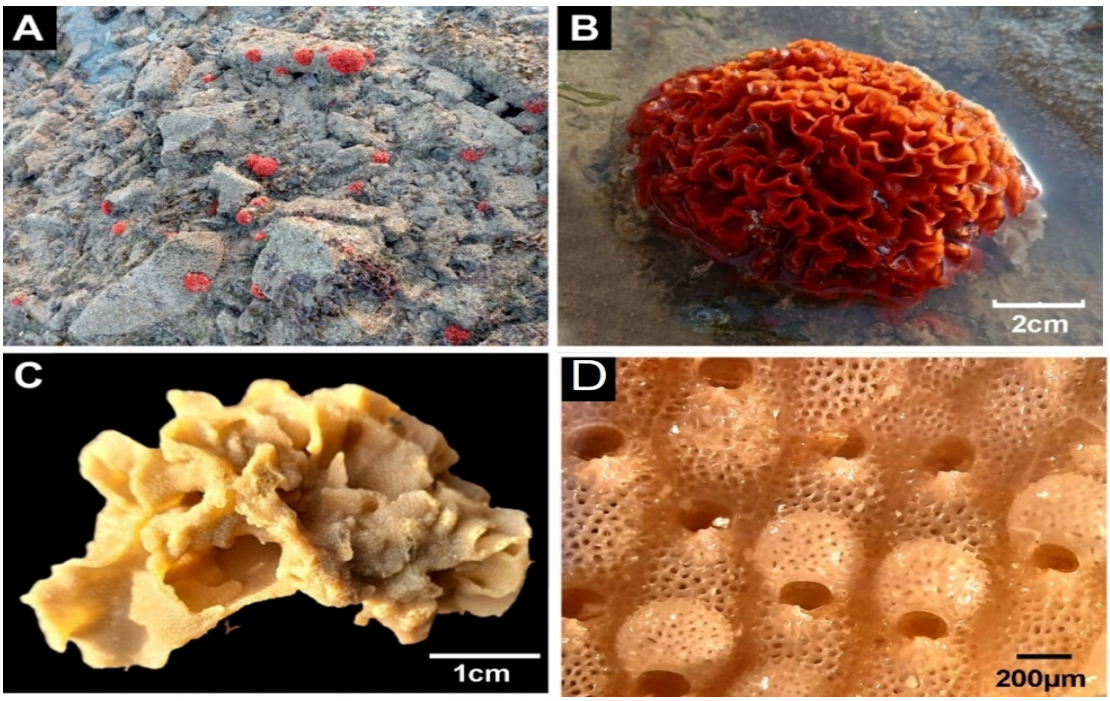

Figure 2. General views of *Calyptotheca alexandriensis*.**(A)** Distribution of colonies in the rocky zone of low tidal areas, **(B)** A fresh specimen exhibiting a leafy colony shape and a deep orange color, **(C)** The preserved specimen displays a pale brown and yellow coloration, **(D)** Zooids with ovicells

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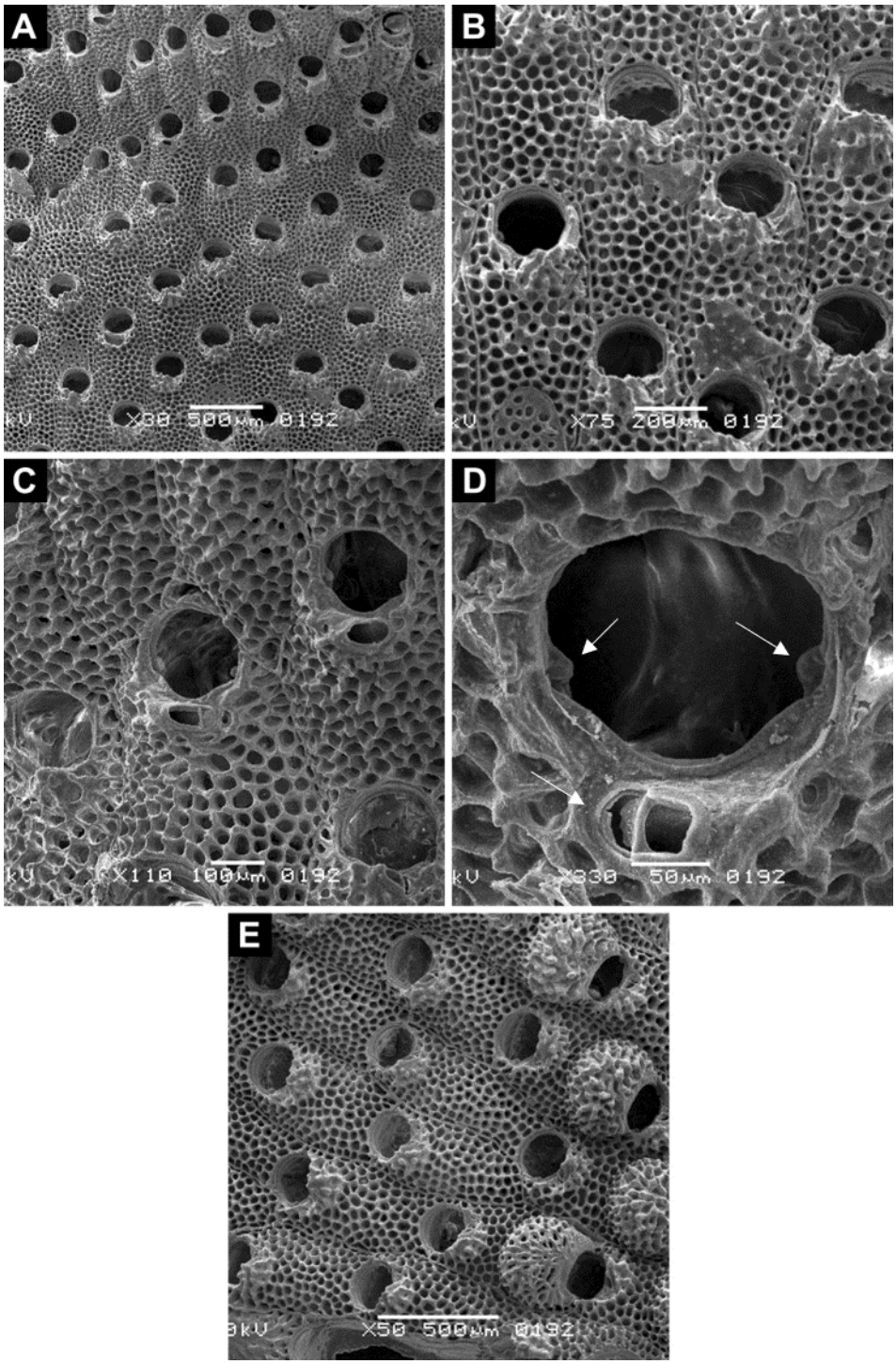

Figure 3. *Calyptotheca alexandriensis.***(A–B)** General views of zooids without operculum,**(C–D)** Primary orifice, condyles and suboral avicularium,**(E)** Group of zooids, some with complete ovicells

Discussion

This research represents the first documented occurrence of *C. alexandriensis* at Ras Juddi, Pasni along the Makran coast. It was found during monitoring surveys conducted between December 2021 and October 2022. Therefore, this study significantly contributes to the bryozoan fauna of Pakistan by introducing a new species, *C. alexandriensis* (Harmer, 1957).

The specimens from Pakistan closely match the description of *C. alexandriensis,* as outlined by Abdelsalam et al. (2017) for the species found in Alexandria, Egypt. One striking feature is the distinctive deep-orange, erect, foliaceous colony form. Additionally, zooid-level characteristics, such as the broad sinus, evenly pseudoporous frontal shield, and notably the transversely oriented suboral avicularium, distinguish *C. alexandriensis* from other known species of *Calyptotheca*.

Table 1. Comparative Measurements (in µm) of *Calyptotheca alexandriensis* from Ras Juddi (Pakistan) and Alexandria (Mediterranean Egypt)

Character	Location	Mean	Range	SD	N
Zooid length	Pakistan	567.8	480616	52.8	15
	Mediterranean Egypt	560	460-650	60.0	12
Zooid width	Pakistan	351	300-421	49.8	15
	Mediterranean Egypt	320	270-350	30.0	12
Orifice length	Pakistan	182.4	150-207	20.5	10
	Mediterranean Egypt	130	110-140	10.0	10
Orifice width	Pakistan	188.1	165-200	14.0	10
	Mediterranean Egypt	170	170-180	10.0	10
Ooecium length	Pakistan	505.4	427-576	59.2	7
	Mediterranean Egypt	260	250-270	10.0	10
Ooecium width	Pakistan	407.4	375-429	27.8	7
	Mediterranean Egypt	350	330-370	20.0	10

Note: SD: standard deviation; N: number of determinations

When comparing the given values for the two specimens, variations in the size and measurements in the morphological structures were seen. Specimens from Mediterranean Egypt and the present specimens exhibit insignificant differences in the dimensions of their zooids, primary orifices, and ovicells. The present specimens exhibit larger zooids, with length ranging from 480-616 µm and width from 300-421 µm, compared to Mediterranean Egypt specimen's zooid length of 460-650 µm and width of 270-350 µm. The primary orifices in our specimens are also larger, measuring 150-207 µm in length and 165-200 µm in width, while those in the Mediterranean Egypt specimens measure 110-140 µm in length and 170-180 µm in width. Similarly, the ovicells of our specimens are larger, measuring between 427 and576 µm in length and 375 to 429 µm in width. In contrast, the ovicells from the Mediterranean Egypt specimen are smaller, with lengths ranging from 250 to 270 µm and widths from 330 to 370 µm. These differences underscore the variability in morphological features between the two specimens.

Conclusion

The first documented occurrence of *Calyptotheca alexandriensis* along the Makran coast at Ras Juddi represent a significant contribution to the bryozoan fauna of Pakistan. This discovery not only introduces the family Lanceoporidae and the genus *Calyptotheca* to the region but also extends the known distribution of *C. alexandriensis* to the Northern Arabian Sea.

The recent discovery of *C. alexandriensis* in the Arabian Sea, following its initial identification in the eastern Mediterranean (Abdelsalam et al., 2017), raises important questions about the species' origins. This finding suggests that the species likely entered the Mediterranean Sea through the Suez Canal, rather than migrating from the Atlantic. However, the precise location of the species' origin remains uncertain.

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Compliance With Ethical Standards

Authors' Contributions

QMA: Conceptualization
AB: Investigation, Data curation, Writing – original draft
QA: Supervision, Writing – review & editing
PDT: Validation, Taxonomic identification and reviewing
LB: Writing – review & editing
All authors read and approved the final manuscript.

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Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical Approval

For this type of study, formal consent is not required.

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Not applicable.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

AI Disclosure

The authors confirm that no generative AI was used in writing this manuscript or creating images, tables, or graphics.

References

Abdelsalam, K. M., Taylor, P. D., & Dorgham, M. M. (2017). A new species of *Calyptotheca* (bryozoa: Cheilostomata) from Alexandria, Egypt, southeastern Mediterranean. *Zootaxa, 4276*(4), 582-590. https://doi.org/10.11646/zootaxa.4276.4.9

Ahmed, M., Rizvi, S. H. N., & Moazzam, M. (1978). *Final technical report on the studies on the settlement and control of marine organisms in the cooling systems of coastal installations*. Institute of Marine Biology, University of Karachi.

Ali, Y. (2006). *Report of the survey conducted by KSDC in the year 2005-2006*. p.6

Anonymous (2025). *Calyptotheca* Harmer, 1957. Retrieved on May 27, 2025 from https://www.bryozoa.net/cheilostomata/lanceoporidae/calyptotheca.html

Aslam, S., Siddiqui, G. H., Kazmi, J., & Moura, C. J. (2019). First occurrence of the non-indigenous bryozoan *Amathia verticillata* (Della Chiaje, 1882) at the Hab River mouth in Pakistan. *Regional Studies in Marine Science*, *30*, 100706. https://doi.org/10.1016/j.rsma.2019.100706

Baig, H. S. (2014). The mobile and sessile fauna associated with some ecological remarks *Caulerpa taxifolia*. *Pakistan Journal of Oceanography*, *7*(1), 31-40.

Bock, P. (2024). *World List of Bryozoa. Calyptotheca Harmer, 1957*. World Register of Marine Species. Retrieved on May 27, 2024, from https://www.marinespecies.org/aphia.php?p=taxdetails&id=110934

Bock, P. (2025). World List of Bryozoa (version 2025-05-01). In O. Bánki, Y. Roskov, M. Döring, G. Ower, D. R. Hernández Robles, C. A. Plata Corredor, T. Stjernegaard Jeppesen, A. Örn, T. Pape, D. Hobern, S. Garnett, H. Little, R. E. DeWalt, J. Miller, & T. Orrell, *Catalogue of Life* (Annual Checklist 2025). Catalogue of Life Foundation, Amsterdam, Netherlands. https://doi.org/10.48580/dgr6n-3bb

Boonzaaier, M. K. (2017). *Diversity and zoogeography of South African Bryozoa.* [Ph.D. Dissertation. University of the Western Cape].

Cumming, R. L., & Tilbrook, K. J. (2014). Six species of *Calyptotheca* (Bryozoa, Cheilostomata, Lanceoporidae) from the Gulf of Carpentaria and northern Australia, with description of a new species. *Zootaxa*, *3827*(2), 147-169.https://doi.org/10.11646/zootaxa.3827.2.2

Florence, W. K., Hayward, P. J., & Gibbons, M. J. (2007). Taxonomy of shallow-water Bryozoa from the west coast of South Africa. *African Natural History*, *3*(1), 1-58.

Guha, A. K., & Gopikrishna, K. (2007). Some fossil Ascophoran bryozoans from Tertiary sequences of western Kachchh, Gujarat. *Journal of the Palaeontological Society of India*, *52*(2), 195-222. https://doi.org/10.1177/0971102320070207

Haq, S. M., Moazzam, M., & Rizvi, S. H. N. (1978). Studies on marine fouling organisms from Karachi coast I. Preliminary studies on the intertidal distribution and ecology of fouling organisms at Paradise Point. *Pakistan Journal of Zoology*, *10*, 103-115.

Javed, M., & Mustaquim, J. (1995). The occurrence of fouling organisms on navigational buoys in the Manora Channel, Pakistan. In Thompson, M. F., & Tirmizi, N. M. (Eds.), *The Arabian Sea: Living marine resources and the environment* (pp. 99-100). CRC Press.

Javed, M., & Tirmizi, N. M. (1993). Four species of *Bugula* (Bryozoa: Bugulidae) new to the Pakistan coast (northern Arabian Sea). *Pakistan Journal of Zoology*, 25(4), 285-288.

Javed, M.J. (1990). Systematic study of Bryozoa from Sindh (Karachi) and Makran (Gadani and Sunari) coasts. (M.Phil. Dissertation), *Centre of Excellence in Marine Biology*, University of Karachi,.p.114

Karim, S. I. (1970). Bryozoa of the genus Bugula of Karachi coast. *Records of the Zoological Survey of Pakistan*, 17-23.

Kazmi, Q. B., Naushaba, R., Moazzam, M., & Kazmi, M. A. (2019). Pakistani Marine Faunal Biodiversity Inventory and Taxonomic Resources.Zoological Society Pakistan. p.721.

Menon, N. R. (1973). Species of the suborder Ctenostomata (Bryozoa) from Indian waters. In: Zeitzschel, B. (Ed.), *The Biology of the Indian Ocean*, pp. 407-408. Chapman and Hall, London.https://doi.org/10.1007/978-3-642-65468-8_36

National Oceanic and Atmospheric Administration (2024). MZGdb Atlas Bryozoa (Indian Ocean). https://www.st.nmfs.noaa.gov/copepod/collaboration/metazoogene/atlas/html-src/short_T4000076_o05.html

Ostrovsky, A. N., Cáceres-Chamizo, J. P., Vávra, N., & Berning, B. (2011). Bryozoa of the Red Sea: history and current state of research. *Annals of Bryozoology*, *3*, 67-97.

Sanjay, M. S., Venkatraman, C., Louis, S., Shrinivaasu, S., & Yogesh Kumar, J. S. (2022). New distributional records of Indo-Pacific Bryozoans from East and West coast of India. *Indian Journal of Geo-Marine Sciences,50*(09), 714-722.https://doi.org/10.56042/ijms.v50i09.66667