Bulletin of Pure and Applied Sciences
Geology (Geological Science), Vol.43F, No.2,
July-December 2024: P.164-171
Original Research Article

Print version ISSN 0970 4639
Online version ISSN 2320 3234
Available online at www.bpasjournals.com

Some Cyclostomes (Bryozoa) from Arabian Sea Coast of Maharashtra, India

Dnyaneshwar V. Wayal* and Mohan A. Sonar

Author's Affiliations:
[1,2]Post Graduate department of Geology, Institute of Science, Chhatrapati Sambhajinagar, Maharashtra 431004, India.

***Corresponding Author: Dnyaneshwar V. Wayal**, Post Graduate department of Geology, Institute of Science, Chhatrapati Sambhajinagar, Maharashtra 431004, India.
E-mail: wayaldnyaneshwar@gmail.com
Received on 01.06.2024, Revised on 18.11.2024, Accepted on 08.12.2024

How to Cite This Article: Dnyaneshwar V. Wayal* and Mohan A. Sonar. (2024). Some Cyclostomes (Bryozoa) from Arabian Sea Coast of Maharashtra, India. *Bulletin of Pure and Applied Sciences- Geology,* 43F (2), 164-171.

Abstract:
In the present study, we have examined the colonies of family Tubuliporidae, Crisiidae and Lichenoporidae that were collected from intertidal zone. Among the studied samples, Patinella radiata is reported for the first time from the Arabian Sea. However, two species namely Patinella sp. *and Disporella* sp. *are left in open nomenclature. The present paper contributes to improve the knowledge of biodiversity of bryozoans regarding Cyclostomes generated in the recent years from the Arabian Sea.*

Keywords: *Arabian Sea, Tubuliporidae, Patinella, Disporella, India*

INTRODUCTION

This study examines recent bryozoan fauna inhabiting various substrates, including shells, and sand samples. Sonar and Badve (2008) have significantly improved our understanding of Holocene cyclostomes bryozoans of the Konkan coast of India through their comprehensive study. Last few years, the study of bryozoans predominantly focused on the waters surrounding Mumbai (northern Konkan) except Alan *et al*. (1988) and Mankeshwar *et al*. (2015) explore recent bryozoan species around Ratnagiri. Further Badve and Sonar (1995, 1997), Sonar and Badve (2008, 2010a, 2010b) and Sonar *et al*. (2021) explore Holocene bryozoans along west coast. The vast majority of central Konkan coastline remains largely unexplored and wanting new data on bryozoan fauna.The main objective of this study is to close the gap of cyclostome bryozoan studies in the area and improve our understanding of their marine populations.

MATERIAL AND METHODS

In the present study, the samples were collected from intertidal zone of five localities, namely Mirkarwada Jetty (17°00′04″ N, 73°16′40″ E), Mirya beach (17°01′27″ N, 73°16′16″ E), Asgoli Beach (17°28′06″ N, 73°11′36″ E) of Ratnagiri District; Nagaon beach (18°36′41″ N, 72°53′39″ E) and Akshi beach (18°37′25″ N, 72°53′10″ E) of Raigad District of Maharashtra (Fig. 1). The fragments and colonies were identified and selected for SEM using a 10X micrometer ocular in a Nikon SMZ-800 Optical Stereo Microscope. Selected specimens were coated with gold and photographed using a JEOL (JSM–IT800 HL) at the Department of Earth Science, Indian Institute of Technology, Bombay.

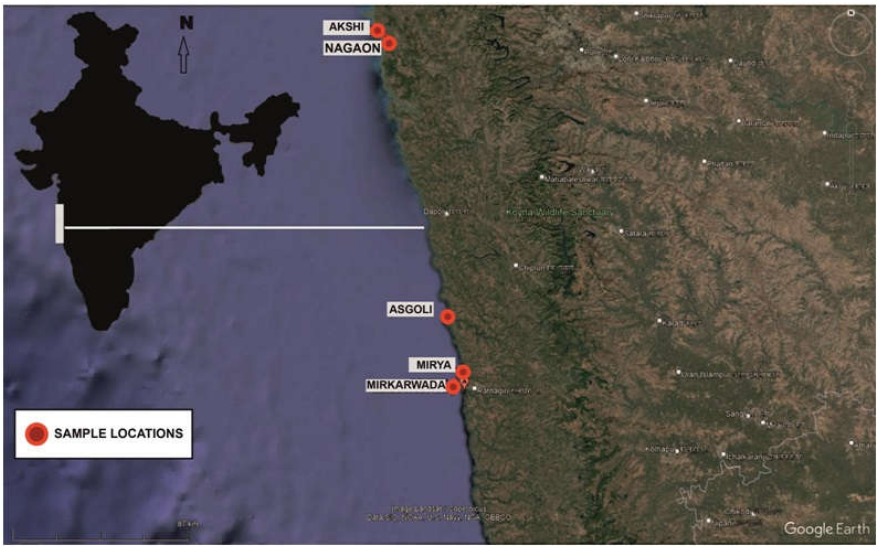

Figure 1: Map of study area.

The specimens are registered and deposited in the Museum of Geology, Postgraduate Department of Geology, Government Institute of Science, Chhatrapati Sambhajinagar, Maharashtra, India. The specimens are prefixed with the accession number GIS/R.

RESULTS

(Systematic paleontology)
Class: Stenolaemata Borg, 1926
Order: Cyclostomata Busk, 1852
Suborder: Tubuliporina Johnston, 1838
Family: Tubuliporidae Johnston, 1938
Genus: ***Exidmonea*** David, Monegerau and Pouyet, 1972
Exidmonea* (?)*atlantica David, Monegerau and Pouyet, 1972
(Fig. 2)
Material: GIS/R 129– GIS/R 132.
Description: Colony erect, dichotomously branching, stem triangular in cross section (Fig. 2A). Autozooecia closely spaced, arranged in alternating transverse fascicles on the frontal side, 2–5 autozooecia in each fascicle, aperture subcircular (Fig. 2B & C). Gonozooecium broken, placed frontally and/or at bifurcation of the stems, or sometimes comprising 5 to 6 interfacicular areas of the frontal surface of the main branch (Fig. 2B). Lateral furrows exhibiting zigzag pattern. Dorsal surface flat, porous, covered with transversely oriented undulating striations (Fig. 2D & E).
Remarks: The present material resembles *Exidmonea* (?)*atlantica* Sonar & Badve, 2008, observed in Holocene deposits along the west coast, in all characters except broken Gonozooecium.
Occurrence: Akshi and Nagaon.

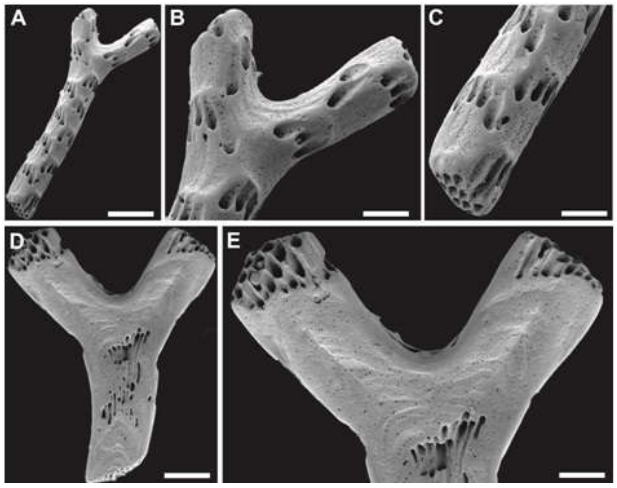

Figure 2: A–E, *Exidmonea* (?)*atlantica* David, Monegerau and Pouyet, 1972; A. General view of colony. B. Close-up of colony at bifurcation. C. Close-up of colony. D. Dorsal view of colony. E. Close-up of dorsal surface.

Exidmonea decorata (Canu and Bassler), 1929
(Fig. 3)

Material. GIS/R 133– GIS/R 139.

Description: Colony erect, dichotomously branching, triangular cross section. The autozooecia arranged in alternating fascicles having 4–5 autozooecia in each series (Fig. 3A).Gonozooecium frontal, at the bifurcation, occupying 1 or 2 interfacicular areas of bifurcations of each branch. Ooeciopore terminal. Dorsal surface having wrinkles, flat, transversely oriented striations with small, serial psuedopores (Fig. 3B).

Remarks: Initially, Canu and Bassler (1929) described ?*E. decorata* from Philippines as *Pleuronea*(?) *decorata* which has characteristic regular dorsal wrinkles; the present material clearly resembles ?*E. decorata* by Canu and Bassler. Sonar & Badve (2008) also described this species from Holocene deposits of same region, which is conspecific with the present material.

Occurrence: Akshi, Asgoli and Nagaon.

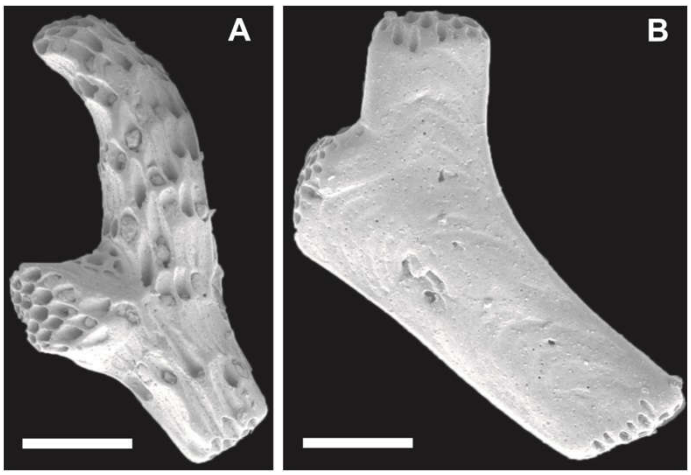

Figure 3: A–B, *Exidmonea decorata* (Canu and Bassler), 1929; A. General view of internode. B. Dorsal view of internode.

Suborder: Articulata Busk, 1859
Family: Crisiidae Johnston, 1838
Genus: *Crisia* Lamouroux, 1812
Crisia* aff. *elongata Milne Edwards, 1838
(Fig. 4)
Material: GIS/R 140– GIS/R 151.
Description: Colony erect, tubular, surface punctuate, more crowed slit-like striations (Fig. 4A). Orifices subcircular to oval with thin and short peristome. Almost 14–16 zooids arranged alternately in each internodes. Gonozooid broken, wider distally. Ooeciopore transverse (Fig. 4B). Slit like psuedopores emplaced at the back of the gonozooids (Fig. 4C).
Remarks: Winston (1986) described *Crisia elongata* from Panama and Taylor (2001) provisionally identified *Crisia elongata* from Neogene of Panama Central. Both the species shows close affinity with the present material.
Occurrence: Most common in Recent and Holocene deposits along the west coast of Maharashtra.

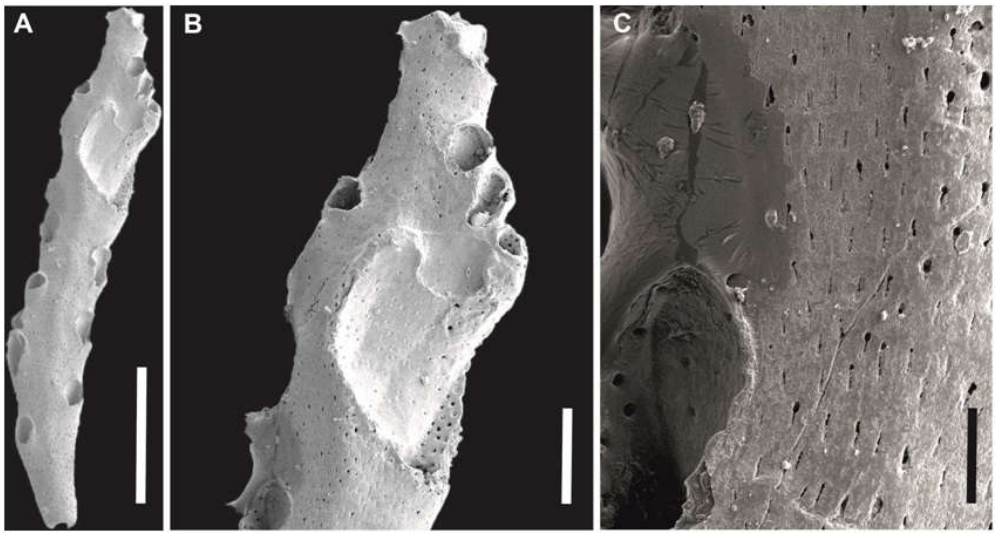

Figure 4: A–C, *Crisia* aff. *elongata* Milne Edwards, 1838; A. General view of internode. B. Close-up of gonozooid. C. Enlargement of surface of internode.

Suborder: Rectangulata Waters, 1887
Family: Lichenoporidae Smitt, 1867
Genus: ***Patinella*** Gray, 1848
***Patinella radiata* (Audouin, 1826)**
(Fig. 5)
Material. GIS/R 152– GIS/R 154.
Description. Colony encrusting. Autozooids arranged in irregular radial rows, diverging from the centre to the outer margin of the colony (Fig. 5A). Apertures squarish, arranged in fascicles of 2–4; mural spines numerous, short with distinct star-shaped tips (Fig. 5B & C). Kenozooids (alveoli) numerous, polygonal, often larger than autozooidal apertures and containing numerous mural spines, with distinct star-shaped tips. Gonozooid and ooeciopore not observed.
Remarks. *Patinella radiata* (Audouin, 1826) has similar growth pattern and spines with star-shaped tips.
Occurrence. Akshi and Nagaon.

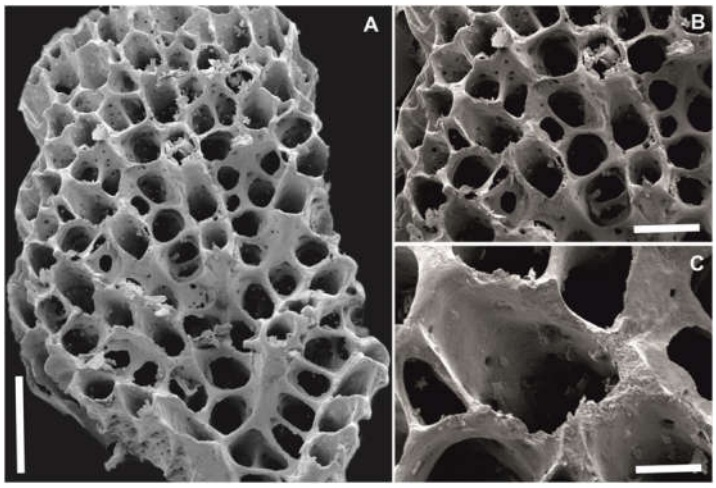

Figure 5: **A–C, *Patinella radiata* (Audouin, 1826); A. General view of colony. B. Close-up of colony. C. Enlargement of autozooecia.**

***Patinella*? sp.**
(Fig. 6)
Material. GIS/R 155.
Description. Colony encrusting surrounded wide basal lamina (Fig. 6A). Autozooids arranged in irregular radial rows, diverging proximally towards the margin of the colony. Apertures subrectangular to subcircular; mural spines numerous, short with distinct star-shaped tips (Fig. 6B & C). Kenozooids (alveoli) polygonal, often larger than autozooidal apertures and containing numerous mural spines, with distinct star-shaped tips (Fig. 6A). Gonozooid and ooeciopore uncertain.
Remarks. A single specimen with some uncertain characters found in studied region. So the present materialindefinite even at genus level and so kept in open nomenclature until better preserved material is available.

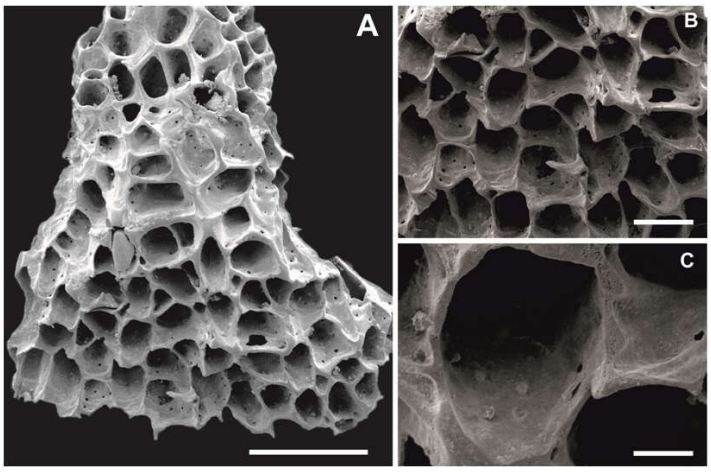

Figure 6: **A–C, *Patinella* sp.; A. General view of colony. B. Close-up of colony. C. Enlargement of autozooecia.**

Genus *Disporella* Gray, 1848

***Disporella* sp.**

(Fig. 7)

Material. GIS/R 156– GIS/R 157.

Description. Colony encrusting (Fig. 7A). Autozooids chaotically arranged, indistinct radial rows. Apertures oval to irregular. Mural spines projecting inside the apertures, numerous and small, with narrow tips (Fig. 7B & C). Gonozooid often indistinct; ooeciopore larger than autozooidal apertures, oval, wider than long with flared ooeciostome on one side, directed towards the centre of the colony (Fig. 7B).

Remarks. Two specimens with some unsure characters are studied from the region. The species kept in open nomenclature until well preserved material is available.

Occurrence. Asgoli and Mirya.

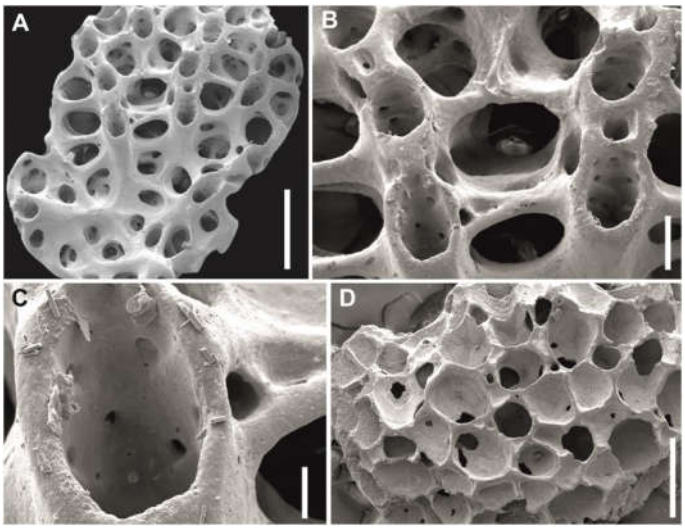

Figure 7: **A–D, *Disporella* sp. A. General view of colony. B. Close-up of colony. C. Enlargement of autozooecia. D. Dorsal view of colony.**

DISCUSSION

Bryozoans are an important part of the marine ecosystem of the Arabian Sea, but they are inadequately studied in the region. Several attempts were made to study of fossils and recent bryozoans along west coast of India including Konkan coast of Maharashtra (Menon & Nair, 1969, 1972, 1975; Pillai, 1978, 1981; Swami & Karande, 1987; Alan *et al*., 1988; Raveendran *et al*., 1990; Karande & Udhayakumar, 1992; Badve & Sonar, 1995, 1997; Chapgar& Sane, 1996; Sonar & Badve, 2008, 2010; Sonar *et al*., 2010, 2021; Udhayakumar, 2010; Gaonkar *et al*., 2010; Mankeshwar *et al*., 2015). Almost all these studies focused on cheilostome and very less literature available on recent cyclostomes of west coast except cyclostomes of Holocene deposits (Sonar &Badve, 2008). In the present study we concentrate on cyclostomes of west coast and found alien species like *Patinella radiata* (Audouin, 1826) and *Patinella*? sp. Further investigation of some well-preserved material is needed to confirm the taxonomic record and phylogeny of cyclostomes.

CONCLUSION

In the present study, we tried to close the huge gap of knowledge regarding cyclostome bryozoans in the studied region. Very few historical records available on recent cyclostome bryozoans of this region. This study added information about 3 families (Tubuliporidae, Crisiidae and Lichenoporidae) and 4 genera

(*Exidmonea*, *Crisia*, *Patinella* and *Disporella*) in the record of cyclostomes of Arabian Sea coast of Maharashtra.

Acknowledgements
The authors are thankful to K. M. Wanjarwadkar and R. R. Randhave (Government Institute of Science, Chhatrapati Sambhajinagar) and Azhar Shaikh (IISER, Berhampur) for meticulously reviewing the English language. We are grateful to the Earth Science department, Indian Institute of Technology Bombay, Mumbai for providing access to SEM facility. Our immense gratitude to Rushikesh Golekar (Khare Dhere college of Science, Guhagar, District. Ratnagiri) for expert guidance in field.

REFERENCES

Audouin, J. V.,(1826). Explication sommaire des planches de polyps de l'Egypteet de la syrie. In: Description de l'Egypte, ourecueil des observations et des recherches qui ontetefaites en Egypte pendant l'expedition de l'armeefranc¸aise. Histoire naturelle Volume 1. ImprimerieImperiale, Paris; 225–224 pp.

Alan, S. M., Khan, A. K. and Nagabhushanam, R., (1988). Marine biofouling at Ratnagiri Coast, India. In: Marine Biodeterioration. Oxford Publishing Company, 539–550 pp.

Badve, R. M. and Sonar, M. A., (1995). Bryozoa Cheilostomata from Holocene, west coast of Maharashtra, India. Geobios, 28(3), 317–335.

Badve, R. M. and Sonar, M. A., (1997). Some fossil Neocheilostomine bryozoans from the Holocene of the west coast of Maharashtra and Goa, India. Journal of the Palaeontological Society of India, 42, 35–48.

Bock PE 2024. The Bryozoa homepage. www.bryozoa.net

Borg, F.,(1926). Studies on recent cyclostomatous Bryozoa. Zoologiska Bidragfrån Uppsala, 10, 181–507.

Busk, G., (1852). An account of the Polyzoa, and sertularian zoophytes, collected in the voyage of the Rattlesnake, on the coasts of Australia and the Louisiade Archipelago. In: Narrative of the Voyage of the H.M.S. Rattlesnake London, 1, 343–402.

Busk, G.,(1859). A monograph of the fossil Polyzoa of the Crag. Palaeontographical Society Monograph, London, 1–136 pp.

Canu, F. and Bassler, R. S., (1929). Bryozoa of the Philippine region. Bulletin of US National Museum, 100, 1–685.

Chapgar, B. F.and Sane, S. R., (1996). Intertidal entoprocta and ectoprocta (bryozoa) of Bombay. Journal of Bombay Natural History Society, 63, 449–454.

David, L., Mongerau, N. and Pouyet, S., (1972). Bryozoaraires du Néogéne du basin du Rhône. Gisements burdigaliens de Mus (Gard). Docum. Lab Géol. Fac. Sci. Lyon,52, 1 – 118.

Gaonkar, C. A., Sawant, S. S., Anil, A. C., Krishnamurthy, V. and Harkantra, S. N., (2010). Changes in the occurrence of hard substratum fauna: A case study from Mumbai harbor India. Indian Journal of Marine sciences, 39(1), 74–84.

Johnston, G., (1838). A History of British Zoophytes. W.H. Lizars, Edinburgh, London & Dublin.

Karande, A. A.and Swami, B. S., (1988). Importance of test coupons in the assessment of marine biofouling community development in coastal waters of Bombay India. Indian Journal of Marine sciences, 17(4), 317–321.

Karande, A. A. and Udhayakumar, M., (1992). Consequences of crowding on life-histories of bryozoans in Bombay waters. Indian Journal of Marine sciences,21, 133–136.

Lamouroux, J.V.F., (1812). Extrait d'un mémoiresur la classification des Polypierscoralligènes non entièrementpierreux. Nouveau Bulletin scientifique de la SociètèPhilosophique, 3, 181–188. .

Mankeshwar, M. Kulkarni, A. and Apte, D., (2015). Diversity of Bryozoans of India with New Records from Maharashtra. In: Marine Faunal Diversity in India. Taxonomy, Ecology and Conservation,95–106.

Menon, N. R.and Nair, N. B., (1967). Observations on the structure and ecology of *Victorella pavida* KENT (Bryozoa) from the South West Coast of India. Internationale Revue der gesamten

Hydrobiologie und Hydrographie, 52(2), 237–256.

Menon, N. R. and Nair, N. B., (1969). Rediscovery of *Bugulella clavata* Hincks, 1887 (Ectoprocta). Current Science,38(5), 116.

Menon, N. R. and Nair, N. B., (1972). Indian species of the genus *Bugula*. Proceedings Indian National Science Academy. Part B. Biological Sciences,38, 403–413.

Menon, N. R. and Nair, N. B. (1975). Indian species of Malacostega (Polyzoa, Ectoprocta).Journal of the Marine Biological Association of India, 17(3), 553–579.

Milne Edwards, H., (1838). Mémoiresur les Crisies, les Hornères et pluisiurs autres polypes vivants dont l'organisation est analogue à celle des Tubulipores. Ann. Sci. Nat. zool., Paris, 9(2),193 – 238.

Pillai, S. R. M., (1978). A new species of *Hippoporina* from Bombay waters. Current Science, 47, 61–63.

Pillai, S. R. M., (1981). A further report on taxonomy of fouling bryozoans from Bombay harbor and vicinity. Journal of Bombay Natural History Society, 78, 317–329.

Raveendran, T. V., DeSouza, A. P. and Wagh, A. B., (1990). Fouling polyzoans of Bombay off shore waters. Mahasagar: Bulletin National Institute of Oceanography, 23(2), 169–178.

Smitt, F. A., (1867). Kritisk Förteckning öfver Skandinaviens Halfbryozoer. II. Öfversigt af Kongliga Vetenskaps Akademiens Förhandingar, 23, 395 –533.

Sonar, M. A. and Badve, R. M., (2008). Fossil cyclostome bryozoans from the Holocene rocks of west coast of Maharashtra and Goa, India. Gondwana Geological Magazine, 23(1), 69–76.

Sonar, M. A. and Badve, R. M., (2010). Fossil Catenicellid Bryozoans from the Holocene of the West Coast of Maharashtra. Journal Geological Society of India, 76, 283–288.

Sonar, M. A., Badve, R. M. and Gaikwad, S. G., (2010). Usefulness of Bryozoa to deduce palaeoenvironment: a case study from the Holocene of the West Coast of Maharashtra and Goa. Gondwana Geological Magazine, 25(1), 69–80.

Sonar, M. A., Wayal, D. V. and Badve, R. M., (2021). Lepraliomorph bryozoans from Holocene deposits along the Konkan Coast of Western India. Alcheringa: An Australasian Journal of Paleontology, 45(2), 274–287. https://doi.org/10.1080/03115518.2021.1916836

Swami, B. S. and Karande, A. A., (1987). Encrusting bryozoans in coastal waters of Bombay. Mahasagar: Bulletin National Institute of Oceanography, 20(4), 225–236.

Taylor, P. D., (2001). Preliminary systematics and diversity patterns of Cyclostome bryozoans from the Neogene of the Central American Isthmus. Jour. Paleonto, 75(3), 578–589.

Venkatraman, C., Rajan, R., Louis, S., Shrinivaasu, S. and Padmanaban, P., (2016). Bryozoans of Gulf of Mannar Marine Biosphere Reserve, southeast Coast of India. Records of the Zoological Survey of India, 116, 167–189.

Venkatraman, C., Padmanaban, P., Louis, S. and Shrinivaasu, S., (2018). Marine bryozoans of Gujarat and Maharashtra. Records of the Zoological Survey of India,389–404 pp. https://doi.org/10.26515/rzsi/v118/i4/2018/122918

Waters, A. W., (1887). On Tertiary Cyclostomatous Bryozoa from New Zealand. Quaterly Journal of the Geological Society of London,43, 337–350.

Winston, J. E., (1986).An annotated check-list of coral-associated bryozoans. American Museum Novitates,2859, 1–39. http://digitallibrary.amnh.org/dspace/handle/2246/5196

WoRMS(2024). https://www.marinespecies.org. Accessed 2024-10-20.

****