



An account of hexactinellid sponge, *Hyalonema (Cyliconema) apertum apertum* collected from Andaman waters

K. Vinod*, ¹Rani Mary George, N. K. Sanil, A. A. Jayaprakash, Hashim Manjebraayakath and Divya Thankappan

Central Marine Fisheries Research Institute, P.B. No.1603, Ernakulam North P.O., Cochin – 682 018, Kerala, India. *E-mail: vinod_kavungal@yahoo.co.in

¹Vizhinjam Research Centre of CMFRI, Vizhinjam – 695 521, Kerala, India.

Abstract

The hexactinellid sponge collected aboard FORV *Sagar Sampada* from the eastern side of North Andaman waters at 13°06' N lat. and 93°11' E long. was identified as *Hyalonema (Cyliconema) apertum apertum*. This species, collected at a depth of 402 m, belonged to the Class Hexactinellida, Order Amphidiscosida and Family Hyalonematidae. The body is spindle-like, followed by basalia in the form of long twisted spicules. Identical specimens collected from 12°57' N lat. & 93°07' E long. and 12°45' N lat. & 93°09' E long. confirmed the presence of *H. (Cyliconema) apertum apertum* in the Central Andaman waters too. The present communication describes the characteristic features of *H. (Cyliconema) apertum apertum* along with a detailed account of the types and dimensions of spicules.

Keywords: Deep-sea sponge, Hexactinellida, *Hyalonema*, Andaman waters

Introduction

The sponges are unique group of organisms; although multicellular, they lack tissue grade of construction. Owing to the structural peculiarities, they are considered as a blind offshoot of multicellular organisms grouped under a single phylum Porifera under a separate subkingdom Parazoa. The marine forms occur in the inshore waters as well as in greater depths of oceans. The 'World Porifera Database' enlists 8132 valid species of sponges (Van Soest *et al.*, 2005).

A study on the diversity and taxonomy of sponges from different waters is of paramount importance as sponges are known to have both historical and evolutionary significance. Sponges have survived largely unchanged in their fundamental *bauplans* since the Late Cambrian (509MYA) and were important reef builders during the Phanerozoic period (Hooper and Van Soest, 2002). Although most of the older groups became extinct during the late Devonian crisis (373MYA), sponges have radiated and diversified in recent

seas, with representatives found in all aquatic habitats. Sponges, besides their fundamental role in marine ecological processes, are important source of secondary metabolites, useful for mankind in the pharmaceutical industry. However, of late, there has been a continuous threat to these sessile organisms due to habitat destruction and indiscriminate fishing activities.

The hexactinellid sponges, popularly known as 'glass sponges', are deep-sea forms that remain attached to the ocean substratum. The hexactinellids also have survived longer than a plethora of other animals, despite their rudimental composition. Analytical fossil research suggests that they are more ancient than other porifera. Having originated in the Late Proterozoic, hexactinellids are believed to be the earliest animals still existent. The hexactinellids include about 500 described species, which forms 7% of all Porifera, distributed in 5 orders, 17 families and 118 genera (Reiswig, 2002). They are unknown in freshwater and intertidal habitats.

The hexactinellids constitute one of the important members of deep-sea communities, many of which remain unsampled or poorly sampled. Database on distributional locality and description of species characteristics is important for understanding the relationships between species and regions. In the present study, an attempt has been made to identify the sponge species of the Class Hexactinellida, which was collected from Andaman waters during the cruise on board FORV *Sagar Sampada*.

Materials and methods

Morphologically identical specimens of *Hyalonema (Cyliconema) apertum apertum* were obtained from the eastern side of Andaman waters during a cruise aboard FORV *Sagar Sampada*

(Cruise No.252) in January-February 2007. The samples were obtained by bottom trawl "Expo" from three stations in North and Central Andamans, viz. stations 4, 5 and 7 of the cruise (Fig. 1).

Station 4 was located off Diglipur at 13°06' N lat. and 93°11' E long. at a depth of 402 m. Station 5 (depth: 329 m) and 7 (depth: 369 m) were located off Mayabandar at 12°57' N lat. & 93°07' E long. and 12°45' N lat. & 93°09' E long. respectively.

The collected samples were brought to the laboratory, air-dried and preserved in air-tight polythene bags for further examination. One specimen collected from station 4 was studied in detail for morphological and spicule characteristics. Fragments from proximal, middle and distal

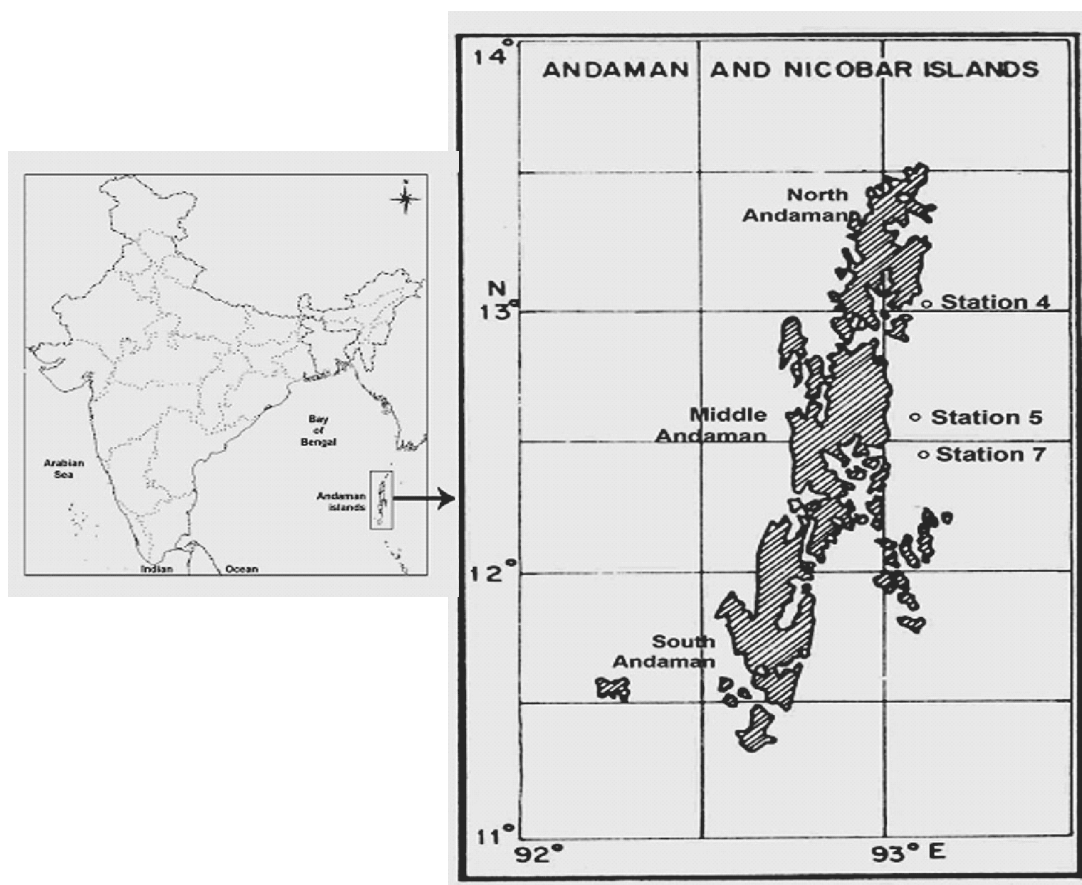


Fig. 1. Sampling sites

portions of the sponge body were heated in concentrated nitric acid for digestion of organic matter and separation of spicules. The siliceous spicules that are bonded on to the substrate were used for microscopic analysis. Microphotographs of spicules were taken and the spicules were measured using the software 'Image Manager Leica IM50' and were expressed in micrometer (μm). Specimens are deposited in the Marine Biodiversity Referral Museum of the Central Marine Fisheries Research Institute, Cochin, India (Acc. No., 7.1.1.1, date 04.02.2007).

Results and discussion

The morphological studies and spicule characteristics of the collected sponge revealed that the species belonged to the Class Hexactinellida, Family Hyalonematidae, genus *Hyalonema* Gray, 1832; species *apertum* Schulze, 1886 and sub-species *apertum* Schulze, 1886.

Systematic position

Phylum	: Porifera Grant
Class	: Hexactinellida Schmidt
Sub-class	: Amphidiscophora Schulze
Order	: Amphidiscosida Schrammen
Family	: Hyalonematidae Gray
Genus	: <i>Hyalonema</i> Gray
Sub-genus	: <i>Cyliconema</i> Ijima

Hyalonema (Cyliconema) Ijima

The body varies from ovoid to inverted-conical, funnel-like, cup-like; oscular sieve plate absent; without ambuncinates.

Type : *Hyalonema (Cyliconema) apertum* Schulze, 1886

Hyalonema (Cyliconema) apertum apertum Schulze, 1886

Restricted Synonymy

H. (Stylocalyx) apertus Schulze, 1886

H. (Cyliconema) apertum apertum Schulze, 1886

H. (Stylocalyx) apertum Schulze, 1887*

H. apertum Schulze, 1893*

H. affine Schulze, 1899*

H. affine japonicum Schulze, 1899*

H. (Cyliconema) apertum solidum Okada, 1932*

* From Hooper and Van Soest, 2002

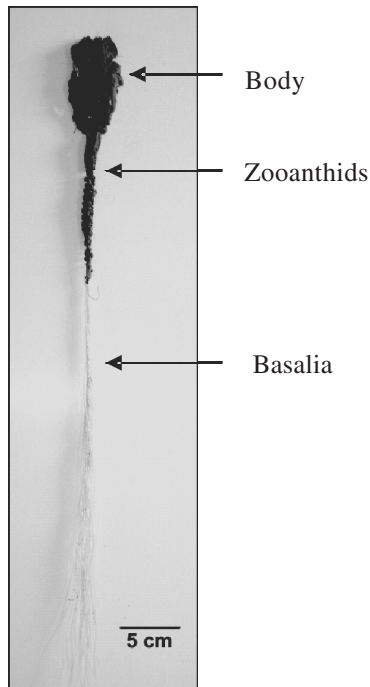
Material examined: Three specimens; one entire and in other two, only basalia present.

Type: Not seen. One entire specimen collected from 13°06' N lat. and 93°11' E long., at 402 m depth. Only basalia with epizoids available in the other two specimens collected from central Andaman (12°57' N lat. & 93°07' E long. and 12°45' N lat. & 93°09' E long.) at depths of 329 and 369 m.

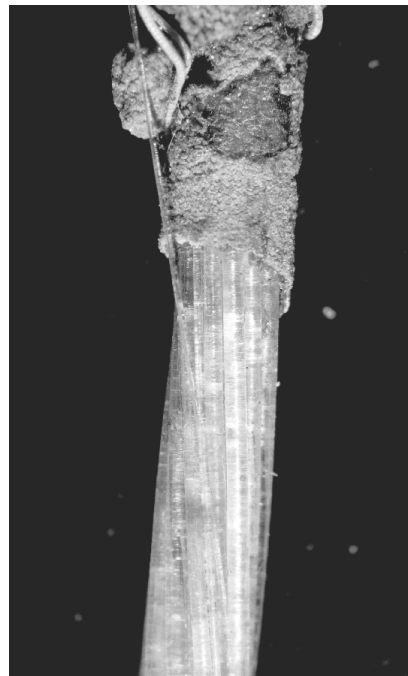
Description: The body is more or less inverted cone (Fig. 2) with small osculum and narrow atrial cavity which is almost similar to that of *Hyalonema (Cyliconema) apertum apertum* Schulze. The different sub-species of *H. apertum* have various body forms like funnel shape with shallow atrial cavity in *H. apertum maehrentali* Schulze; cup-like body with deeply concave atrial cavity in *H. apertum solidum* Okada; vase-like with shallow atrial cavity and apical cone in *H. apertum tuberosum* Ijima and Okada and a poor fragment in *H. apertum simplex* Koltun.

The length of the body is 95mm and the body is followed by basalia which is in the form of long twisted spicules (Fig. 3); the twisting is more apparent proximally and the length of basalia is 410 mm; towards the proximal part of basalia, epizoic zooanthids are found in large numbers (Fig. 4).

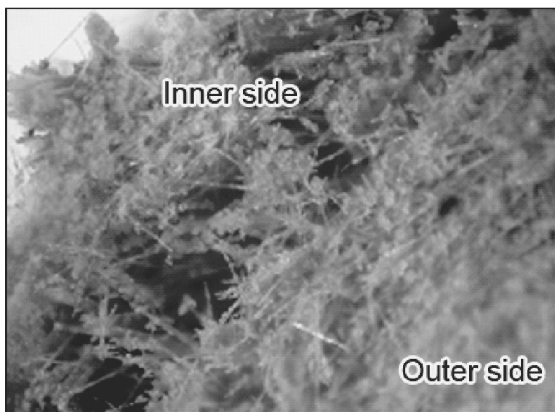
Spicules: The hexactinellid sponges have siliceous spicules of hexactinic, triaxonic symmetry or shapes derived from such forms by reduction of primary rays or terminal branches added to the ends of the primary rays (Reiswig, 2002). They lack calcareous minerals and sclerified organic spongin as skeletal components. *H. (Cyliconema) apertum apertum* identified during the present study



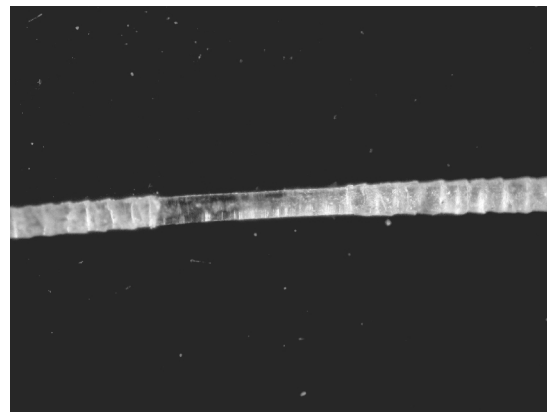
(a) Whole specimen



(a) Proximal part of basalia in the form of twisted tuft of spicules



(b) Photomicrograph of C. S. of body



(b) Interrupted spiral denticulate ridge in basalia

Fig. 2. *Hyalonema (Cyliconema) apertum apertum*

Fig. 3. A view of basalia

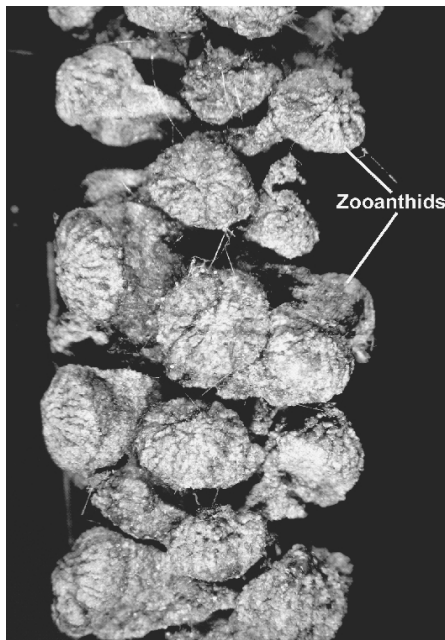


Fig. 4. Epizoic zooanthids attached to the proximal part of basalia

encompassed of diverse type of spicules (Fig. 5); their measurements are given in Table 1.

Small diactines (G1-G8): These were all microscleres. Some of the small choanosomal diactines were found to have rounded terminations, while others were conically pointed. The surface was smooth in some, while others had rough surfaces. Some diactines were even and some of them had swellings in the middle.

Large diactines (C1-C7): Various types of large choanosomal diactines were observed and these were megascleres. Some were even while some had widenings in the middle and few others had tubercles in the middle. The tips of the diactines also showed variations. In some, the tips were more bulky with granulations, while in some, the tips were smooth. Some of the large choanosomal diactines had tips bearing prominent serrations (B1-B4).

Pentactines (A1-A8): The pentactines varied in their sizes and both mega and microscleres of this

Table 1. Dimensions of spicules of *Hyalonema* (*Cyliconema*) *apertum apertum*

Sl. No.	Type of spicules	Size range (μm)	
		From Tabachnick and Menshenina (2002)	Present study
1.	Small choanosomal diactine	NA	122.20 - 360.83
2.	Large choanosomal diactine	500.00 - 2700.00	763.79 - 3047.29
3.	Pentactines (dermal & atrial)		
	i) Pinular ray	46.00 - 296.00	109.35 - 527.00
	ii) Tangential ray	14.00 - 42.00	22.86 - 109.96
4.	Micropentactine	NA	37.12 - 94.52 (individual ray)
5.	Stauractines	NA	83.00 - 571.92 (individual ray)
6.	Large hexactine	NA	106.83 - 282.30 (individual ray)
7.	Microhexactine	18.00 - 59.00	27.64 - 54.57 (individual ray)
8.	Macramphidisc		
	i) Total length	83.00 - 342.00	132.93 - 434.38
	ii) Umbel length	22.00 - 91.00	52.99 - 132.08
	iii) Umbel diameter	23.00 - 122.00	48.06 - 147.34
9.	Mesamphidisc		
	i) Total length	25.00 - 101.00	50.00 - 89.58
	ii) Umbel length	7.00 - 41.00	19.90 - 34.83
	iii) Umbel diameter	7.00 - 53.00	13.96 - 33.35
10.	Micramphidisc		
	i) Total length	11.00 - 22.00	20.35 - 32.37
	ii) Umbel length	3.00 - 9.00	7.24 - 10.13
	iii) Umbel diameter	4.00 - 14.00	6.86 - 10.43

NA- Data not available

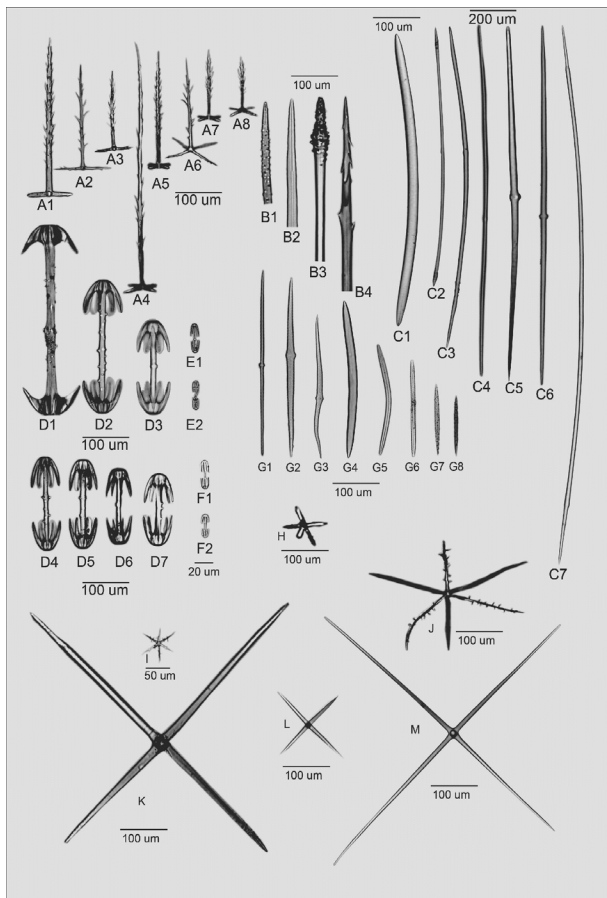


Fig. 5. Scicules of *Hyalonema (Cyliconema) apertum apertum*. A1-A8: Pinular pentactines; B1-B4: Terminations of diactines; C1-C7: Large diactines; D1-D7: Macramphidiscs; E1-E2: Mesamphidiscs; F1-F2: Micramphidiscs; G1-G8: Small diactines; H: Micropentactine; I: Microhexactine; J: Larger hexactine; K-M: Stauractine

type were present. The pinular ray of pentactines had short spines. Some pinular rays were shorter in length, while some were long and whip-like. The tangential rays were also covered with short spines and their terminations were conically pointed. In some pentactines, the tangential rays were short, while in some they were long. The micropentactines (H) were rare and spiny.

Stauractines (K-M): The stauractines varied in size and both mega and microscleres of this type were present. They were conically pointed and the terminations were smooth in some and rough in others.

Hexactines: The microhexactines (I) which were microscleres had spiny and distally curved rays. The larger hexactines (J) which were megascleres were also found to have spiny rays.

Amphidiscs: The amphidiscs were represented by three types viz. macramphidiscs, mesamphidiscs and micramphidiscs. The macramphidiscs (D1-D7) had tuberculated shafts and the length of the shafts varied considerably. Some macramphidiscs had a whorl of tubercles in the middle, while in others, tubercles were found throughout the length of the shaft. The macramphidiscs had umbels about 1/2.5 to 1/4.0 as long and about 1/2.5 to 1/4.5 as broad as the length of the whole spicule. The mesamphidiscs (E1-E2) possessed tuberculated shafts. They had umbels about 1/2.5 to 1/3 as long and about 1/2.5 to 1/4 as broad, as the length of the whole spicule. The micramphidiscs (F1-F2) also had tuberculated shafts and had umbels about 1/2.5 to 1/3.5 as long and about 1/2.5 to 1/4 as broad, as the length of the whole spicule.

Remarks: Tabachnick and Menshenina (2002) opined that the descriptions of all the 5 sub-species of *H. (Cyliconema) apertum* are inadequate. The description of spicules given above suggests that the specimen is *H. (Cyliconema) apertum apertum*. Although the size of the spicules differed when compared to the descriptions given by Tabachnick and Menshenina (2002) for *H. (Cyliconema) apertum apertum*, the differences might be due to the ambient environmental conditions of the locality.

Acknowledgements

The work was carried out as part of the Ministry of Earth Sciences (MoES)/CMLRE Project and the financial assistance provided by MoES, Govt. of India is greatly acknowledged. The authors are thankful to the Director, CMLRE Dr. V. N. Sanjeevan for support.

The authors express their sincere thanks to the Director, Central Marine Fisheries Research Institute, Cochin for the support

and facilities provided for carrying out this work. The help rendered by Dr. P. A. Thomas, the sponge authority of India, in confirmation of the species is sincerely acknowledged. The authors also express their gratitude to Dr. Thomas for critically going through the manuscript and providing valuable comments.

References

- Hooper, J. N. A. and R. W. M. Van Soest. 2002. Systema Porifera: A Guide to the Classification of Sponges. In: Hooper, J.N.A. and R.W.M. Van Soest. (Eds.) *Systema Porifera: A Guide to the Classification of Sponges*. Kluwer Academic/Plenum Publishers: New York, NY (USA), I: 1-3.
- Reiswig, H. M. 2002. Class Hexactinellida Schmidt, 1870. In: Hooper, J.N.A. and R. W. M. Van Soest. (Eds.) *Systema Porifera: A Guide to the Classification of Sponges*. Kluwer Academic/Plenum Publishers: New York, NY (USA), II: 1201-1202.
- Schulze, F. E. 1886. *Über den Bau und das System der Hexactinelliden*. Abhandlungen der Königl. Akademie der Wissenschaften zu Berlin (Physikalisch-Mathematisch Classe) : 97 pp.
- Tabachnick, K. R. and L. L. Menshenina. 2002. Family Hyalonematidae Gray, 1857. In: Hooper, J.N.A. and Van Soest, R.W.M (Eds.) *Systema Porifera: A Guide to the Classification of Sponges*. Kluwer Academic/Plenum Publishers: New York, NY (USA),II : 1232-1256.
- Van Soest, R. W. M., N. Boury-Esnault, D. Janussen and J. N. A. Hooper. 2005. World Porifera Database. Available online at <http://www.vliz.be/vmdcdata/porifera>.

Received: 24 April 2008

Accepted: 29 April 2008