Indian J.L.Sci. 4 (1) : 129-134, 2014

ISSN : 2277-1743 (Print)
ISSN : 2278-7879 (Online)

NEW RECORD OF SPONDYLUS LIMBATUS G. B. SOWERBY II, 1847 (BIVALVIA: PTERIOMORPHIA: SPONDYLIDAE) FROM VIZHINJAM, KERALA, INDIA

S. SOUJI[a1] AND TRESA RADHAKRISHNAN[b]

[ab]Department of Aquatic Biology and Fisheries, University of Kerala, Thiruvananthapuram, Kariyavattom, Kerala, India

ABSTRACT

New record of *Spondylus limbatus* (Sowerby, 1847) from Kerala water is described in this paper. Spondylidae is a small family of bivalves have only one genus and they are considered as the typical marine bivalve. The specimens were collected from Vizhinjam, Kerala, south westcoast of India. Species level classification was done using morphometric characters of the shell. It is an unexploited bivalve species in Kerala coast and it's commercial exploitation is nil in this part of Kerala.

KEYWORDS : Spondylidae, Spondylus Calcifer, Spondylus Limbatus, Vizhinjam, Kerala

Pelecypods are economically important group of marine invertebrates. The family Spondylidae composed of sedentary bivalves like true oysters. The bivalve family, Spondylidae (Gray, 1826) has only one genus, Spondylus (Linnaeus, 1758). It is commonly known as thorny oysters. From Spondylidae family 76 living species are reported from different parts of the world (Lamprel, 2006). Lamprell (2006) found Spondylus calcifer (Carpenter, 1857) to be a synonymy of the earlier name Spondylus limbatus (Sowerby, 1847). Coan and Valentich-Scott (2008) gave a description about the nomenclature of three Spondylidae species. They proposed to use the earliest available name for the species S. limbatus for the Eastern Pacific species. Besides these, Macensen et al. (2012) used the name Spondylus limbatus (Sowerby, 1847) based on Huber's (2009) description. Instead of Spondylus calcifer, the accepted name used inWorld Register of Marine Species (WoRMS) is Spondylus limbatus (Sowerby, 1847). Thus now the accepted name in use is Spondylus limbatus (Sowerby, 1847) for the newly found Spondylidae species from the Indian south west coast, Vizhinjam, Kerala. Many authors had used the name Spondylus calcifer (Carpenter, 1857). Hence literature is available in the name Spondylus calcifer (Carpenter, 1857). Thus we are also used the synonym Spondylus calcifer (Carpenter, 1857) in this paper.

Three species of Spondylidae were found along the Ecuadorian coast: Spondylus princeps (Broderip, 1833) and Spondylus leucacanthus (Broderip, 1833) and Spondylus calcifer (Carpenter, 1857). Spondylus calcifer (Carpenter, 1857) is distributed from the Gulf of California to Peru and can be found from intertidal to subtidal zones, attached by the right valve to exposed boulders or under rock ledges (Skoglund and Mulliner 1996; Pountier, 1995). Lamprell (2006) reported that this species was distributed from the Sea of Cortez Mexico in the north to Ecuador in the south. According to Keen (1971), S. limbatus is by far the largest of west American thorny oysters and reaches length upto 249 mm. Its distribution is from Panama to north-western Peru (Keen, 1971). Coan and Valentich-Scott (2008) reported S. limbatus as the typical Panamic bivalve. As per WoRMS data it is distributed in Djibouti and Madagascar. Huber (2010) described Spondylus asiaticus from India. Based on the data of www. Sea life base Spondylus limbatus was reported from 3 countries namely China, Japan and the Philippines.

Spondylus calcifer, first described by Abbot (1974) which is the largest of west American spondylids. West American spondylids range from the Gulf of California to North-western Peru. The hinge plate in adults has two large corral teeth in the right (lower) shell, and the corresponding sockets in the left shell (Yonge, 1973.) The genus, Spondylus is characterized by a large muscle scar, posterior to centre of shell; the cardinal area of the hinge is larger in the right shell, the ligament is deeply sunken in a triangular pit. The wall of the bivalves radially ribbed, and along the ribs scaly projections or long spines are present. Commonly the shells are distorted in shape because of crowding of species or it is attached to the rocky substratum. The species are variously colored and ribbed spines on the shell make them more beautiful (Keen, 1971). Thorny oysters live cemented to shells or other substrates as epifaunal species.They have well developed middle mantle that carries sensory tentacles with multiple eyes, their

[1]**Corresponding author**

cerebral and visceral ganglia have become much more concentrated in the visceral region, and they show distinct optic lobes with nerve trunks to the mantle edges (Morton, 1960). The species reaches sexual maturity between 1.5 to 3 years of age and can live to atleast 10 to 12 years. Maximum length reported for this species is 250 mm, suggesting Spondylus calcifer could live much longer (Cudney-Bueno and Rowell, 2008). The species attain 25 cm in shell height. The fertilization is external. The planktonic stages are followed by settelment of sessile individuals (Villalejo-Fuerteet al., 2002).

The Spondylus species were exported from Ecuadorand its import into Peru was known even from the Prehistoric eras. The shell is prominent in carvings at Chavin de Huntar, indicated its highly sacred value in the religious system practiced there. It was reported that there was a gradual increase in the import of Spondylus over time. The large Spondylus shells are magnificent that have a long history in South American culture as ceremonial offerings and currency, reaching back to Valdivian and Incan times (Paulsen, 1974). Beginning in 1990s, after centuries of oblivion, S. calcifer and S. princeps have made a comeback as a valuable resource in coastal Ecuador. These spondylids were once known as "the food of the Gods" by ancient Ecuadoria. The jewelry using Spondylus and its recent fame as a delicacy, probably resulting from a misinterpretation of the nickname 'manjar de los dioses' ("food of the gods"); most likely for their ancient use as ceremonial offerings. A Spondylus species known as Spondylus princeps was more precious than gold by the time the Spanish arrived in western South America and the desire for it seems to have been a critical factor in the active and extensive long-distance commerce that was taking place (Lamprell, 2006). Large quantities of S.princeps were exported by land and water from Perú, and nowadays it is suffered from overfishing. At present, S. princeps is rare; however S.calcifer is to be the most currently abundant of the two spondylid species in Ecuadoria. They whole shells or valves carved in to small images and ground in to powder. Often it was cut and polished as beads or used as inlays to adorn objects, sometimes in conjunctions with less valuable purple colored Spondylus calcifer. The source of the Spondylus, the coast from Ecuador northwards, was not only far from many of the regions where it was valued, but the shell also exists deep on Ocean beds (Pountier, 1995).

A local expansion of Spondylus is present in southern and central coast of Peru.In the Ica Valley of South Coastal Peru, a Late Horizon youth was buried with "parts of necklaces of Spondylus shell pendants" along with whole Spondylus valves (Menzel, 1977). Spondylus species have been used by South American people for a wide variety of purposes in thousand years ago. The exterior shell and margin of this shell is thick and durable can be shaped into various forms, they includepurple, red, orange, pink and white.The annual landing of more than 68,040 kg of flesh of the Spondylidae species in Ecuadoria were reported (Mackensen et al., 2011). Divers collect Spondylus calcifer and S. princeps in 2000, mainly for demand of Peruvian artisans. Because of the overexploitation, Spondylus species were depleted from the Ecudor coast. Hence subsecretary of fishing resources in Ecudor finally took action and announced a complete closure of S.calcifer and S. princeps fisheries (Mackensenet al, 2011).

MATERIALS AND METHODS

Specimens collected were washed with clean water, labelled properly and transported to the lab, in plastic

Fig . 1 Study site

buckets for further identification. The living specimens both the whole animal and soft part of the organisms were washed and soft parts of the organisms were extracted, and only the shells were used for taxonomic identification; in some cases, the remnants of the adhered epibiota were removed from the shell. The taxonomic identification of species was performed using FAO identification sheets and online data base was used for the species level classification, identification and confirmation. After identification the specimen were deposited in the Marine Biodiversity Museum, Central Maine Fisheries Research Institute (CMFRI) Kochi with Accession number D. C. 8.1. 2. The study site Vizhinjam (8°22′45″N 76°59′29″E), is shown in Figure1.

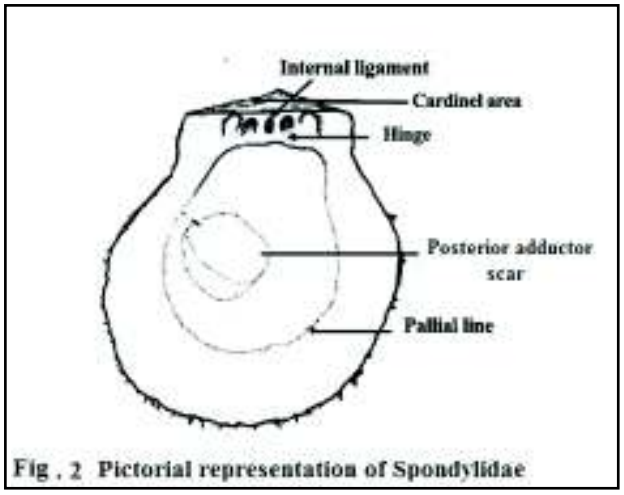


Fig . 2 Pictorial representation of Spondylidae

Spondylus limbatus G. B. Sowerby II, 1847

RESULTS AND DISCUSSION

Spondylidae species are disingushed by their relatively large size and presence of long spines. Their shell shape is circular to oval with convex valves. The right valve is usually cemented to a hard substrate and is more flattened than the left valve. The umbo and ligament are higher than the left valve. The exterior part of the left valve is irregular, spiny radial ribs of different shapes and sizes. Both valves are equipped with sturdy, interlocking teeth and sockets. The spondylid adductor muscle system is monomyarian.Its size is range from 25 to 230mm (Rehder, 1981). The systamatics and description of the Spondylidae species collected from Vizhinjam coast, Thiruvananthapuram is described in this paper. The pictorial representation of Spondylidae species is shown in Figure. 2 and Figures 3a and b show the outer surface of the shell and the inner part of the valve respectively.

Parent: Spondylus Linnaeus, 1758

Class	: Bivalvia
Subclass	: Pteriomorphia
Order	: Pectinoidea
Superfamily	: Pectinoidea
Family	: Spondylidae
Genus	: Spondylus
Locality	:Vizhinjam,Thiruvananthapuram, Kerala, India
Habitat	: Rocky sea shore

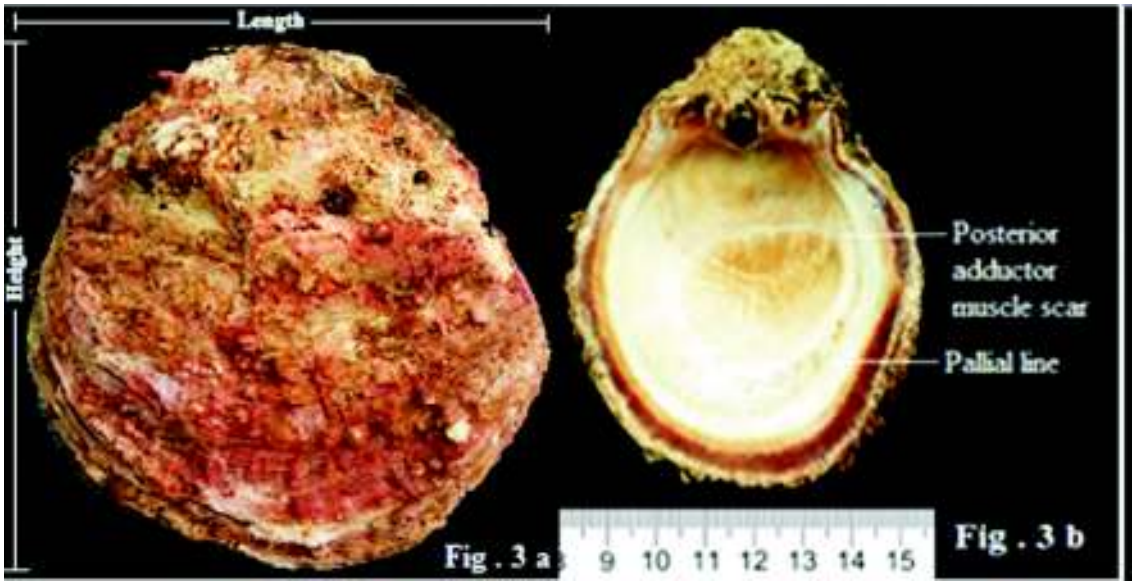


Fig . 3 a Fig . 3 b

Synonyms

Spondylus coccineus Lamarck, 1819; *Spondylus radula* Reeve, 1856; *Spondylus calcifer* Carpenter, 1857; *Spondylus lamarckiisensu* Carpenter, 1857; *Spondylus smithi* Fulton, 1915; *Spondylus punicus* Cai Bernard, and Morton, 1993.

Description

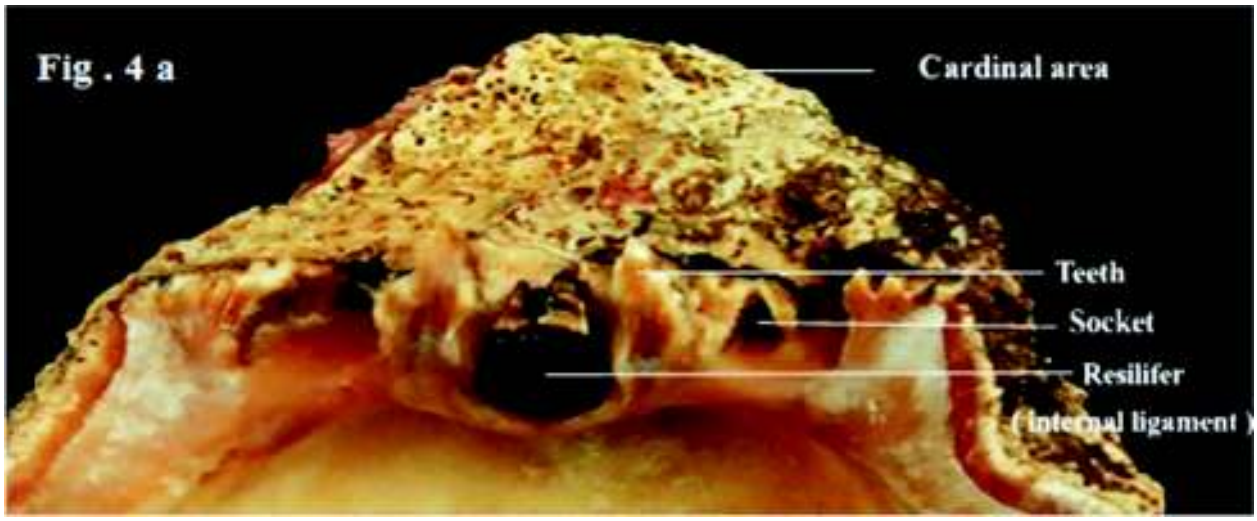
Their distinguishing features are a pair of nearly equal-size teeth in each valve and a centrally placed resilifer. They are monomyarian. Cardinal area appears as a smooth or horizontally grooved triangular area between the beak and the hinge line. Three live specimens were collected from the study site and the noted features of the specimens are as follows: the shells are nearly equilateral and inequivalve. Shell solid, oval shape, smooth flattened scaly projections are present in the periostraccum, small ridges lead to occasional imbrications and shell surface become rough. Cardinal area is prominent and triangular in shape. Internally they are deep concave yellow white with a broad purple margin. A single adductor muscle scar is present near the posterior margin of the shell. The anterior part of the inner shell valve is shown in Figure 4a and the outer surface of the shell is shown in Figure 4b.

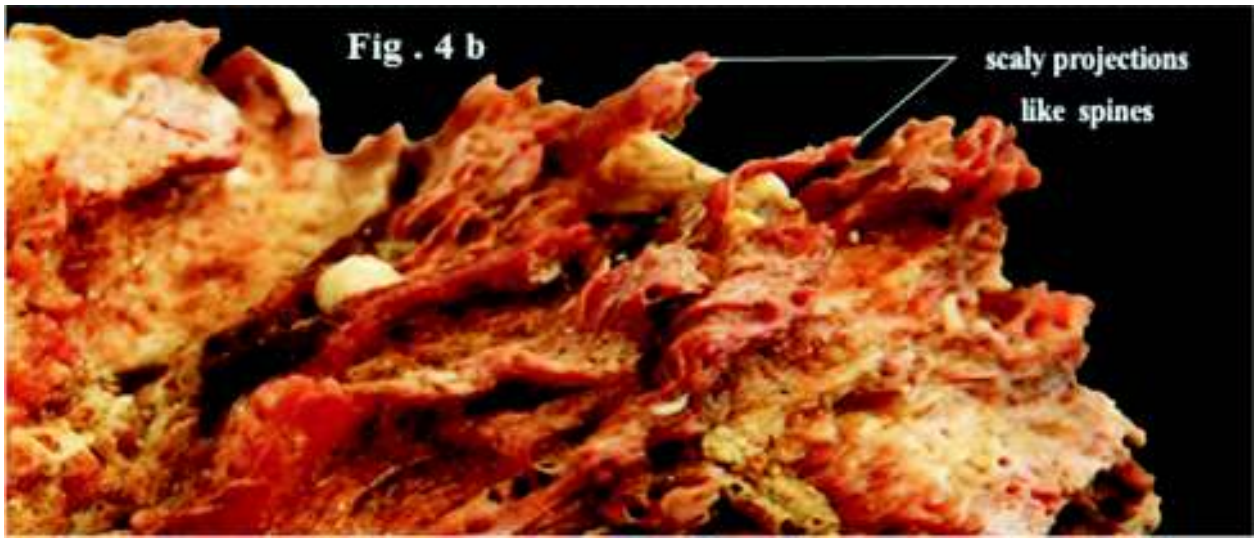
Meassurements

2.5 cm width and 6. 8 cm length

Remarks

This species is reported for the first time from India.





Ecological data

This Spondylus species are attached on the rocky bottom of the Vizhinjam Bay in depths down 1 m-2 m at low tide from intertidal zone. Other fauna a fern is attached on their upper valve. According to Lamprell (2006), *S. limbatus* is found from the intertidal to a depth of 30 metres and can live in tidal as well as in quiet, silty conditions whereas *S. limbatus* reported from Ecuador usually attached with almost the entire right valve and thus very variably taking the form of the rock or crevice where it attaches.

CONCLUSION

The *Spondylus limbatus* (Sowerby, 1847) is seen abundantly with the Perna perna in the intertidal region of Vizhinjam Bay. This valuable species is discarded carelessly along the coast. More than one species are noticed from this area. The lack of knowledge on the economic use of oyster species is the main hindrance for the non-use of this species commercially in India. The awareness on the use of this rich marine bioresource should be created among the coastal public so that this species can be exploited in large scale for good source of protein for the starving and needy population.

ACKNOWLEDGEMENT

First author is indebted to Dr, K.K. Joshi, Principal Scientist and Ms. P.M. Geetha of Marine Biodiversity Museum of CMFRI, Kochi, Rajankuttichal Photographer for the timely help of the work and Kerala University for a JRF during the tenure of this research.

REFERENCES

Abbott R. T., 1974. American Seashells. New York Van Nostrand Rein-hold and Co. 663.

Coan and Valentich-Scott, 2008. Three nomenclatural notes on Panamic Bivalves, Santa Barbara Museum of Natural History, California, U. S. A.

Cundneu-Bueno R, Rowell K, 2008. Establishing a baseline for management of the rock scallop spondylus calcifer (Carpenter 1857): growth and reproduction in the upper Gulf of California, Mexico. J Shell fish Res.,27: 625-632.

Fotis I. M. N. 2011. Spondylus in Prehistory New data and approaches"; Contributions to the archaeology of shell technologies. Archaeo Press, Publishers of British Archaeological Reports, Gordon House 276 Banbury Road. Oxford. England.

Huber M., 2009. Name Changes for two well-known Panamic Spondylids. Festivus 41:103.

Huber M., 2010. Compendium of Bivalves. Hackenheim: Conch Books. 901 pp.

Keen A. M., 1971. Seashells of tropical West America. Marine mollusks from Baja California to Peru.Stanford Stanford University Press. 1064.

Lamprell K., 2006. Spiny oysters: a revision of the living spondylus species of the World. Brisbane; Jean Lamprell.119 pp.

Morton J. E., 1960. Molluscs-An Introduction to Their Form and Function. Harper and Brothers; . Harper Torchbook 1st Ed. 232.

Mackensen A. K., Brey T. and Sonnenholzner, S. 2011, The fate of Spondylus stocks (Bivalvia: Spondylidae) in Ecuador: Is the recovery likely? Journal of Shell fish Reasearch, 30 (**1**): 115-121.

Mackensen A. K., Brey T., Bock C. and Luna S., 2012. *Spondylus crassisquama* Lamarck, 1819 as a microecosystem and the effects of associated macrofauna on its shell integrity: isles of biodiversity or sleeping with the enemy? Mar Bio div DOI 10. 1007/s 12526- 012- 0120-9.

Menzel D., 1977, The Archaeology of Ancient Peru and the Work of Max Ühle, Berkeley: University of California, R.H. Lowie Museum of Anthropology. 275.

Menzel D., 1964. Style and time in the Middle Horizon.Ñawpa Pacha 2: 66-73, 104-105

Paulsen A. C., 1974. The thorny oyster and the voice of God: Spondylus and Strombus in Andean prehistory. Am. Antiq. 39: 597-67.

Pountier J M., 1995. Bivalves. In: Fischer W, Krupp F, Schneider W Sommer C, Carpenter K E, Niem VH (eds) Guia FAO para la identification de especiespara los fines de la pesca: Pacificocentro oriental VolumenI. FAO, Roma, 99-222 pp.

Rehder H. A., 1981. The Audubon Society Field Guide to North American Seashells. New York: Alfred A. Knopf.

Skoglund and Mulliner, 1996. The genus Spondylus (Bivalvia: Spondylidae). Festivus 28: 91-107.

Villalejo-Fuerte M., Arellano-Martinez M., Ceballos-Vazquez13P, Garcia- Dominguez F (2002). Reprouductive cycle of Spondylus calcifer Carpenter, 1857 (Bivalvia: Spondylidae) in the "Bahia de Loreto" National Park Gulf of California, Mexico. J Shell fish Res. 21: 103-108.

Yonge C. M., 1973. Functional morphology with particular reference to hinge and ligament in Spondylus and Pliccatula and a discussion on relations within super family Pectinacea (Mollusca: Bivalvia). Phil. Trans. Roy. Soc. Ser. B. 267; 173-208.