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NEW RECORDS OF *CHONDRILLA AUSTRALIENSIS* AND *CHONDRILLA GRANDISTELLATA* (DEMOSPONGIAE: CHONDROSIDA: CHONDRILLIDAE) FROM HAVELOCK ISLAND, SOUTH ANDAMAN, INDIA

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Abstract: The genus *Chondrilla* is reported from the Andaman group of Islands off Havelock Island for the first time, with two species, *C. grandistellata* and *C. australiensis* in this study. This genus has previously been reported and represented by four species in Indian waters viz., *Chondrilla mixta*, *C. sacciformis*, *C. kilakaria* and *C. australiensis*. *C. australiensis* is light brown to reddish-brown in colour; encrusts primarily on live boulder corals; contains oxyasters measuring 14.8-(18.5)-22.2 µm and spherasters measuring 17.3-(26)-29.7 µm. *C. grandistellata* is tan or brown in colour with unevenly distributed white speckles; Contains large spherasters that measure 106.3-(143.3)-175.6 µm. In this study it is suggested that *C. sacciformis* specimens reported previously from India may be *C. grandistellata*; this probable conspecificity is also discussed.

Keywords: India, marine sponge, new record, Porifera.

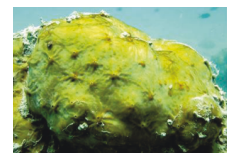
The order Chondrosida Boury-Esnault & Lopès, 1985 contains only a single family Chondrillidae Gray, 1872 with four valid genera *Chondrosia*, *Chondrilla*, *Thymosia* and *Thymosiopsis*. *Chondrilla* Schmidt, 1862 is the most widely distributed genus with a total of 17 valid species (van Soest 2015). These are characterized by the presence of siliceous spicules of the aster type alone, abundant in the cortex and surrounding the canals (Boury-Esnault 2002).

The genus *Chondrilla* has been previously reported from India and is represented by four species: *C. mixta*



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Chondrilla australiensis



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Conflict of Interest: The authors declare no competing interests.



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Schulze, 1877 from the Gujarat coast, *C. kilakaria* Kumar, 1925 from the Gulf of Mannar, *C. sacciformis* Carter, 1879 from the Gulf of Mannar and *C. australiensis* Carter, 1873, from the eastern coast of India, the Gujarat coast and the Gulf of Mannar. Dendy (1916a) had described a species *C. agglutinans*, which was later determined to be a synonym of *C. mixta* Schulze 1877 by Burton (1924). This is the first record of the genus *Chondrilla* from the Andaman and Nicobar Islands, with descriptions of *C. australiensis* and *C. grandistellata*.

MATERIAL AND METHODS

The sponge specimens were collected by diving using SCUBA and the field photographs were taken using a Canon G11 digital camera with an underwater casing. They were preserved in absolute alcohol within two hours of collection. Forty-eight hours later, the alcohol previously used was discarded and fresh alcohol was added for the final preservation. Sponge sections were made using a razor blade and then kept in xylene until they became translucent. A small piece of the sponge tissue was put in nitric acid to dissolve the organic material and isolate siliceous spicules. The sections and the spicules were observed under a compound light microscope and photographed using a Canon digital camera. Spicules were measured (minimum of 50 spicules of each type were measured) using an ocular micrometer, which was calibrated using a stage micrometer.

STUDY AREA

The Andaman and Nicobar Islands, a long chain of islands, lying between 6045'–13041'N and 92012'–93057'E, extending over an expanse of 800km (Ramakrishna et al. 2010). Information on poriferan diversity from these Islands is very scarce (Immanuel & Raghunathan 2010). A total of 486 sponge species have been identified across India (Thomas 1998) of which only 95 species are reported from the Islands (Wilson & Kitto 2012). Havelock Island, where the sponges were collected, is part of Ritchie's Archipelago and the Rani Jhansi Marine National Park (Fig. 1). The Island is a popular tourist destination known for its pristine coral reefs and associated faunal diversity.

Spicule types

The basic shape of spicules (megascleres and microscleres) mentioned in this work are described in detail.

Oxea - Monoaxonic megasclere with pointed ends on either side

Oxyaster - Star-like microsclere that has pointed free

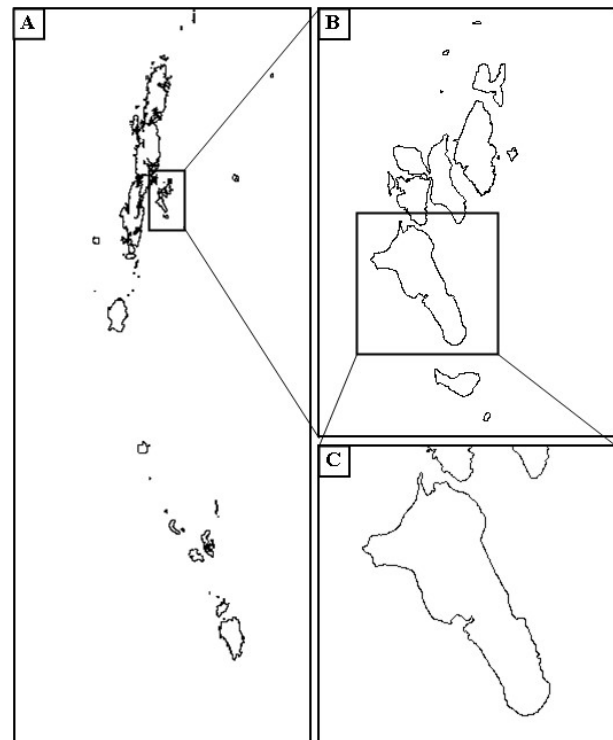


Figure 1. Map of study area. A - Andaman and Nicobar Islands; B - Ritchie's Archipelago; C - Havelock Island.

rays radiating from a small centrum less than one-third the diameter of the whole spicule (Boury-Esnault & Rützler 1997).

Spheraster - Star-like microsclere with a prominent thick centrum and short rays; diameter of the centrum exceeds the length of the rays (Boury-Esnault & Rützler 1997).

RESULTS

Systematics

Phylum Porifera Grant, 1836

Class Demospongiae Sollas, 1885

Order Chondrosida Boury-Esnault & Lopès, 1985

Family Chondrillidae Gray, 1872

Genus *Chondrilla* Schmidt, 1862

Chondrilla australiensis Carter, 1873

Material examined: ZSI/ANRC-7522, 18.xi.2011, one specimen, a thin encrusting sheet with small fragments of corals attached to the bottom measuring around 2cm in length (from a depth of 3–4 m), Havelock Island (12°13.061'N–93°15.207'E), coll. Titus Immanuel,

Description: The sponge was often seen encrusted on live massive boulder corals *Porites* spp. (Image 1A). The thickness of the sponge varies from 1-4 mm and

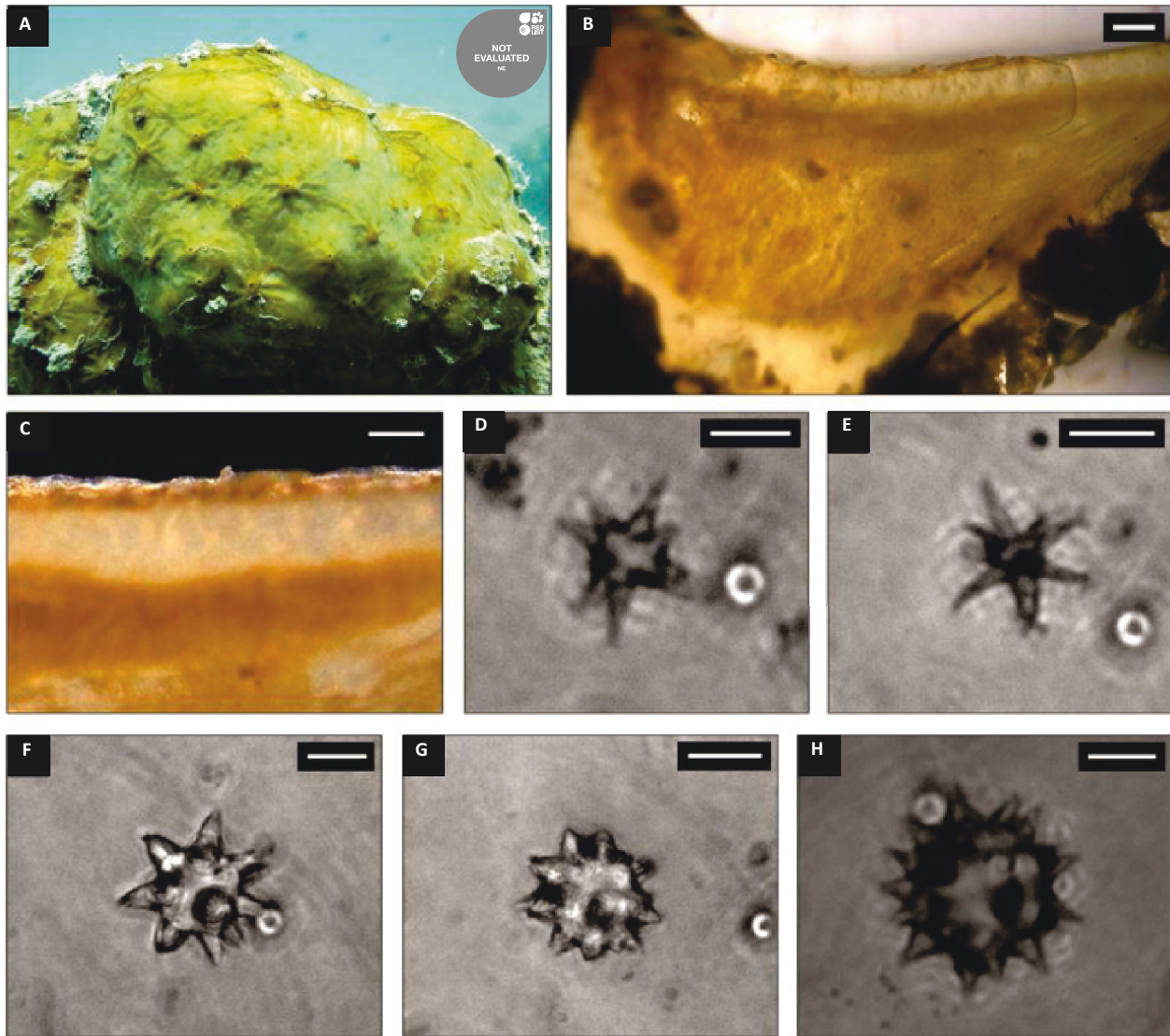


Image 1. *Chondrilla australiensis* [ZSI/ANRC-7522]. (A) In-situ image; (B) Internal organisation of *C. australiensis* (Scale= 200 μ m); (C) Closer view of the Ectosomal region (Scale= 100 μ m); (D–E) Oxyasters (Scale= 10 μ m); (F–H) Spherasters (Scale= 10 μ m). © Titus Immanuel

has been noted to totally smother a coral colony more than 1 m long. The oscules, measuring 1-2 mm when open, are almost evenly distributed over the surface, around 2-3 cm apart. When the sponge is disturbed or brought out of water, contraction is pretty obvious as the oscules, which are usually slightly raised above the surface, contract and get suppressed. The sponge is fleshy and smooth to the touch when alive but turns very tough, with cartilaginous consistency, once preserved in ethanol. It was very firmly attached and hence it had to be collected along with the substrate.

Colour: Light brown to reddish brown in live condition, turning very pale in ethanol.

General organisation: The ectosome consists of a superficial thin layer, the cortex, which is darkly

pigmented (Image 1C), followed by a less pigmented region. The thickness of the ectosomal layer was 110-180 μ m. The choanosomal region was clearly differentiated from the ectosomal region in colour and density of the mesohyl (Image 1B). The internal canals were distinct and the spherasters and oxyasters were distributed with no apparent pattern. The concentration of asters was scarce in comparison to other species of *Chondrilla*.

Spicules: The spicules were made up of both spherasters and oxyasters. The smaller oxyasters (Image 1D & E) measure 14.8-(18.5)-22.2 μ m. The larger spherasters (Image 1F-H) measure 17.3-(26)-29.7 μ m (Table 1).

Distribution: The sponge has been previously reported from Australia, Indonesia, Marshall Islands,

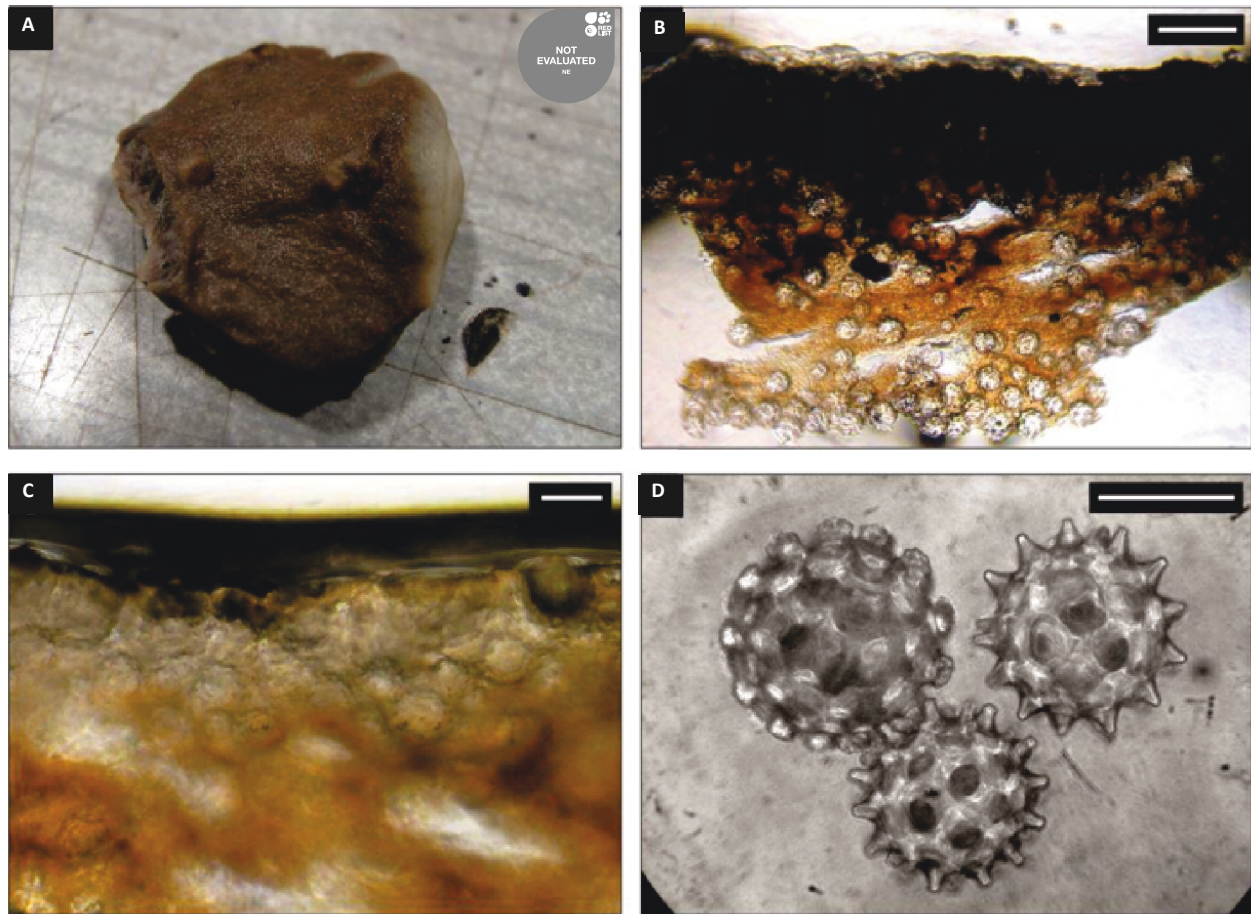


Image 2. *Chondrilla grandistellata* [ZSI/ANRC-7531]. (A) Preserved specimen; (B) Internal organisation (Scale= 500µm); (C) Closer view of the cortex packed with spherasters (Scale= 100µm); (D) Spherasters (Scale= 100µm). © Titus Immanuel

South Indian Coast, Sri Lanka, and the Eastern coast of Africa and Oman.

***Chondrilla grandistellata* Thiele, 1900**

Material examined: ZSI/ANRC-7531, 20.iii.2012, one specimen, a single piece measuring 2cm in length and 5mm in thickness, Havelock Island (12°00.005'N & 92°56.808'E), from a depth of 15m, coll. Titus Immanuel.

Description: The specimen collected (Image 2A) as well as the ones nearby were characterized by distinct thick lobular mounds measuring around 2–5 cm each. The sponge grew on the underside of a ledge located 15m deep which had little chance of getting any direct sunlight. Oscules were quite prominent and slightly raised above the surface of the sponge measuring about 2–3 mm. The sponge was tough, cartilaginous and very slightly compressible. Its surface was rough to touch, like fine sandpaper because of the asters that lined the cortex of the sponge ectosome.

Colour: It is mostly tan or brown, mottled with white. The colour persists in ethanol and is not lost in

preservation.

General organisation: The ectosome was characterised by a prominent cortex of 250–590 µm thickness, packed with large spherasters (Image 2B & C). The choanosomal region is characterised by scattered spherasters (Image 2B).

Spicules: Spherasters (Image 2D) of *C. grandistellata* are the largest of the genus, their diameter ranging from 106.3–(143.3)–175.6 µm (Table 1).

Distribution: Previously reported from Indonesia (Thiele 1900) and the Marshall Islands (De-Laubenfels 1954); it is also suspected to be reported as *C. sacciformis* from India (Dendy 1916b) and East Africa (Pulitzer-Finali 1993).

Remarks: *Chondrilla sacciformis* Carter, 1879 bears a very close resemblance to *C. grandistellata* Thiele, 1900 (excluding the oxea that Carter (1879) had described, which has for long been considered not to be of the type specimen, i.e., of extraneous origin). Thiele (1900) has mentioned in the description that *C. grandistellata* had spherasters of diameter 150 µm and that no other

Table 1. Spicule dimensions of *Chondrilla australiensis* and *Chondrilla grandistellata*

	<i>Chondrilla australiensis</i>		<i>Chondrilla grandistellata</i>	
	ZSI/ANRC-7522		ZSI/ANRC-7531	
	Oxyspheraster	Oxyaster	Spheraster	
	27.2	17.3	163.2	150.9
	24.7	19.8	153.3	136.0
	24.7	14.8	153.3	165.7
	29.7	19.8	145.9	168.2
	27.2	19.8	150.9	128.6
	29.7	18.5	145.9	148.4
	27.2	19.8	165.7	155.8
	26.0	22.3	145.9	160.7
	28.4	16.1	148.4	150.9
	29.7	18.5	150.9	148.4
	27.2	17.3	145.9	160.7
	17.3	18.5	165.7	160.7
	18.5	19.8	148.4	153.3
	24.7	17.3	165.7	150.9
	29.7	19.8	165.7	145.9
	26.0	14.8	153.3	165.7
	27.2	18.5	145.9	160.7
	26.0	17.3	148.4	153.3
	18.5	16.1	160.7	148.4
	28.4	19.8	165.7	163.2
	29.7	17.3	160.7	160.7
	26.0	18.5	155.8	145.9
	24.7	17.3	141.0	175.6
	27.2	22.3	153.3	111.3
	26.0	18.5	153.3	108.8
	29.7	19.8	158.3	96.4
	27.2	19.8	160.7	103.9
	27.2	18.5	158.3	94.0
	17.3	19.8	148.4	106.3
	26.0	18.5	131.1	111.3
			123.7	111.3
			118.7	91.5
			113.8	106.3
			111.3	98.9
				113.8
Mean	26	18.5	143.3	
SD	3.6	1.8	21.8	
Range	17.3-29.7	14.8-22.3	106.3-175.6	

Chondrilla spp. has such large spherasters. It was compared only with *C. nucula* Schmidt, 1862 and *C. secunda* Lendenfeld, 1885, whereas *C. sacciformis* was much closer in size (113µm, approximately). Dendy (1916a) had claimed to have in his possession Carter's cabinet, which had dried fragments and a teased fragment in Balsam, both presumably labelled by Carter as *C. sacciformis*. These contained no oxete forms and it was suggested that the oxete forms that Carter (1879) had described could have been oxeads of the sponge *Rhaphidhistia spectabilis* Carter, 1879 over

which *C. sacciformis* had been growing. This claim is not sufficiently justified, as the oxeads of *C. sacciformis* are much larger than the size of oxeads present in *R. spectabilis* as described by Carter (1879). A recent study by Fromont et al. (2008) confirms that the type specimen of *C. sacciformis* from the Natural History Museum, London (BMNH 95.8.9.2) had oxeads. Fromont et al. (2008) also questioned the taxonomic position of *C. sacciformis* and suggested that it needs to be reassigned to the family Geodiidae as the type specimen seemed to possess sterrasters rather than spherasters. In view of all the above arguments and also in agreement with Fromont et al. (2008), it is probable that *C. sacciformis* Carter, 1879 is a member of the Family Geodiidae. Investigations of the specimens of *C. sacciformis* described by other works after Carter (1879) have to be made before any conclusions on the validity of the name *C. sacciformis* can be made.

DISCUSSION

In this study, two sponge species of the genus *Chondrilla* from Havelock Island, *C. grandistellata* and *C. australiensis*, have been examined in detail and described from this region for the first time. We also found that Fromont et al. (2008) have discussed in detail, the possibility of the type specimen of *C. sacciformis* (Carter, 1879) being shifted to the Family Geodiidae. *C. sacciformis* described from Indian waters by Dendy (1916a), is probably a junior synonym *C. grandistellata* Thiele, 1900, but since type specimens could not be examined, both species are considered valid for this study. The Genus *Chondrilla* is represented by five species in Indian waters, namely *C. australiensis*, *C. grandistellata*, *C. kilakaria*, *C. mixta* and *C. sacciformis*. There have been revisions of species and grouping of several species as one in previous works describing *Chondrilla* (Dendy 1916b; Burton 1924; De Laubenfels 1954; Fromont et al. 2008). This is probably due to the fact that most of the sponges have a very inconsistent organisation of spicules internally, with variable concentrations (Fromont et al. 2008). The most reliable characteristic for identification of sponges seems to be their spicule complement and spicule sizes. Cavalcanti et al. (2007) state that characters, such as spicule size and spicule concentration vary with season and cannot be a valid taxonomic character for studying the genus *Chondrilla* and that valid characters have to be assigned before confirmed descriptions of *Chondrilla* spp. can be made. In case of the two sponges described in this study, there is little confusion since the spicule complements are conspicuously different and also correlated with very

Keys to species of *Chondrilla* reported from the South Andaman Island

1. Only spherasters present, with diameters more than 100µm; in larger asters the rays are terminally microspined but never branched *Chondrilla grandistellata*
- Both spherasters and oxyasters present; oxyasters with microspined, irregularly bent rays which are frequently bi-rayed or multi-rayed *Chondrilla australiensis*

different growth forms. But for some of the more closely related sponges, such as *C. australiensis* and *C. mixta*, which have very similar sizes of spicules, suggestion of con-specificity is inevitable (Burton 1924; Fromont et al. 2008). Usher et al. (2004) studied the phylogeny of the species of *Chondrilla* present in Australia and concluded that *C. nucula* could not be present in Australia, although it has been reported from there. Thus conclusive determination of conspecificity and heterospecificity can probably be achieved only by DNA barcoding or other molecular techniques (Duran & Rützler 2006; Rützler et al. 2007). While there is a certain degree of reluctance from traditional taxonomists in using a small part of the DNA as an identification factor, this molecular tool, when used along with traditional taxonomy could play a great role in solving some of the issues in the taxonomy of sponges with very few phenotypical variations.

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