

New record of sponge from Narara Reef, Gulf of Kutch

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Abstract

We report one species of sponge i.e. *Haliclona (Reniera) debilis* Pulitzer-Finali, 1993 collected from Narara Reef areas of Gulf of Kutch, Gujarat, as a new record to India. The details of the morphometric analysis along with previous distributional details are depicted here. This study also confirms the report of *Haliclona (?Reniera) cf. cinerea* (Grant, 1826) *sensu* Dendy (1916) from the aforementioned study area.

Keywords: Porifera, Haplosclerida, Chalinidae, Gujarat Coast

Introduction

Porifera (sponges) are among the most common benthic epifaunal invertebrates in shallow coastal inshore environments of temperate and tropical zones. The history of sponge research in the Gulf of Kutch and Gujarat is very limited. Dendy (1916) described ten Haplosclerida from the collections of James Hornell (1905–1906) from the Okhamandal Coast (seven of which are accepted species of *Haliclona* in the *World Porifera Database* (<https://www.marinespecies.org/porifera/>) (WPD); and much later, Thomas (1996) described 25 species from Port Okha to the west of Narara, two of which were Haplosclerida but none of which were species of *Haliclona*. Dendy (1916)'s species of *Haliclona* include five valid species and two questionable species. The five valid species include: *Gellius fibulatus* var. *microsigma* Dendy, 1916, now accepted as *H. (G.) cymaeformis* (Esper, 1806) in WPD; *Gellius ridleyi* Hentschel, 1912, now accepted as *H. (G.) ridleyi* (Hentschel, 1912) in WPD; *Reniera hornelli* Dendy (1916), now accepted as *H. hornelli* (Dendy, 1916) in WPD; *Reniera semifibrosa* Dendy,

1916, now accepted as *H. semifibrosa* (Dendy, 1916) in WPD; and *Siphonochalina minor* Dendy, 1916, now accepted as *H. pacifica* Hooper in Hooper & Wiedenmayer, 1994, in WPD. Two records are considered to be inaccurate in WPD because they represent species first described elsewhere: *Reniera topsenti* (Thiele, 1905), now accepted as *H. (R.) topsenti* (Thiele, 1905), was considered inaccurate by Burton (1929) as this species was first described from Patagonia; and *Reniera permollis* (Bowerbank, 1866), now accepted as *H. (R.) cinerea* (Grant, 1826) in WPD, is a northeastern Atlantic species. Dendy (1916)'s record of *R. permollis* in Western India is thus questionable, but his specimens are valid species of *Haliclona* because of the skeleton architecture. Species of *Haliclona* are difficult to identify without the diagnostic morphology and live colouration, which are frequently lost after collection and preservation, and almost never present in older descriptions (Kelly and Rowden, 2019). The purpose of this study is to record these living characters in fresh specimens that resemble Dendy's *Reniera permollis* and update that record.

Material and Methods

Sponge specimens were collected from the Narara Reef of Gulf of Kutch, Gujarat by snorkeling and hand collection. Specimens were photographed *in situ* using a Nikon Z6II Underwater still camera, and in the lab using a Nikon Eclipse 50i Clinical microscope. Location maps were created using ArcGIS® Pro software, ver. 3.0.3. Upon collection, specimens were preserved in 95% ethanol and stored in 70% ethanol. Spicule preparations were made following the methods of Boury-Esnault & Rützler (1997). For light microscopy, spicules were cleaned in nitric acid at 80°C, rinsed several times in water and spread on a glass microscope slide, air-dried, and mounted with a permanent mountant medium. Spicules were examined using a Nikon Eclipse 50i Clinical microscope at 40–400× fitted with a PixelINK digital camera that was connected to NIS elements imaging software. Digital images were taken for spicule measurements, a minimum of twenty spicules were measured for each specimen examined. Spicules were measured for maximum length and maximum width and are presented as mean length (range) × mean width (range). Spicule measurements in the species descriptions are the mean of all tabulated measurements for the examined specimens. The skeletons were examined via a series of impermanent thin sections. Specimens were deposited in the National Zoological Collection at the Marine Biology Regional Centre of the Zoological Survey of India, Chennai (accession prefix MBRC/ZSI/S.553 & S.584).

Results

A species of *Haliclona (Reniera) debilis* Pulitzer-Finali, 1993 is reported from Narara Reef areas of Gulf of Kutch, Gujarat as new to Indian waters. This study also approves the report of *Haliclona (?Reniera) cf. cinerea* (Grant, 1826) *sensu* Dendy (1916) from the study area. The details are cited below. We also describe living Narara sponges that resemble *H. (R.) debilis* and compare them to *H. (R.) debilis* and other species in the Western Indo-Pacific Province (Table 1).

Systematics

Class Demospongiae Sollas, 1885

Order Haplosclerida Topsent, 1928

Family Chalinidae Gray, 1867

Genus *Haliclona* Grant, 1867

Subgenus *Haliclona (Reniera)* Schmidt, 1862

Diagnosis. Delicate sponges with a cushion-shaped or an encrusting morphology, or clusters of tubes. Consistency varying from soft and compressible but fragile to moderately firm. Colours are commonly bright, varying from purple, violet to orange and yellow. Surface is smooth and even. If present, ectosomal skeleton has a regular, tangential, unispicular, isotropic, reticulation. Choanosomal skeleton also a delicate, regular, unispicular, isotropic reticulation. Oxeas are frequently blunt pointed or strongylote. Microscleres, if present, toxas and sigmas (modified from de Weerd 2002).

Type species. *Reniera aquaeductus* Schmidt, 1862

Haliclona (Reniera) debilis Pulitzer-Finali, 1993

Figure 1, 3; Table 1

Haliclona debilis Pulitzer-Finali, 1993: 325, Figure 63.

Haliclona (Reniera) debilis, Kelly 1997: 124 + Figure

Material Examined. MBRC/ZSI/S.584: Location- Narara, Gujarat (Lat. 22.37–22.46° N & Long. 69.56–69.66° E); Date- 19.xii.2022; Habitat-Intertidal; Collector- G. Sivaleela (Figure 1).

Type & locality. R.N.KEN.158, Ras Iwetine Mombasa, Kenya.

Description. Sponge forms clusters of short, thick, conjoined tubes arising from a thick base, lobes topped with large oscules leading to deep cylindrical tubes, attached basally to coral rubble (Figure 3A–C); 116 mm high, 57 wide mm, whole sponge 54 mm diameter; surface macroscopically smooth, microscopically punctate with subsurface canals; texture soft, compressible, elastic, easily torn in life; colour in life bright fuchsia to purple (Figure 3A, B), grey in preservative (Figure 3C), yellowish brown in the dried state.

Skeleton and spicules. Choanosomal skeleton consists of a delicate, unispicular, isotropic reticulation, formed by single spicules lightly attached end to end. Ectosomal skeleton a delicate reticulation in places (Figure 3D). Oxeas, stout, slightly curved, 86 (73–97) × 5 (3–6) μm (Figure 3E).

Substrate, depth range, and ecology. Often nestled amongst seagrass or *Halimeda* plants on muddy sand flats adjacent to mangroves, 0–1 m (Kelly 1997); in Narara (Figure 1), found in the intertidal on dead coral rubble amongst dense cyanobacteria in the intertidal (Figure 3A, B).

Distribution. Kenya, Tanzania (Zanzibar Island) (Pulitzer-Finali 1993; Kelly 1997); Narara, Gujarat Coast.

Remarks. New record to India. Fifty-three species of *Haliclona* (*Reniera*) are currently known from predominantly cold temperate waters of Chile and China in the Pacific, and the Western Caribbean and Western Mediterranean in the Atlantic Ocean (de Voogd *et al.* 2023). Only five species are known from the Western Indo-Pacific Province in addition to *Haliclona* (*Reniera*) *debilis* (Table 1): *Haliclona* (*R.*) *atra* Pulitzer-Finali, 1993, also from Kenya; *H. (R.) cribricutis* (Dendy, 1922) and *H. (R.) tufoides* (Dendy, 1922) from the Seychelles; *H. (R.) ligniformis* (Dendy, 1922) from Chagos, and *H. (R.) tabernacula* (Row, 1911) from the Red Sea. All species differ considerably from *H. (R.) debilis* in terms of their spicule dimensions, which in all species are well over double the length of those in *H. (R.) debilis*. Kenyan *Haliclona (R.) atra* Pulitzer-Finali, 1997 is the closest species in terms of skeletal architecture, but the sponge is branching and black, and the spicules are double the length. *Haliclona (Reniera) debilis* has the smallest of all oxeas in the Chalinide described thus far for Western India.

2. *Haliclona* (?*Reniera*) cf. *cinerea* (Grant, 1826) *sensu* Dendy (1916)

Figure 1, 2; Table 1

Reniera permollis (Bowerbank, 1866), Dendy 1916: 109.

Material Examined. MBRC/ZSI/S.553 (5 specimens); Location- Narara, Gulf of Kutch, Gujarat (Lat. 22.37–22.46° N & Long. 69.56–69.66° E); Date- 19. xii, 2022; Habitat- Intertidal; Collector- G. Sivaleela (Figure 1).

Description. Irregular globular to basally encrusting sponge with small spherical oscules, 2–3 mm diameter, always on the apex of lobes (Figure 2A). Surface microhispid with projecting spicules, texture soft; colour in life bright peach pink, in preservative pale pinkish tan (Figure 2B).

Skeleton & spicules. Isodictyal reticulation of single spicules, end-to-end, with some minor development of primary tracts, 1 spicule wide (Figure 2C). Oxeas, slightly curved, 119 (110–130) × 5 (4–6) μm (Figure 2D).

Substrate, depth range, and ecology. Attached to dead coral rubble, intertidal.

Distribution. Adatra; north of Poshetra; off Beyt (Beyt

Dwarka) (Previous doubtful record) and Narara (Present confirm record), Gulf of Kutch, Gujarat.

Remarks. Dendy (1916) described a number of specimens as encrusting on parchment-like worm-tubes, growing to a considerable size, but so irregular as to be impossible to measure. The texture was very soft and friable, and the surface was minutely hispid, with small, scattered oscules. The skeleton was described as “an irregular isodictyal reticulation of mostly single spicules, but with a strong tendency to form primary fibres, several spicules thick, separated from each other by one spicule’s length. The oxea are gradually curved and sharply pointed, 120 × 6 μm wide. Dendy (1916) considered the identification of *Reniera permollis* to be “good”, especially with the “nut-brown colour”, but noted the similarity of *R. permollis* to *R. cinerea* (the former is now recognised as a junior synonym of the latter).

Of all the five species of *Haliclona* described by Dendy (1916), our specimens most closely resemble those described by Dendy (1916: 109) as *Reniera permollis*, especially in terms of the overall morphology (irregular and lobate encrusting), and spicule morphology (slender, curved) and dimensions (119 μm *versus* 120 μm (Dendy 1916)); no other Western Indo-Pacific species has spicules around 120 μm long (see Table 1). The only major difference between Dendy’s specimens and the Narara specimens is the tendency to development of primary lines in Dendy’s specimens, compared with ours which show only minor development of unispicular lines (Figure 2C). Dendy’s Western Indian specimens differ from the northeastern Atlantic species, *Haliclona (Reniera) cinerea*, based on location (Gray first described it from the western coastline of Scotland, but now common in the northeastern Atlantic), colouration (originally described as blackish grey), skeleton (possessing a very regular, tangential, unispicular, isotropic ectosomal and choanosomal reticulation of oxeas), and spicule dimensions, being 100 (77–113) × 7 (5–10) μm (de Weerd, 2002), and considerably smaller than Dendy’s specimens’ spicules.

The presence of occasional primary fibres in Dendy’s specimens, and minor development of these in the Narara specimens, raises some doubt as to the present identification as these features are more common in *Haliclona (Haliclona)*. We consider the following representation to be acceptable: *Haliclona* (?*Reniera*) cf. *cinerea* (Grant, 1826) *sensu* Dendy (1916: 109).

Discussion

Here we update the record for *Reniera permollis* (Bowerbank, 1866) in Dendy (1916: 109) from the Gulf of Kutch and add a new record for India. Dendy (1916)'s original descriptions do not include the key diagnostic characters that we are able to add (morphology images and colouration and range in spicule dimensions) and which are necessary for future recognition in the field. The colour in life and morphology of the Western Indian specimens of *H. (R.) debilis* (squat

fuscia tubes) is remarkably similar to those described from Mombasa by Pulitzer-Finali (1993) and described and illustrated from Zanzibar by Kelly (1997). These species are both easily distinguished from all other species of the subgenus in the Western Indo-Pacific Province, and we are comfortable with reporting a correction to the Porifera record, and adding a new record for the region, as the Western India and East Africa Coral Coast marine ecoregions are linked biogeographically through the Western Indo-Pacific Province.

Table 1. Comparison of *Haliclona* (?*Reniera*) cf. *cinerea* (Grant, 1826) *sensu* Dendy (1916) and *Haliclona* (*Reniera*) *debilis* Pulitzer-Finali, 1993 (holotype) with species described from Kenya and other locations in the Western Indo-Pacific Province.

Taxa	Synonyms	Locality & depth	Spicules & dimensions	Description	Remarks
<i>Gelliodes fibroreticulata</i> (Dendy, 1916)	<i>Reniera fibroreticulata</i> Dendy, 1916	Gulf of Kutch, Gujarat	Oxeas, 100 × 6 µm, in a close irregular network of single spicules and numerous, multispicular fibres, 400 µm thick.	Short anastomosing branches, sponge 31 mm long, 20 mm high, 5 mm thick; surface smooth; texture firm	
<i>Haliclona</i> (? <i>Reniera</i>) cf. <i>cinerea</i> (Grant, 1826) <i>sensu</i> Dendy (1916)	<i>Reniera permollis</i> (Bowerbank, 1866) <i>sensu</i> Dendy (1916)	Adatra, north of Poshetra. Off Beyt Dwarka, Gulf of Kutch, Gujarat, 5–7 m	Oxeas, 120 × 6 µm, irregular isodictyal reticulation of single spicules, some multispicular fibres, separated by a spicule	Encrusting sponge growing over parchment-like worm tubes; colour dark brown; texture soft, fragile; surface hispid due to projecting spicules and fibres; oscules small and scattered.	<i>Reniera permollis</i> (Bowerbank, 1866) is now accepted as <i>Haliclona</i> (<i>R.</i>) <i>cinerea</i> (Grant, 1826). Dendy (1916)'s record from Western India is questionable as <i>H. (R.) cinerea</i> is from the northeastern Atlantic.

Taxa	Synonyms	Locality & depth	Spicules & dimensions	Description	Remarks
<i>Haliclona (Gellius) cymaeformis</i> (Esper, 1806)	<i>Gellius fibulatus</i> var. <i>microsigma</i> Dendy, 1916	Off Beyt Dwarka, Gulf of Kutch, Gujarat, 27–31 m	Oxeas, 250 × 10 µm, sigmas 16.4 µm (Dendy 1916); oxeas, 155 (128–177) × 5–8 µm, sigmas 18 (17–20) µm (Kelly-Borges & Bergquist, 1977)	An erect bushy or ramose sponge with bifurcating branch tips. Completely invests the red algae <i>Ceratodictyon spongiosum</i> . Deep green in life	
<i>Haliclona (Gellius) ridleyi</i> (Hentschel, 1912)	<i>Gellius ridleyi</i> Hentschel, 1912	Aru Islands, 10 m	Oxeas, 136–192 µm, sigmas 15–25 µm	Composed of thick, horizontal or vertical, 1 cm thick lamellae, bearing small oscules in rows on the margins, length up to 14 cm; surface smooth, colour pale grey to reddish brown.	
<i>Haliclona (Reniera) atra</i> Pulizer-Finali, 1993	<i>Adocia atra</i> Pulizer-Finali, 1993	Kenya, 2–4 m	Oxeas, 160–180 × 9 µm, unispicular reticulation	Irregularly cylindrical, branching from the base, 20 cm long, 1 cm thick, colour in life and preservative, black; soft, limp	
<i>Haliclona (Reniera) cribricutis</i> (Dendy, 1922)	<i>Reniera cribricutis</i> Dendy, 1922	Seychelles, 38–55 m	Oxeas, 170 × 6 µm, confused subisodictyal reticulation of plurispicular fibres	Subcylindrical, unbranched, 68 mm by 15 mm, 5 mm oscules, numerous surface subdermal cavities; texture soft	
<i>Haliclona (Reniera) debilis</i> Pulizer-Finali, 1993	<i>Haliclona debilis</i> Pulizer-Finali, 1993	Kenya, 0–1 m	Oxeas, 70–85 × 3–4.5 µm, unispicular reticulation	Cluster of coalescent tubes, 3 cm high, 7–15 mm wide, thin walls; extremely soft, fragile	

Taxa	Synonyms	Locality & depth	Spicules & dimensions	Description	Remarks
<i>Haliclona (Reniera) ligniformis</i> (Dendy, 1922)	<i>Reniera ligniformis</i> Dendy, 1922	Chagos Archipelago, lagoon	Oxeas, 140 × 6 µm, dense, confused subisodictyal reticulation	Erect, tree-like, angular, flattened branches; surface smooth, hispid, narrowly grooved; texture resembling driftwood	
<i>Haliclona (Reniera) tabernacula</i> (Row, 1911)	<i>Reniera tabernacula</i> Row, 1911	Red Sea Agig Harbour	Oxeas, 110–140 × 35 µm, dense plurispicular fibres	Triangular sponge, 55 mm long by 22 mm wide, flattened, almost lamellar, tough but easily compressible	
<i>Haliclona (Reniera) tufoides</i> (Dendy, 1922)	<i>Reniera tufoides</i> Dendy, 1922	Seychelles, 512 m	Stout oxeas, 270 × 12 µm, loose sub-isodictyal uni- to plurispicular reticulation	Flattened, cake like, thick dermal membrane, elongate subsurface canals; texture hard, incompressible	
<i>Haliclona hornelli</i> (Dendy, 1916)	<i>Reniera hornelli</i> Dendy (1916)	SW of Beyt Dwarka Island, Gulf of Kutch, Gujarat	Oxeas, 140 × 8 µm, in thin, multispicular fibres running towards the surface, united by one spicule length	Irregularly subglobose body, numerous large oscules with deep cylindrical oscular tube. Surface 'wooly'due to deep, close-set inhalant canals; texture soft	

Taxa	Synonyms	Locality & depth	Spicules & dimensions	Description	Remarks
<i>Haliclona pacifica</i> Hooper in Hooper & Wiedenmayer, 1994	<i>Siphonochalina minor</i> Dendy, 1916	Adatra Reef, Dheb Mora, 2 m	Oxeas, 130 × 6 µm, in a rectangular mesh of stout multispicular fibres	Flattened, branching and anastomosing stolons from which arise anastomosing tubes, terminating in a wide vent	
<i>Haliclona semifibrosa</i> (Dendy, 1916)	<i>Reniera semifibrosa</i> Dendy, 1916	Dhed Mora, between Beyt Dwarka and Arama, west of Beyt Dwarka Island, Gulf of Kutch, Gujarat, 5–9 m	Stout oxeas, 160 × 10 µm, in a unispicular, isodictyal reticulation and ectosomal reticulation, and subdermal reticulation of fibres, representing growth lines	Massive convex crust, closely adherent to the substrate, interior hollow, 85 mm high, 15 mm thick; surface smooth; texture firm	
<i>Reniera topsenti</i> (Thiele, 1905) <i>sensu</i> Dendy (1916)	<i>Reniera topsenti</i> (Thiele, 1905)	Adatra, Gulf of Kutch, Gujarat	Oxeas, 200 × 9 µm in an irregular reticulation of mostly single spicules with a tendency to form slender, multispicular fibres running to the surface	Depressed ramose-lobose form, numerous large oscules; texture soft, fragile	<i>Reniera topsenti</i> (Thiele, 1905) is now accepted as <i>Haliclona (Reniera) topsenti</i> (Thiele, 1905). Dendy (1916)'s record in Western India is inaccurate (Burton, 1929) because the skeletal architecture of Dendy's specimen is more akin to <i>Haliclona (Haliclona)</i> .

FIGURES

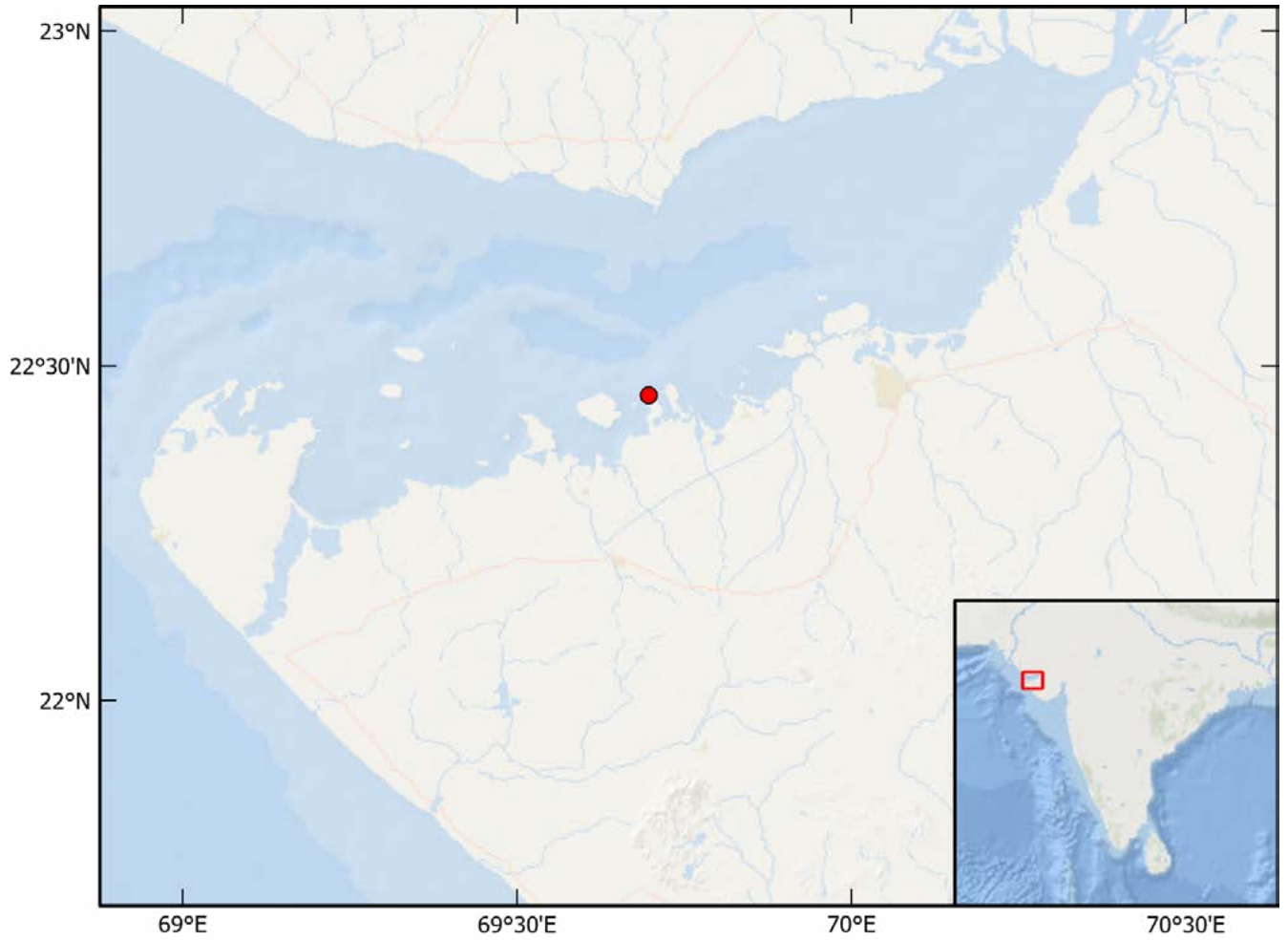


Figure 1. Study site, showing Narara on the Gujarat Coast, Gulf of Kutch, Western India.

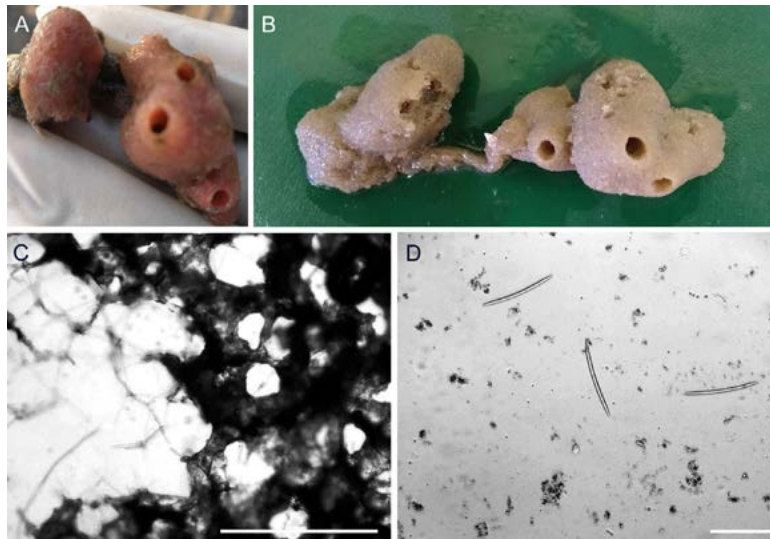


Figure 2. *Haliclona (Reniera) cf. cinerea* (Grant, 1826) *sensu* Dendy (1916), specimen MBRC/ZSI/S.553, from Narara, Gulf of Kutch, Gujarat, Western India: **A.** Fresh specimen showing peach pink colour in life; **B.** Preserved specimen showing faint pink to tan colouration; **C.** Choanosomal skeleton showing delicate unispicular tracts and isodictyal reticulation, scale = 500 μm ; **D.** Oxeas, scale = 100 μm .

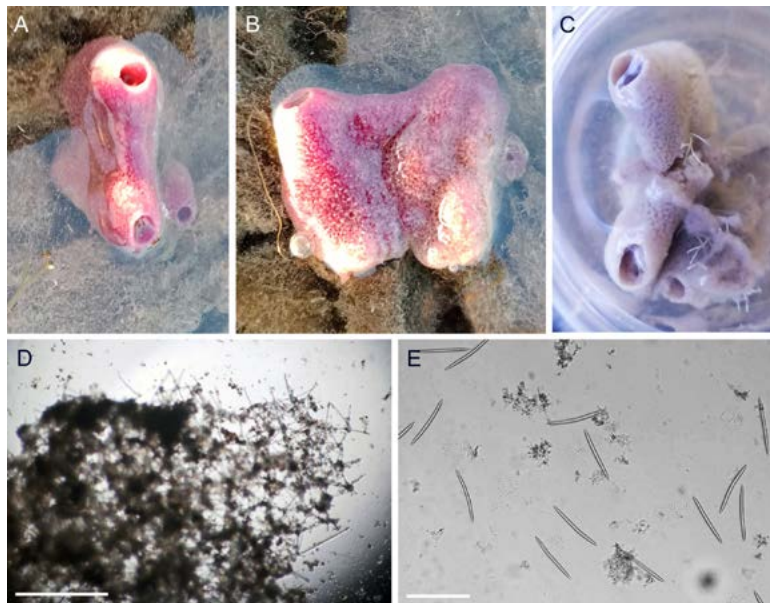


Figure 3. *Haliclona (Reniera) debilis* Pulitzer-Finali, 1993, specimen MBRC/ZSI/S.584 from Narara, Gulf of Kutch, Gujarat, Western India: **A, B.** Freshly collected specimen, showing the bright fuschia colour in life and faintly conulose surface covered by a translucent membrane; **C.** Preserved specimen showing the subdermal canals visible through the surface membrane, and loss of colour upon preservation; **E.** Ectosomal skeleton squash showing delicate single-spicule isodictyal reticulation, scale = 500 μm ; **F.** Oxeas, scale = 100 μm .

Recent surveys at Narara Reef of Gulf of Kutch, on the Gulf of Kutch, Gujarat, revealed numerous sponges in the intertidal, two of which are species of *Haliclona* Grant, 1835, one strongly resembling *Reniera permollis* (Bowerbank, 1866) *sensu* Dendy (1916), and the other closely comparable to *H. (R.) debilis* Pulitzer-Finali, 1997, first documented from shallow coastal waters off Mombasa, Kenya (Pulitzer-Finali 1997) and Zanzibar (Kelly, 1997).

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