

A new species of the cheilostome bryozoan *Trematooecia* Osburn, 1940 from the Mediterranean Sea

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Abstract: Although missing from a standard identification guide to bryozoans of the Mediterranean Sea, the warm water cheilostome bryozoan *Trematooecia* is shown to be present in this sea. A new species, *T. ligulata* Ayari & Taylor sp. nov., is here described using material from the Aegean, the Gulf of Tunis and Alexandria. It differs from *T. turrita* (Smitt, 1873), with which it had been previously confused in the collections of the NHM, London, principally in having an ovicell with a long median foramen. The existence of this new Mediterranean bryozoan underscores our incomplete knowledge of the Mediterranean bryofauna.

Résumé : Une nouvelle espèce de Bryozoaire cheilostome du genre *Trematooecia* Osburn, 1940 de Méditerranée. Malgré le manque de guide standard d'identification des bryozoaires en Méditerranée, le genre *Trematooecia* de bryozoaire cheilostome d'affinité chaude a été signalé dans cette mer. Une nouvelle espèce, *T. ligulata* Ayari & Taylor sp. nov., est décrite à partir de matériel de la Mer Egée, du golfe de Tunis et d'Alexandrie. Elle diffère de *T. turrita* (Smitt, 1873), avec laquelle elle a été confondue dans la collection du Musée d'Histoire Naturelle de Londres, principalement par un ovicelle avec un long foramen médian. L'existence de ce nouveau bryozoaire méditerranéen souligne notre connaissance incomplète de la bryofaune méditerranéenne.

Keywords: Mediterranean Sea • Bryozoa • Cheilostomata • Taxonomy

Introduction

The bryozoan fauna of the Mediterranean Sea is perhaps the most intensively studied from anywhere in the world (e.g. Canu & Bassler, 1930; Calvet, 1931; Gautier, 1962; Harmelin, 1976; Zabala, 1986; Zabala & Maluquer, 1988;

Novosel & Pozar-Domec 2001; Hayward & McKinney, 2002; d'Hondt & Mascarell, 2004). An estimated 476 species of bryozoans have been recorded (Rosso, 2003), yet it is becoming clear that there are still significant gaps in our knowledge of the diversity and distribution of bryozoans in the Mediterranean. For example, in a recent faunal study of bryozoans from the Adriatic (Hayward & McKinney, 2002), out of a total of 106 species, five species were found to be new. The monographic paper of Berning & Kuklinski (2008) on a single cheilostome genus,

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Buffonellaria, was also able to recognise a significant number of new species living in the Mediterranean. In the context of anthropogenic introductions and invasions by marine species into the Mediterranean, which may increase with global warming, it is important to document the current diversity of the Mediterranean bryozoan fauna more completely.

The genus *Trematooecia* Osburn, 1940 is an ascophoran cheilostome with a heavily mineralized skeleton. Globally, nine living species of *Trematooecia* have been recognized, with a further four known only as fossils (Bock, 2008). The genus is distributed predominantly in the warm waters of the tropics or subtropics, for example, the Caribbean, southwestern Pacific and West Africa. A popular identification guide to Mediterranean bryozoans (Zabala & Maluquer, 1988) omits mention of *Trematooecia* but does refer to a species, *Cigclisula turrita* (Smitt, 1873), which is the type species of *Trematooecia*. An earlier paper (Gautier, 1957) also refers to this species as *Holoporella turrita*, showing its occurrence off Tunisia and Syria in a distribution map.

Prompted by the discovery of *Trematooecia* in the Gulf of Tunis, the present paper applies SEM to compare Mediterranean *Trematooecia* specimens with those from elsewhere, including *T. turrita*, using material in the collections of the Natural History Museum, London (NHM), and introduces a new species, *T. ligulata* Ayari & Taylor sp. nov.

Material and Methods

New material examined came from the benthic dredging conducted by the oceanographic vessel *Hannibal* in the Gulf of Tunisia during August 2004. The specimen of *Trematooecia* was sieved from a sediment sample rich in seaweeds and has been deposited in the collections of the Institut National des Sciences et Technologie de la Mer, Tunis (INSTM). Comparative material in the reference collections of the Department of Zoology, NHM was also studied. Specimens were examined using a LEO 1455VP scanning electron microscope that generated backscattered electron images.

Description of new species

Family Hippoporidridae Vigneaux, 1949

Genus *Trematooecia* Osburn, 1940

Trematooecia ligulata Ayari & Taylor sp. nov.

(Figs 1A-D, 2A-D)

1930 *Holoporella turrita* (Smitt, 1873): Canu & Bassler, p. 74, pl. 10, figs 10-16.

1939 *Holoporella turrita* (Smitt, 1873): O'Donoghue & de Watteville, p. 44.

1957 *Holoporella turrita* (Smitt, 1873): Gautier, p. 559, fig. 4.

?1962 *Cigclisula turrita* (Smitt, 1873): Gautier, p. 177.

?1988 *Cigclisula turrita* (Smitt, 1873): Zabala & Maluquer, p. 159, fig. 443.

Holotype

NHM 1899.7.1.1435, Aegean Sea, Busk Collection.

Paratypes

NHM 1963.8.2.50, Alexandria, 7-25 fathoms (= c. 13-46 metres), O'Donoghue Collection (possibly part of the material described by O'Donoghue & de Watteville, 1939). INSTM 2004.01.01.01, Gulf of Tunis, 10°51'31''E - 36°58'40''N, 22 metres, Ayari Collection.

Etymology

From *ligula*, tongue-like, in reference to the shape of the mandible of the large interzooidal avicularia.

Description

Colony encrusting, initially unilamellar, becoming multilamellar through frontal budding, very pale pink in colour.

Autozooids polygonal, delineated by slightly salient boundary walls, variable in size and shape, generally longer than wide, 0.47-0.81 mm long by 0.33-0.75 mm wide; frontal shield moderately convex, cryptocystal, granular, penetrated by areolae and a few scattered pseudopores, developing solid spine-like tubercles of moderate height (up to 0.21 mm) often positioned around the orifice. Orifice

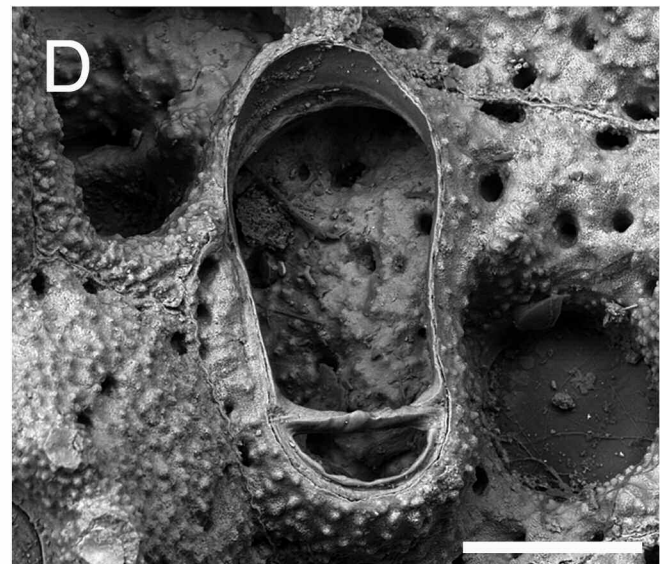
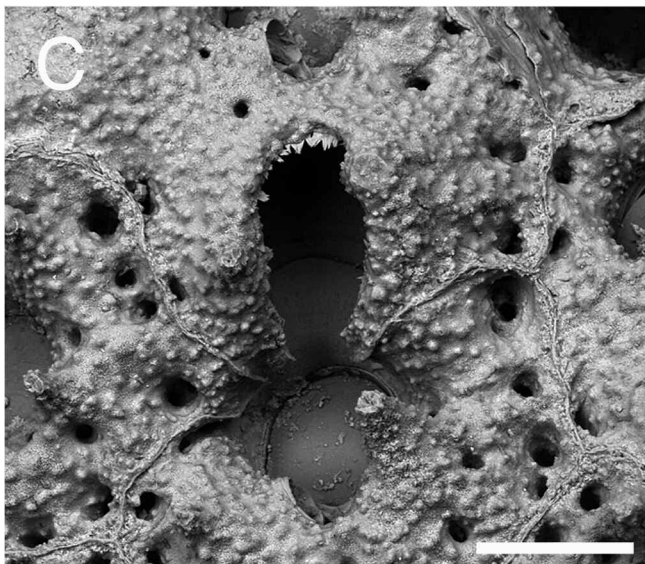
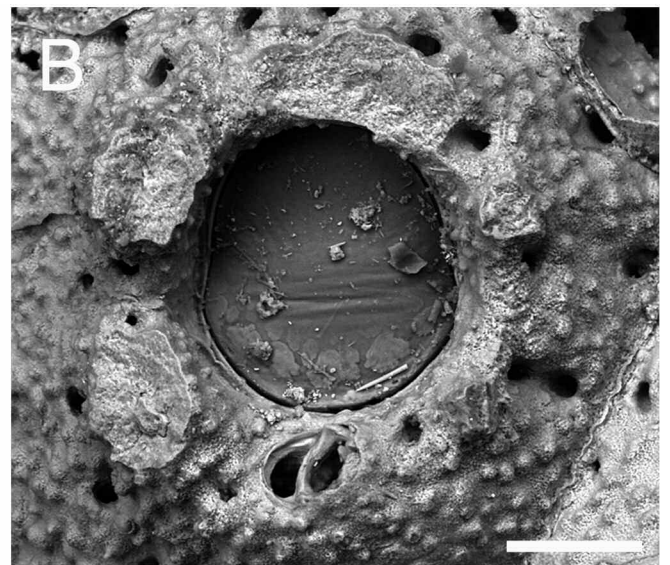
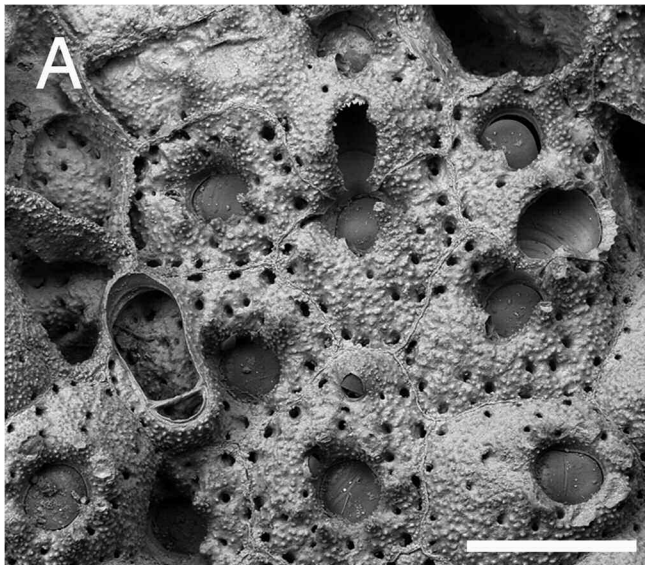


Figure 1. *Trematooecia ligulata* Ayari & Taylor sp. nov. Holotype, NHM 1899.7.1.1435, Aegean Sea. **A.** Part of the dried colony showing autozooids and a large interzooidal avicularium. **B.** Orifice, with intact operculum, and small suboral adventitious avicularium. **C.** Ovicell. **D.** Interzooidal avicularium. Scale bars: **A** = 500 µm; **B** = 100 µm; **C**, **D** = 200 µm.

Figure 1. *Trematooecia ligulata* Ayari & Taylor sp. nov. Holotype, NHM 1899.7.1.1435, Mer Egée. **A.** Portion de colonie séchée montrant des autozoécies et un grand aviculaire interzoécial. **B.** Orifice, avec opercule intact et petit aviculaire suboral. **C.** Ovicelle. **D.** Aviculaire interzoécial. Échelle: **A** = 500 µm ; **B** = 100 µm ; **C**, **D** = 200 µm.

Table 1. Measurements (in mm; 20 zooids per colony)
Tableau 1. Mesures (en mm, 20 zoécies par colonie).

	autozooid length	autozooid width	orifice length	orifice width
NHM 1899.7.1.1435	mean = 0.67 SD = 0.078 range = 0.48-0.81	Mean = 0.56 SD = 0.074 range = 0.48-0.75	mean = 0.19 SD = 0.010 range = 0.18-0.21	Mean = 0.17 SD = 0.014 range = 0.15-0.21
NHM 1963.8.2.50	mean = 0.57 SD = 0.070 range = 0.50-0.80	mean = 0.44 SD = 0.060 range = 0.33-0.53	mean = 0.19 SD = 0.020 range = 0.13-0.22	mean = 0.16 SD = 0.020 range = 0.12-0.20
INSTM 2004.01.01.01	mean = 0.60 SD = 0.068 range 0.47-0.72	mean = 0.50 SD = 0.048 range 0.44-0.60	mean = 0.21 SD = 0.014 range 0.20-0.25	mean = 0.17 SD = 0.020 range 0.15-0.22



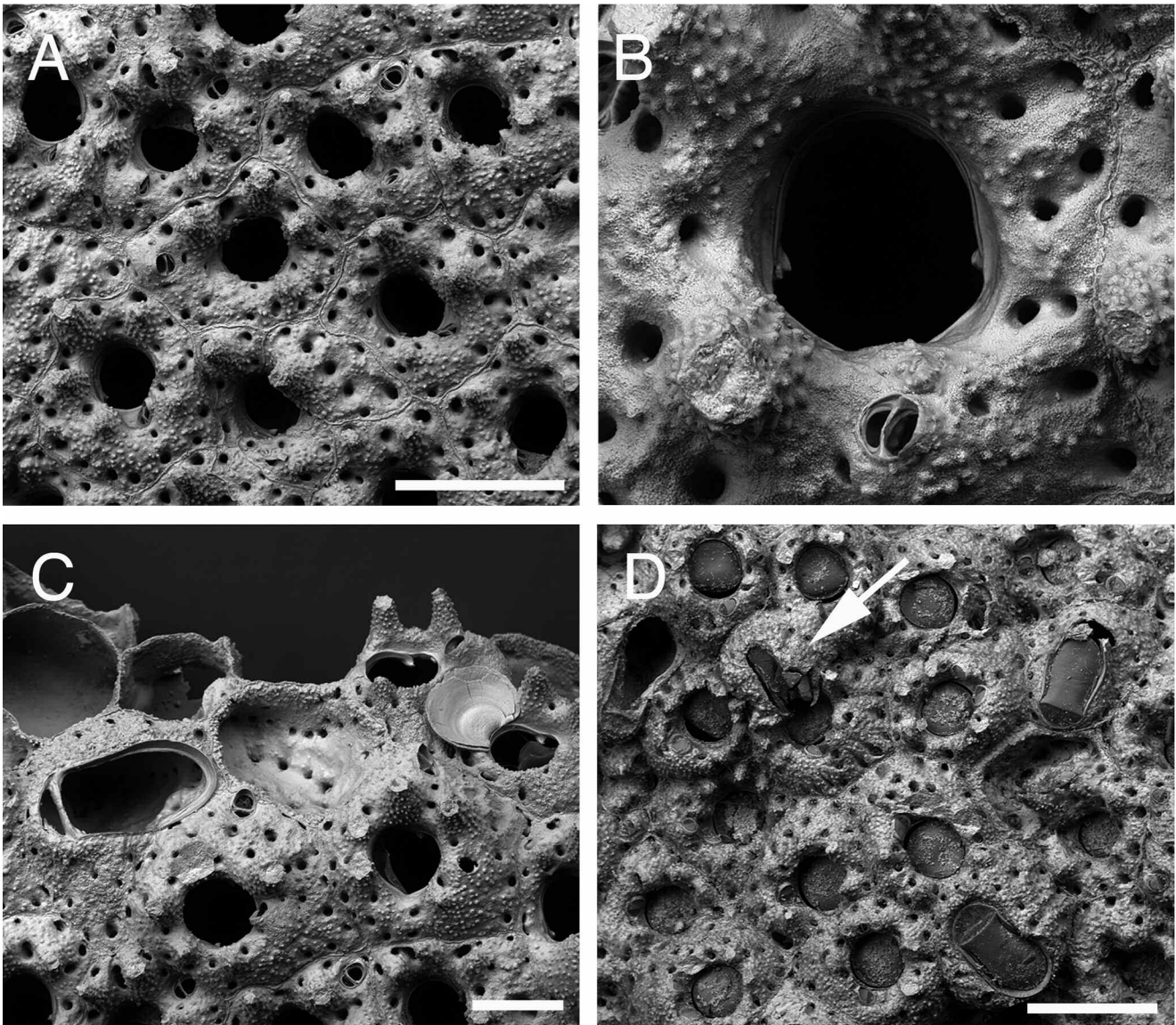


Figure 2. *Trematooecia ligulata* Ayari & Taylor sp. nov. Paratypes (A-C. INSTM 2004. 01.01.01 (bleached), Gulf of Tunis; D. NHM 1963.8.2.50, Alexandria). **A.** Autozooids and small adventitious avicularia. **B.** Primary orifice and suboral adventitious avicularium. **C.** Edge of colony showing interzooidal avicularium, buds and tubercles in profile (top right). **D.** Surface of dried colony showing autozooids with opercula, interzooidal avicularia and an ovicell (arrowed). Scale bars: **A, D** = 500 μ m; **B** = 100 μ m; **C** = 200 μ m.

Figure 2. *Trematooecia ligulata* Ayari & Taylor sp. nov. Paratypes (A-C. INSTM 2004. 01.01.01 (blanchi), Golfe de Tunis ; D. NHM 1963.8.2.50, Alexandria). **A.** Autozoécies et petits aviculaires adventifs. **B.** Orifice primaire et petit aviculaire suboral. **C.** Colonie montrant un aviculaire interzoécial, bourgeons et tubercules de profil (en haut à droite). **D.** Surface de colonie séchée montrant des autozoécies operculées, aviculaires interzoéciaux et un ovicelle (flèche). Échelle: **A, D** = 500 μ m; **B** = 100 μ m; **C** = 200 μ m.

large relative to frontal shield, longer than wide, averaging 0.19 mm long by 0.17 mm wide, sunken, roughly egg-shaped, the poster semielliptical and wider than the rounded arch-shaped anter; condyles prominent, curved proximally. No oral spines. Ovicell mostly immersed within distal zooid, about 0.36 mm long by 0.45 mm wide, oecium granular, calcification continuous with frontal shield of distal zooid, with a long median elliptical foramen

and a few marginal pores; incomplete ovicells showing ectoecium and entoecium separated by lumen.

Avicularia of two types, adventitious and interzooidal. Adventitious avicularia small, about 0.08 mm long by 0.06 mm wide, elliptical, usually one but occasionally two per autozooid, located around outer margins of autozooids and oriented radially outwards, or positioned suborally and oriented tangentially to orifice, not columnar, acutely

inclined to colony surface; pivotal bar calcified. Interzooidal avicularia large, about 0.6-0.7 mm long by 0.3-0.6 mm wide, rostrum tongue-shaped, well rounded, longer than wide; opesia semielliptical, wider than long, much shorter than rostrum; pivotal bar calcified, the distal edge slightly concave; palette very narrow.

Ancestrula and early astogeny unknown.

Remarks

There are several differences between *T. turrita* (Smitt, 1873) (Fig. 3A-D) and *T. ligulata* sp. nov. (Figs 1A-D & 2A-D) that warrant introduction of this new species for Mediterranean specimens previously identified as *T. turrita*. The most striking is in the morphology of the ovicell. Winston's (2005) redescription and figures of the

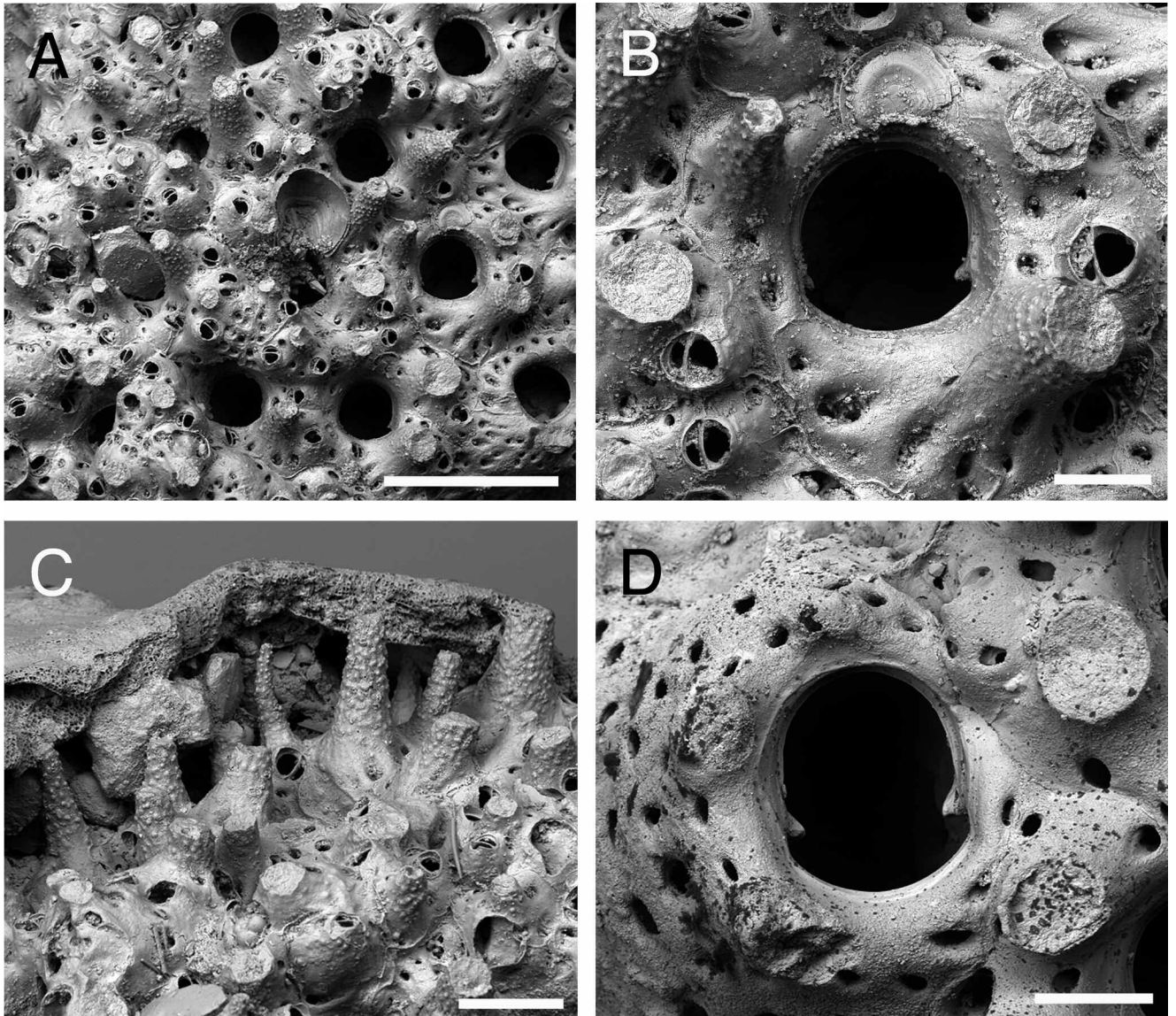


Figure 3. *Trematooeicia turrita* (Smitt, 1873). (A-C. NHM 1932.3.7.32, Albatross Station 2639, Straits of Florida; D. NHM 1979.7.3.13, Ghana). **A.** Colony surface showing numerous adventitious avicularia. **B.** Primary orifice and adventitious avicularia. **C.** Edge of colony with tall spine-like tubercles becoming overgrown by a calcareous alga. **D.** Primary orifice. Scale bars: **A** = 500 μ m; **B**, **D** = 100 μ m; **C** = 200 μ m.

Figure 3. *Trematooeicia turrita* (Smitt, 1873) (A-C. NHM 1932.3.7.32, Albatross Station 2639, Straits of Florida ; D. NHM 1979.7.3.13, Ghana). **A.** Surface frontale de la colonie montrant de nombreux petits aviculaires. **B.** Orifice primaire et petits aviculaires. **C.** Bord de colonie portant de longs tubercules épineux surmonté par une algue calcaire. **D.** Orifice primaire. Échelle: **A** = 500 μ m; **B**, **D** = 100 μ m; **C** = 200 μ m.

ovicell of *T. turruta*, including syntypic material from Florida, shows it to have a median band of pores (e.g. Winston, 2005, figs 293, 294, 296) and not the long elliptical slit present in *T. ligulata* (Figs 1C & 2D). Spine-like tubercles are more numerous, thicker and longer in *T. turruta* than *T. ligulata* (compare Fig. 2C with Fig. 3C), areolae appear larger, and adventitious avicularia may be more abundant and raised (Fig. 3A & B). Differences in primary orifice shape between the two species are also evident, that of *T. turruta* being more parallel-sided compared with the almost egg-shaped orifice of *T. ligulata*, although variations in aspect angle may make this difference difficult to appreciate.

Another species of *Trematoeocia*, *T. aviculifera* (Canu & Bassler, 1923), differs from *T. ligulata* in lacking orificial condyles, having spatulate interzooidal avicularia with deep palettes, and ovicells with a large circular foramen (see Winston, 2005, fig. 301). Although *T. clivulata* Tilbrook, 2006, from the Solomon Islands, is described as having ovicells with a median oral slit, recalling the ovicell of *T. ligulata*, the Pacific species has much more prominent spines than *T. ligulata* and also possesses dimorphic adventitious avicularia compared with the single type of adventitious avicularium present in *T. ligulata*.

Gautier (1962) considered so-called *Cigclisula turruta* to be a variable species in the Mediterranean, based on material from Syria and Tunisia. He described the species as yellow-white, in contrast to the pink colour of the species described by Canu & Bassler (1930) from Tunisia and the fresh material here described as *Trematoeocia ligulata*, raising some doubts about its identity as *T. ligulata*. The drawing given by Zabala & Maluquer (1988) of the Mediterranean species they identified as *Cigclisula turruta* (Smitt, 1873) is enigmatic. While the apparent ovicell shows a median fissure resembling that of the new species described here, the presence of numerous small, columnar avicularia is not typical of *T. ligulata* sp. nov., raising doubts over the identity of their species.

The fossil species *Trematoeocia pauciosculata* (Manzoni, 1870), described from the Pliocene of Italy (see Poluzzi, 1975), resembles *T. ligulata* but, to judge from material borrowed from the private collection of Claudio Piffaferri (Parma, Italy), has sparse adventitious avicularia which, when located suborally, are oriented radially rather than tangentially to the edge of the orifice. Unfortunately, the structure of the ovicell is unknown in *T. pauciosculata*, all available examples being broken.

Distribution

Currently known only from the Mediterranean Sea, including the Gulf of Tunis, the Aegean, off Alexandria, Egypt, and Syria (Gautier, 1957). The unfigured and undescribed record of *Trematoeocia turruta* (Smitt, 1873) given

by d'Hondt (1979) from Portichol, Spain may also represent *T. ligulata* sp. nov. D'Hondt & Mascarell (2004) tabulated 201 bryozoan species from Tunisia, among which is a record (p. 447) of *Cigclisula turruta* (Smitt, 1873), derived from the work of Canu & Bassler (1930), which may represent the new species described here.

Discussion

Despite more than two centuries of study, the bryozoan fauna of the Mediterranean Sea is still incompletely known. As shown by this description of a new Mediterranean species of *Trematoeocia*, knowledge of the full range of species present has yet to be achieved, let alone a comprehensive understanding of their geographical and bathymetric distributions. While it may be tempting to interpret the discovery of *T. ligulata* sp. nov. in terms of a newly introduced species, this is not the case as the type specimen of the species was collected over 100 years ago and has been registered into the collections of the NHM since 1899. The failure to recognise *T. ligulata* in the Mediterranean in part reflects a paucity of research on bryozoans. However, it is also a function of the recent realization that minor differences in skeletal morphology among bryozoans that were previously considered as due to intraspecific variability are significant at the species level; material of *T. ligulata* in the NHM collections was previously misidentified as *T. turruta* (Smitt, 1873).

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