The European Zoological Journal

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/tizo21

Cheilostomatida (Bryozoa) from the Ionian Apulian coast (Italy) with the description of new species

D. Pica, B. Berning & R. Calicchio

To cite this article: D. Pica, B. Berning & R. Calicchio (2022) Cheilostomatida (Bryozoa) from the Ionian Apulian coast (Italy) with the description of new species, The European Zoological Journal, 89:1, 371-422, DOI: 10.1080/24750263.2022.2032849

To link to this article: https://doi.org/10.1080/24750263.2022.2032849

Published online: 24 Mar 2022.

The European Zoological Journal, 2022, 371–422
Vol. 89, No. 1, https://doi.org/10.1080/24750263.2022.2032849

Taylor & Francis
Taylor & Francis Group

Check for updates

Cheilostomatida (Bryozoa) from the Ionian Apulian coast (Italy) with the description of new species

D. PICA [1,*,#], B. BERNING [2,#], & R. CALICCHIO [3]

[1]*Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Calabria Marine Centre, Amendolara, Italy,* [2]*Geowissenschaftliche Sammlungen, Oberösterreichische Landes-Kultur GmbH, Leonding, Austria, and* [3]*Dipartimento di Scienze della Vita e dell'Ambiente, Università Politecnica delle Marche, Ancona, Italy*

(Received 27 July 2021; accepted 4 January 2022)

Abstract
The mesophotic zone is a relatively poorly studied area of the Mediterranean Sea, drawing great interest by the scientific community in the last years. This zone represents a connection between the shallow water and the deep-sea communities, in which photophilic framework builders (e.g. coralline red algae) are gradually replaced by heterotrophic ones, such as ahermatypic corals and the bivalve *Neopycnodonte cochlear*. In this habitat the framework-forming organisms produce a hard substrate with a high topographic complexity, hosting a great biodiversity of secondary structuring taxa like bryozoans. During a survey on coralligenous banks in the mesophotic zone in c. 60 m depth off Gallipoli (southern Apulia), epibiotic aggregations of *N. cochlear* were found on the fans of the hexacoral *Savalia savaglia*. In the present paper the diversity of cheilostomatid bryozoans hosted by these bivalve aggregations is described and compared with published information on similar nearby habitats. A total of 48 taxa were found, six of which are newly described: *Crassimarginatella matildae* sp. nov., *Micropora biopesiula* sp. nov., *Haplopoma celeste* sp. nov., *Schizomavella* (*Schizomavella*) *cerranoi* sp. nov., *Schizomavella* (*Calvetomavella*) *biancae* sp. nov., and *Schizoporella adelaide* sp. nov. The species richness known from the southern Apulian shelf at this depth (47 species) is hereby raised to 83 cheilostomatid bryozoans. Moreover, only 12 species are shared with the other localities studied previously, while 36 are restricted to Gallipoli, supporting the hypothesis of a high rate of exclusivity among Apulian sites in terms of species composition. The differences in faunal composition, and particularly the presence of several new species discovered at Gallipoli, show once more that our knowledge of the bryozoan fauna in certain Mediterranean habitats is still incomplete and warrants further studies.

https://doi.org/urn:lsid:zoobank.org:pub:DDC82039-EF44-4169-8198-C67F60B14BA0

Keywords: Neopycnodonte cochlear, *Mediterranean Sea, animal forest, biogenic structures,* Savalia savaglia

Introduction

In the Mediterranean Sea the bryozoan diversity is relatively high considering the dimensions of the basin: the c. 556 described species represent about 10% of the global bryodiversity (Rosso & Di Martino 2016). This number is expected to increase since many habitats and areas in the Mediterranean are still understudied, such as the eastern and southern regions (D'Onghia et al. 2015; Rosso & Di Martino 2016). Each year, several new species and genera are also being described in the Mediterranean thanks to revision works (e.g. Souto et al. 2010a; Vieira et al. 2014; Reverter-Gil et al. 2016; Berning et al. 2019) as well as owing to newly collected material from hardly accessible habitats like dark caves, the mesophotic zone and deep-sea areas (Rosso et al. 2018; 2020a, 2020b). The mesophothic zone is a relatively unexplored area of the Mediterranean Sea, and growing interest by the scientific community in the exploration of this zone is evident in the last years (e.g. Cerrano et al. 2019 for a

*Correspondence: D. Pica, Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Calabria Marine Centre, C. Torre Spaccata, Amendolara, CS 87071, Italy. Email: daniela.pica@szn.it
#These authors contributed equally to this work.

review; Albano et al. 2020; Giampaoletti et al. 2020). Infact, this zone comprises many different habitats (e.g. part of the coralligenous, various kinds of animal forests and maërl beds) and, due to the limitation of light, the light-dependent, shallow water bioconstructors are gradually replaced by heterotrophic deep-sea communities (see Gori et al. 2017). In the mesophotic zone of the southern Italian Apulian region, two peculiar habitats were recently discovered in which invertebrates are the main bioconstructors (Corriero et al. 2019; Cardone et al. 2020). One of these habitats is constructed by the bivalve *Neopycnodonte cochlear* (Poli, 1795) and the second is made by two species of scleractinan corals (*Phyllangia americana mouchezii* (Lacaze-Duthiers, 1897) and *Polycyathus muellerae* (Abel, 1959)). In these two different habitats the bioconstructions are composed of a multilayered aggregation of dead animals in the centre and an outer layer of presently living organisms, forming a hard substrate with a high topographic complexity, and hosting a huge biodiversity (Corriero et al. 2019; Angeletti & Taviani 2020; Cardone et al. 2020; Giampaoletti et al. 2020). In this habitat the bryozoans, as well as other calcified organisms, play an important secondary role in bioconstruction (Cardone et al. 2020). In a previous study, the analysis of blocks from these peculiar habitats along the Apulian coasts showed the presence of 50 bryozoan species, 46 of which were Cheilostomatida (Giampaoletti et al. 2020).

In the frame of the Mediterreanean Mesophotic research project (MESOMED) expeditions, which aim at exploring the Mediterranean mesophotic zone, coralligenous banks were found off Gallipoli (Apulia, Southern Italy). On the banks the outer layer was dominated by the octocoral *Paramuricea clavata* Risso, 1826 or by the gold coral *Savalia savaglia* (Bertoloni, 1819). Epibiontic organisms occasionally settle on injured branches of *S. savaglia*. Particularly the bivalve *Neopycnodonte cochlear* may form large epibiotic aggregations. The aim of the present paper is to describe the

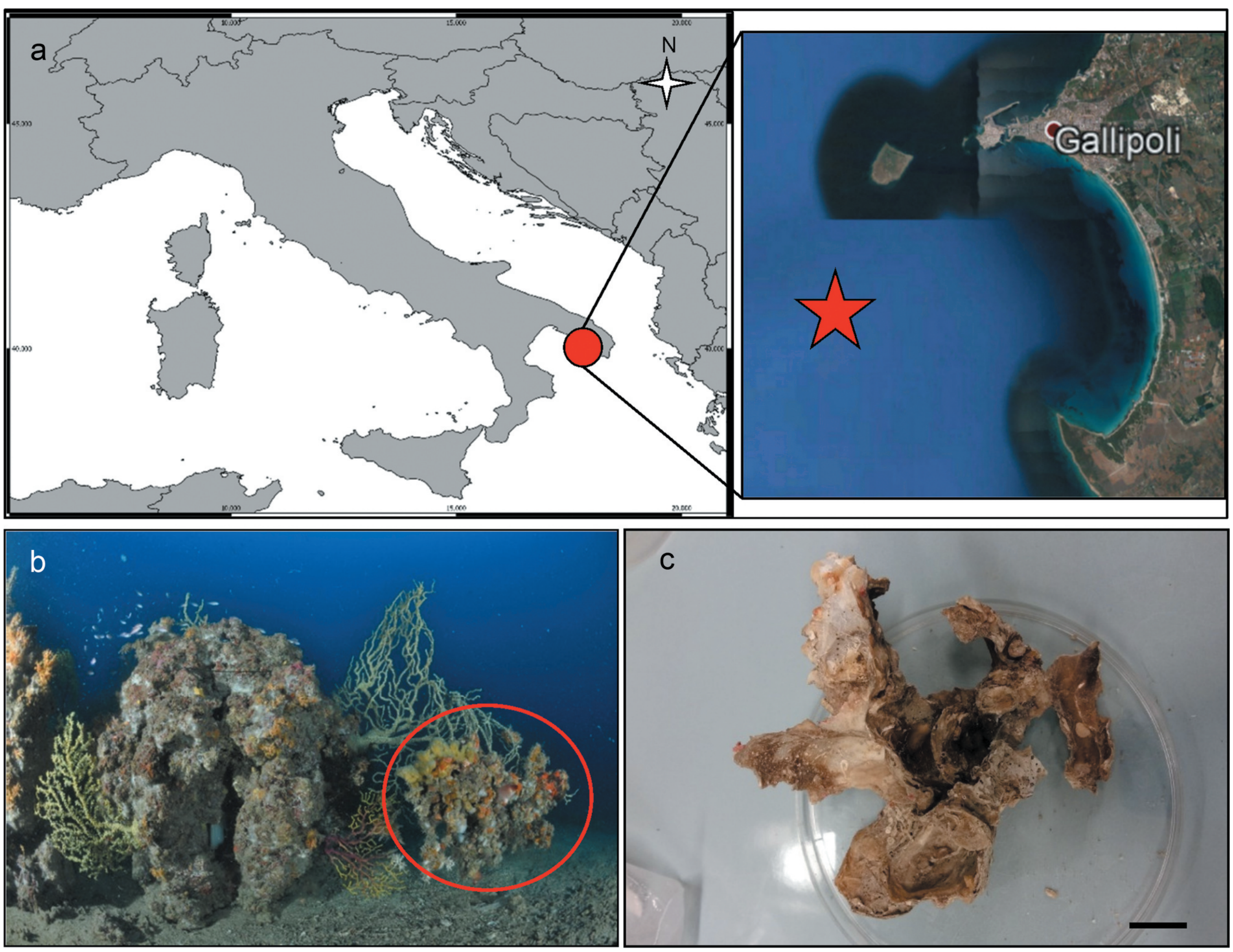

Figure 1. (a) Map of the Italy with a detail of the Gallipoli coast and studied area detailed (star). (b) A colony of the anthozoan *Savalia savaglia* colonized by the bivalve *Neopycnodonte cochlear* (circle) on which the studied bryozoans lived. (c) Group of cemented shells. Scale: C. 1 cm.

diversity of cheilostomatid bryozoans hosted by these aggregations and compare the results with the bryofauna present at the same depth in the adjoining Apulian areas.

Material and methods

The coralligenous banks at 60 m depth off Gallipoli (Lecce) (40°0′56.20″N; 17°55′17.84″E) along the Ionian Apulian coast (Figure 1(a)) were investigated by technical scuba diving on 16 July 2015. The coralligenous banks are up to 2 m in height, towering over a horizontal substrate. The coralligenous is characterised by an outer layer that is dominated by the octocoral *Paramuricea clavata* Risso, 1826 and the gold coral *Savalia savaglia*. Epibiontic organisms settle on injured branches of *S. savaglia*, in particular the bivalve *Neopycnodonte cochlear* (Figure 1(b)). This species starts to colonise dead or damaged portions of the colony (e.g. those inflicted by fishing lines), triggering the development of a very diverse epibiotic community throughout its lifetime as well as *post mortem*. The bryozoan species studied in the present work live on dead shells of *N. cochlear* (Figure 1(c)) that were still attached to the *S. savaglia* skeleton. Fourteen groups of shells cemented to each other (about 5–6 shells each) were collected from different *S. savaglia* colonies and preserved dry. The shell specimens were observed using a Nikon SMZ18 stereomicroscope in order to detect and preliminarily identify the living bryozoan specimens. For all the preliminarily identified bryozoan species, small portions were detached from the shell for detailed analysis of the morphological characters under a scanning electron microscope (SEM). Both untreated and bleached colony portions (using sodium hypochlorite) were mounted on stubs, coated with gold-palladium in a Balzer Union evaporator, and examined with a Philips XL20 SEM. Morphometrics were made on the micrographs using the image software ImageJ (Schneider et al. 2012), and are given in the descriptions as mean ± standard deviation, minimum–maximum values, and number of measurements (whenever >2 measurements were taken). Values are in µm unless otherwise noted; abbreviations: L – length, W – width. The type specimens are deposited in the Museo di Storia Naturale di Genova (Italy) labelled with the acronym MSNG. All other examined material is in the first author's personal collection. Comparative material was examined from the bryozoan collection of the Natural History Museum London (NHMUK).

The synonymy lists of the respective species are not exhaustive. In the light of recent taxonomic revisions, which revealed that many of the previously accepted bryozoan species are actually species complexes, we here provide only those references in which the species is figured (besides the original publication in which the species was introduced), which allowed verifying their synonymy.

Taxonomic accounts

Phylum Bryozoa Ehrenberg, 1831
Class Gymnolaemata Allman, 1856
Order Cheilostomatida Busk, 1852
Suborder Inovicellina Jullien, 1888
Family Aeteidae Smitt, 1868
Genus ***Aetea*** Lamouroux, 1812
***Aetea* spp.**
Fig. 2a, b

Material examined

Pica coll: SEM stubs n°18, 40, 58, all bleached colonies.

Remarks

The colonies are too poorly preserved to permit identification to species level, while it is clear (from

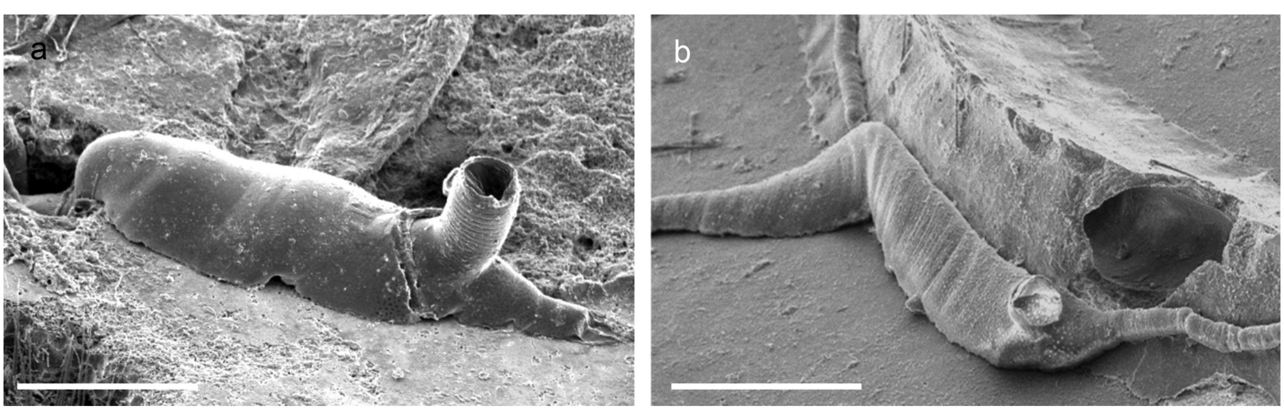

Figure 2. *Aetea* spp. (a, b). Adnate portion of zooids. Scale: (a), (b) 200 µm.

the budding pattern of the encrusting colony portion) that at least two species are present.

Suborder Flustrina Smitt, 1868
Superfamily Calloporoidea Norman, 1903
Family Calloporidae Norman, 1903
Genus **Callopora** Gray, 1848
Callopora dumerilii (Audouin, 1826)
Fig. 3a-d

Flustra dumerilii Audouin, 1826: 240.
Callopora dumerilii: Hayward & Ryland 1998: 160, figs. 40A–C; Hayward & McKinney 2002: 16, figs. 6D–G; Ostrovsky & Schäfer 2003: 20, fig. 4; Chimenz Gusso et al. 2014: 80, figs. 20a–d.

Material examined

Pica coll: SEM stub n°34 bleached colony; two additional unbleached colonies.

Remarks

The auto- and ovicellate zooids in the colonies studied here usually have six oral spines while in other populations most zooids have only four spines (cf. Hayward & Ryland 1998: 160; Hayward & McKinney 2002: 18). While *Callopora dumerilii* usually occurs in shallow waters in the Mediterranean Sea (Hayward & McKinney 2002; Chimenz Gusso et al. 2014), the present specimens from 65 m presumably mark the deepest record of the species in this region.

Genus **Copidozoum** Harmer, 1926
Copidozoum planum (Hincks, 1880)
Fig. 4a-d

Membranipora plana Hincks, 1880b: 81, pl. 11, fig. 2.
Copidozoum planum: Prenant & Bobin 1966: 255, fig. 85; Rosso 1996: pl. 2, fig. c; Chimenz Gusso et al. 2014: 90, figs. 29a–d; Souto et al. 2014: 134, fig. 3B; Reverter-Gil et al. 2019: 227, fig. 2c.

Material examined

Pica coll: SEM stub n°56, bleached colony; two additional unbleached colonies.

Remarks

The present specimens are in morphological accordance with the other Mediterranean populations referred to *Copidozoum planum*.

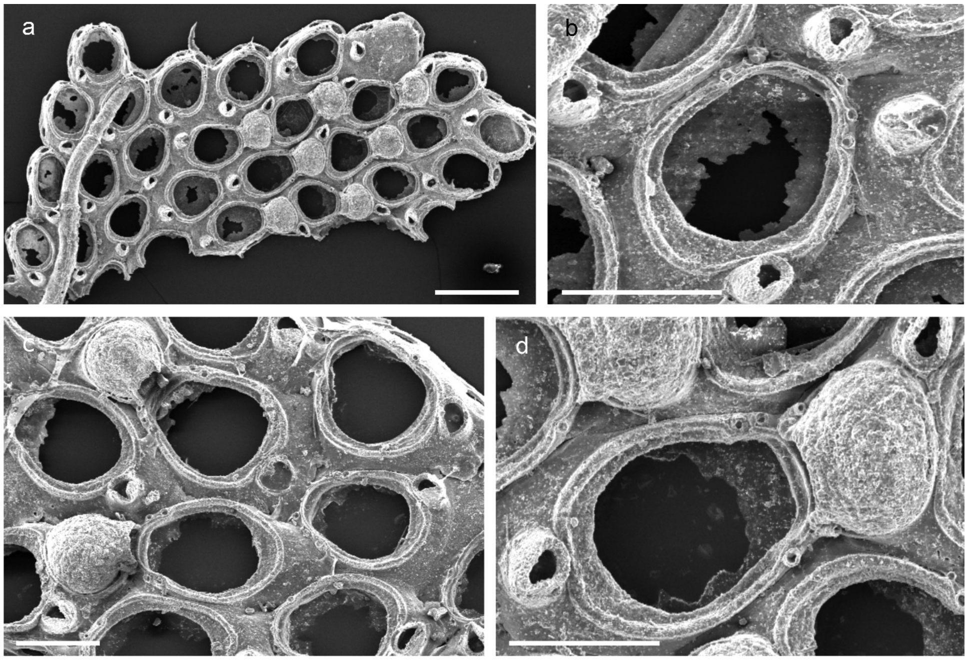

Figure 3. *Callopora dumerilii*. (a) Colony. (b) Autozooid with avicularia. (c) Close up of maternal zooids. (d) Maternal zooid with ovicell. Scale: (a) 500 μm; (b–d) 200 μm.

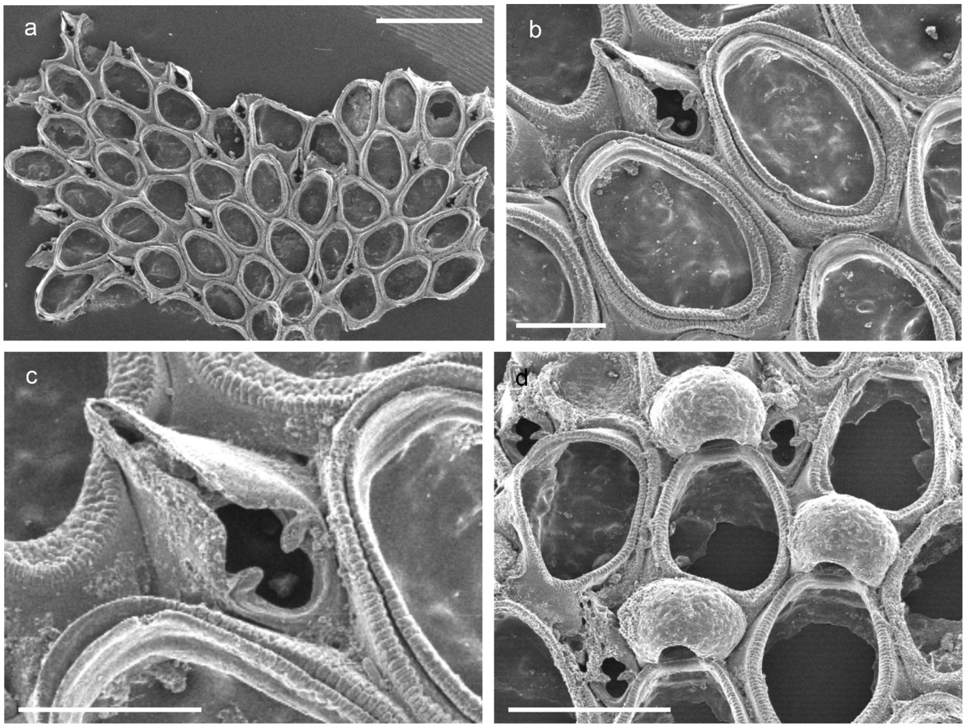

Figure 4. *Copidozoum planum*. (a). Colony. (b) Autozooids with interzooidal avicularium and secondary mural rims, indicating reparative growth by means of intramural budding. (c) Close up of the avicularium. H. Maternal zooids with ovicells. Scale: (a) 1 mm; (b, c) 200 μm; (d) 500 μm.

Genus ***Corbulella*** Gordon, 1984
Corbulella maderensis (Waters, 1898)
Fig. 5a-e

Membranipora maderensis Waters, 1898: 677, pl. 48, fig. 19.
Crassimarginatella maderensis: Harmelin 1973: 481, figs 1a–g, 2k, 3h, 4a; Zabala & Maluquer 1988: 85, text-fig. 103, pl. 1, fig. G.
Corbulella maderensis: Ostrovsky et al. 2009: figs. 1e, 3c; Chimenz Gusso et al. 2014: 92, figs. 31a–c; Rosso et al. 2019a, fig. 5a.

Material examined

Pica coll: SEM stubs n°6 with an unbleached colony; SEM stubs n°7, 9, 15, each with a bleached colony; six addictional unbleached colonies.

Remarks

A comparison of SEM images of the present specimens and material from Madeira (NHMUK 2016.6.9.4, Norman collection), the type locality of *Corbulella maderensis*, showed no morphological differences.

Genus ***Crassimarginatella*** Canu, 1900
Crassimarginatella matildae Pica & Berning sp. nov.
Fig. 6a-g

Crassimarginatella crassimarginata: Prenant & Bobin 1966: 249 (part), non fig. 83; Harmelin 1973: 483 (part), figs. 3e, g (non figs. 3f, i); Zabala & Maluquer 1988: 85, text-fig. 104; Harmelin & d'Hondt 1993: 69 (part), fig. 8 (non fig. 7); Rosso et al. 2017: figs. 5b–c.

Diagnosis

Crassimarginatella with subhexagonal zooids, gymnocyst moderately well developed proximally and narrowing laterally; cryptocyst evenly developed proximally and laterally, narrowing and disappearing only at the very distal end, surface granular to beaded, encircling an oval opesia; zero, two or occasionally three spines on distal zooid margin, two spines in ovicellate zooids. Cystid of vicarious avicularium usually smaller than autozooid but may reach the same size, avicularium with an overall oval appearance, rostrum and mandible distally producing a narrow downcurved mucro; crossbar complete, thick and without columella. Ovicells hyperstomial, ooecium hemispherical; ectooecium

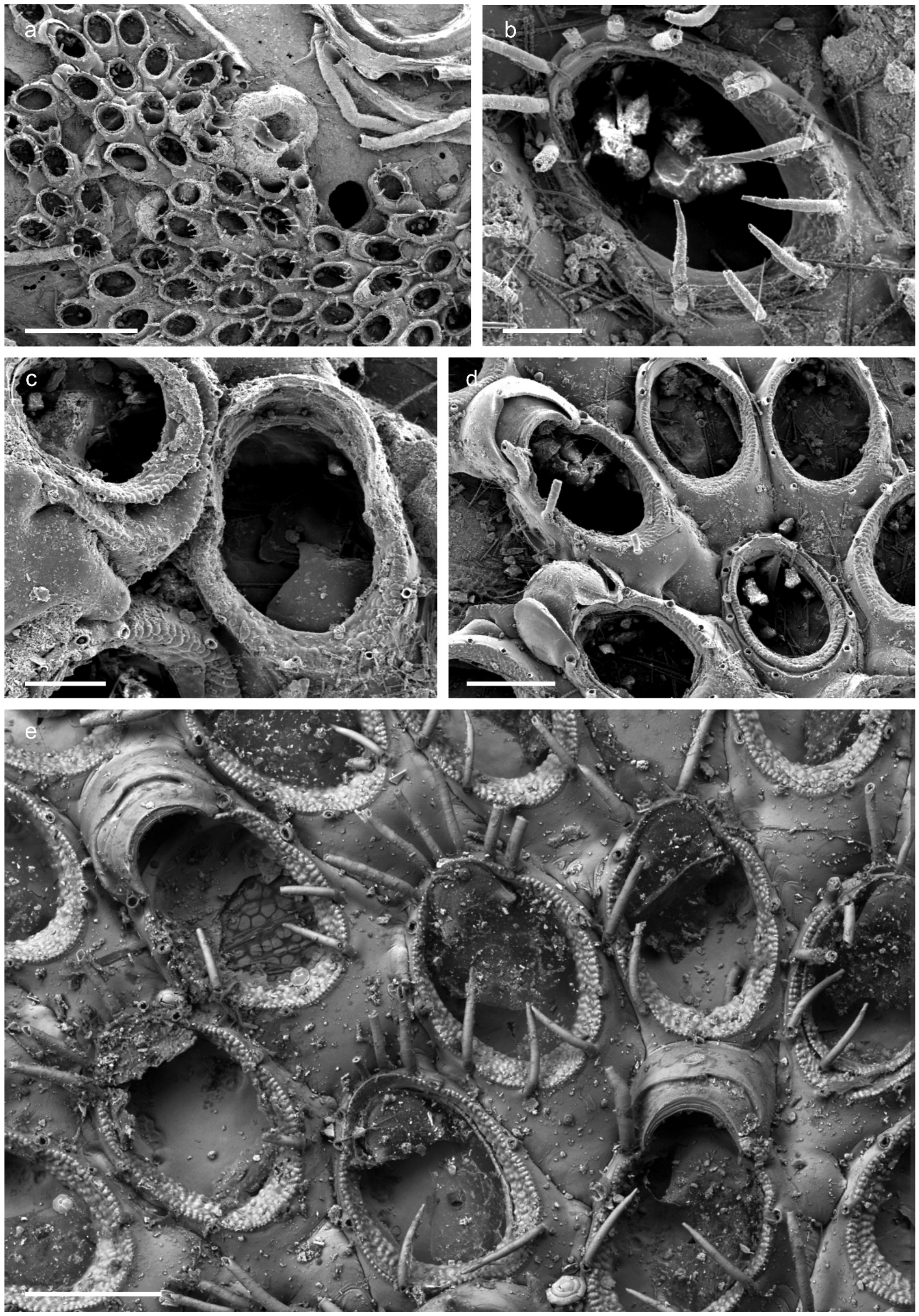

Figure 5. *Corbulella maderensis*. (a) Colony. (b) Autozooid. (c) Vicarious avicularium. (d) Maternal zooids with ovicells. (e) NHMUK 2016.6.9.4, colony from Madeira, Norman collection. Scale: (a) 1 mm; (b, c) 100 μm; (d, e) 200 μm.

smooth, entirely calcified apart from a narrow proximal window of variable shape.

Etymology

Named after the first author's nephew, Matilda Colapaoli.

Material examined

Holotype

MSNG 62402: one bleached ovicellate colony in the internal portion of a shell, Gallipoli, Lecce (Italy), 40° 0′56.20″N, 17°55′17.84″E, depth 60 m; 16 Jul. 2015.

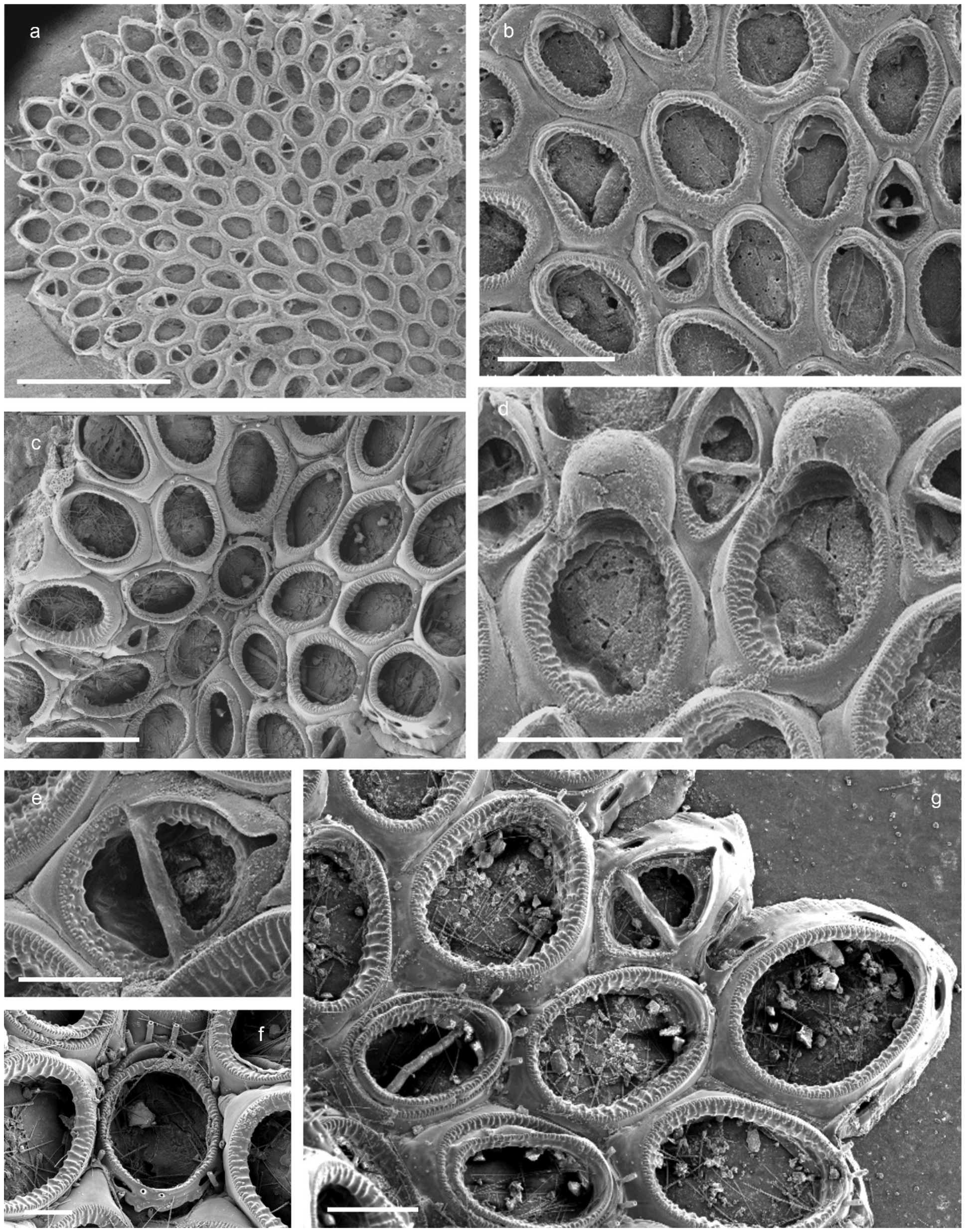

Figure 6. *Crassimarginatella matildae* sp. nov. (paratype) (a) Colony (SEM stub n°83). (b) Several autozooids and vicarious avicularia (SEM stub n°83). (c) Periancestrular zooids (SEM stub n°83). (d) Maternal zooids with ovicell (SEM stub n°83). (e) Close-up of avicularium (SEM stub n°83). (f) Ancestrula (SEM stub n°8). (g) Early astogenetic zooids and colony growth margin (SEM stub n°83). Scale: (a)2 mm; (b–d) 500 μm; (e, g) 200 μm; (f) 100 μm.

Paratypes

Same data as for holotype. MSNG 62403: one bleached colony with ancestrula; MSNG 62404: unbleached colony; MSNG 62405: one bleached colony; MSNG 62406: bleached colony with ovicells; MSNG 62407: SEM stub n°83, one bleached colony; MSNG 62408: SEM stub n°8, one bleached colony with ancestrula.

Description

Colony encrusting unilaminar, multiserial (Figure 6 (a)), forming patches of up to 8 mm in diameter. Dried specimens light brown. Zooids flat (L: 590 ± 110, 305–855, 30; W: 403 ± 75, 283–542, 30) and arranged in quincunx, subhexagonal with rounded distal edge, widest usually at about mid-distance, separated by shallow grooves; smooth gymnocyst moderately developed proximally and laterally, narrowing distally (Figure 6(b)); cryptocyst encircling a usually oval opesia (L: 374 ± 58, 212–479, 30; W: 241 ± 48, 162–402, 30), relatively evenly developed all around the margin except in proximity of orifice, surface beaded along the upper rim and with circumferential ridges in the lower part (Figure 6(b)). Basal walls only marginally calcified; lateral gymnocystal walls well developed, with a single basal pore chamber per neighbouring zooid, communication via uniporous septula surrounded by a large round to oval window. Periancestrular zooids with five short thin orificial spines, these rapidly diminishing to a distal pair in many autozooids (Figure 6(c)) with most zooids in the zone of astogenetic repetition lacking spines while few may have three spines; maternal zooids with a single spine at each proximolateral ooecium corner (Figure 6(d)).

Colony not precocious. Ooecium hyperstomial, hemispherical, wider than long (L: 169 ± 16, 143–186, 5; W: 282 ± 29, 230–304, 5), closure type (sub-) cleithral. Ectooecium smooth, completely calcified with only a thin transversal suture line or a small foramen above the opening (Figure 6(d)).

Avicularium vicarious, surrounded by five autozooids, usually slightly smaller than an autozooid while some may be as large as an autozooid (L: 342 ± 43, 269–399, 15; W: 208 ± 30, 167–267, 14); cystid with variably developed gymnocyst (Figure 6(e)). Rostrum (L: 196 ± 26, 133–235, 14) at an acute angle to frontal plane, distally with a relatively long and narrow mucro that is downcurved and incised into the transverse wall of the avicularian cystid; avicularian surface almost equally divided into a distal rostral and a proximal opesial half by a robust and relatively smooth crossbar, semicircular proximal opesia usually slightly wider than the similarly shaped palatal opesia, both framed by a cryptocystal rim similar to that of autozooids (Figure 6(e)).

Ancestrula tatiform (Figure 6(f)), 230–240 μm long and 296–340 μm wide, more or less circular, with large round opesia and ten evenly spaced spines, surrounded by seven periancestrular zooids (Figure 6(c)).

Remarks

Hincks (1880a) described *Crassimarginatella crassimarginata* from Madeira, which is characterised by avicularia with a distally rounded rostrum and mandible, while oral spines are apparently absent. The nominal species was subsequently recorded also in the Mediterranean Sea (e.g. Gautier 1962; Prenant & Bobin 1966; Zabala & Maluquer 1988). However, although Harmelin (1973) as well as Harmelin and d'Hondt (1993) explicitly noted the differences in avicularium morphology between the Atlantic and Mediterranean forms, the populations have until now been treated as synonymous. As the mucro in the distal rostrum, in which the pointed, sclerotised tip of the mandible comes to rest, is a constant and exclusive character in the Mediterranean population, we here treat the two taxa as specifically distinct, and introduce *Crassimarginatella matildae* as new species. It is endemic to the Mediterranean Sea while the Alboran Sea is an ecotonal area where both species co-occur (Harmelin & d'Hondt 1993).

Genus ***Ellisina*** Norman, 1903
Ellisina gautieri Fernández Pulpeiro & Reverter Gil, 1993
Fig. 7a-d

Ellisina gautieri Fernández Pulpeiro & Reverter Gil, 1993: 98, pl. 2 figs. 1–2.
Ellisina cf. *antarctica*: Harmelin 1969: fig. 7; Zabala & Maluquer 1988: 81, text-figs. 89–90.
Ellisina gautieri: Hayward & Ryland 1998: 192, figs. 56C–D; Hayward & McKinney 2002: 18, figs. 7E–G; Berning 2006: 26, figs. 16–18; Chimenz Gusso et al. 2014: 100, figs. 37a–d; Sokolover et al. 2016: 446, figs. 5A–B.

Material examined

Pica coll: SEM stubs n°8, 24, each with a bleached colony with ancestrula; SEM stub n°12, unbleached colony with ancestrula; two additional unbleached colonies.

Remarks

The present specimens morphologically agree with the other Mediterranean populations referred to *Ellisina gautieri*.

Superfamily Flustroidea Fleming, 1828
Family Flustridae Fleming, 1828
Genus ***Chartella*** Gray, 1848
?***Chartella*** sp.
Fig. 8a-b

Material examined

Pica coll: SEM stub n°51, unbleached colony.

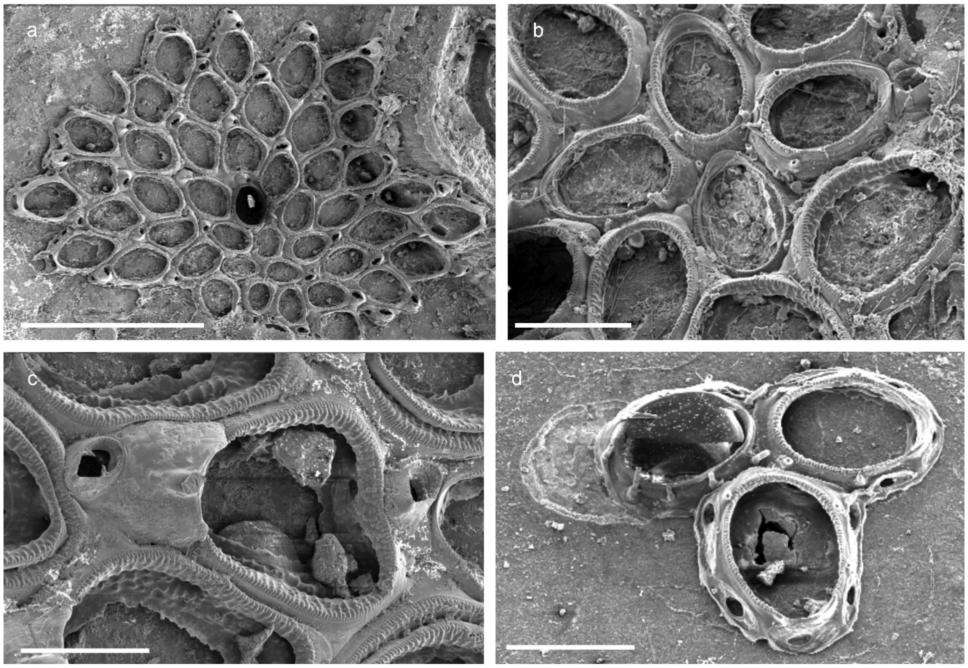

Figure 7. *Ellisina gautieri*. (a) Colony. (b) Ancestrula and early astogenetic autozooids. (c) Maternal zooid with ovicell. (d) Ancestrula and early astogeny. Scale: (a) 1 mm; (b–d) 200 μm.

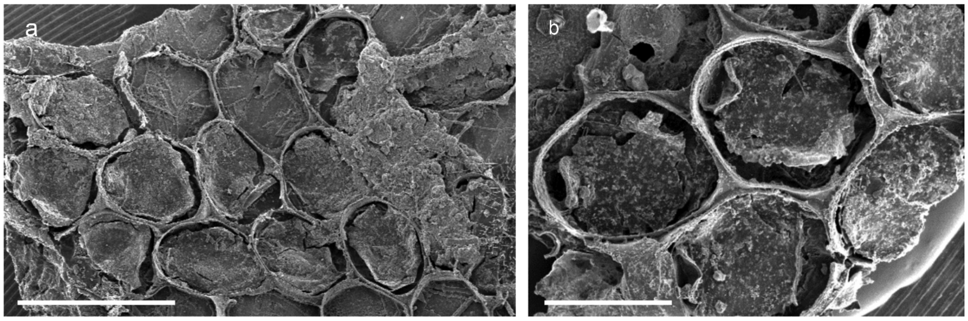

Figure 8. ?*Chartella* sp. (a) Colony. (b) Autozooids. Scale: (a) 1 mm; (b) 500 μm.

Remarks

The small colony studied is possibly the early astogenetic, encrusting phase of an erect flustrid, which cannot be determined even to genus level owing to the absence of significant characters and comparative material as usually only the erect colony portion of flustrids is described and figured. The zooids are very lightly calcified, c. 0.7 mm long and 0.5 mm wide, and a cryptocyst is not developed. Spines or avicularia were not observed. As Giampaoletti et al. (2020) reported *Chartella papyrea* (Pallas, 1766) from the mesophotic site of Monopoli in the Adriatic Sea, we doubtfully assign the present specimens to this genus.

Superfamily Buguloidea Gray, 1848
Family Bugulidae Gray, 1848
Genus ***Bugula*** Oken, 1815
Bugula sp.

Material examined

Pica coll: one unbleached colony.

Remarks

Only a tiny colony was obtained, which was observed using an optical stereomicroscope in order to confirm the genus as it does not allow to determine the specimen to species level.

Family Beaniidae Canu & Bassler, 1927
Genus ***Beania*** Johnston, 1840
Beania mediterranea Souto, Nascimento, Reverter-Gil & Vieira 2018
Fig. 9a-b

Beania mediterranea Souto, Nascimento, Reverter-Gil & Vieira, 2018: 1510, figs. 2c, 6a–h.
Diachoris buskiana: Waters 1879a: 120, pl. 12 fig. 1.
Beania magellanica: Prenant & Bobin 1966: 555, fig. 191; Zabala 1986: 333, fig. 96; Zabala & Maluquer 1988: 101, fig. 176; Hayward & McKinney 2002: 24, figs. 10A–B; Chimenz Gusso et al. 2014: 68, figs. 9a–c.

Material examined

Pica coll: SEM stub n°38, unbleached colony; seven additional unbleached colonies.

Remarks

The specimens from Apulia showed no differences to *Beania mediterranea*, which was recently described by Souto et al. (2018).

Beania mirabilis Johnston, 1840

Beania mirabilis Johnston, 1840: 272.
Beania mirabilis: Zabala & Maluquer 1988: 101, text-fig. 175; Hayward & Ryland 1998: 244, text-fig. 79; Hayward & McKinney 2002: 26, figs. 10C–D; Chimenz Gusso et al. 2014: 69, figs. 10a–d; Rosso et al. 2019b, fig. 4E.

Material examined

Pica coll: one unbleached colony.

Remarks

As only a single colony with few zooids was obtained, the specimen was not examined using SEM.

Superfamily Microporoidea Gray, 1848
Family Microporidae Vigneaux, 1949
Genus ***Micropora*** Gray, 1848
Micropora biopesiula Pica & Berning sp. nov.
Fig. 10a-h

Micropora coriacea: Rosso 1996: pl. 2, fig. f; Chimenz Gusso et al. 2014: 104, fig. 41a–d.

Diagnosis

Micropora with zooids that are somewhat longer than wide (L/W = 1.41); cryptocyst granular, perforated by 25–50 pseudopores and two pairs of opesiules: a larger, elongated and funnel-shaped one in the distolateral corners, and a smaller pair of round opesiules proximal to the former; autozooidal opesia slightly wider than long (L/W = 0.61). Gymnocystal bosses lateral to proximal orifice small and usually inconspicuous. Avicularia absent. Ovicell semi-immersed in distal zooid, ooecium hemispherical, about as wide as long (L/W = 1.12), cryptocystal surface granular, proximal margin arched, composed of a broad flat band of smooth gymnocyst with a central suture above which an apex is formed; ooecial orifice dimorphic, slightly larger than in autozooids but with similar length/width ratio (0.63).

Etymology

The name refers to the presence of two pairs of opesiules.

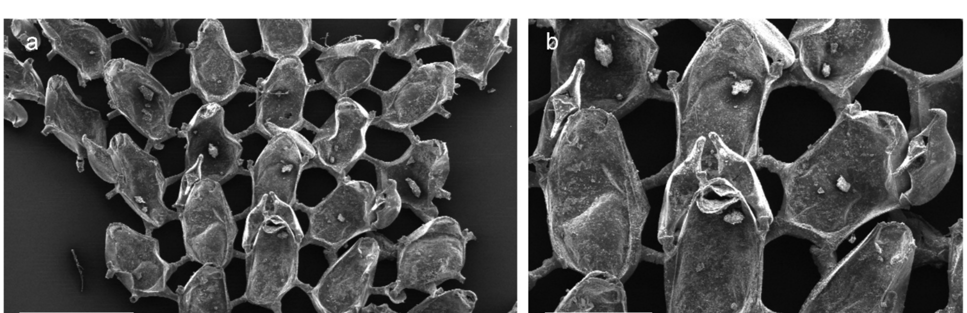

Figure 9. *Beania mediterranea*. (a) Colony. (b) Autozooids with avicularia. Scale: (a) 1 mm; (b) 500 μm.

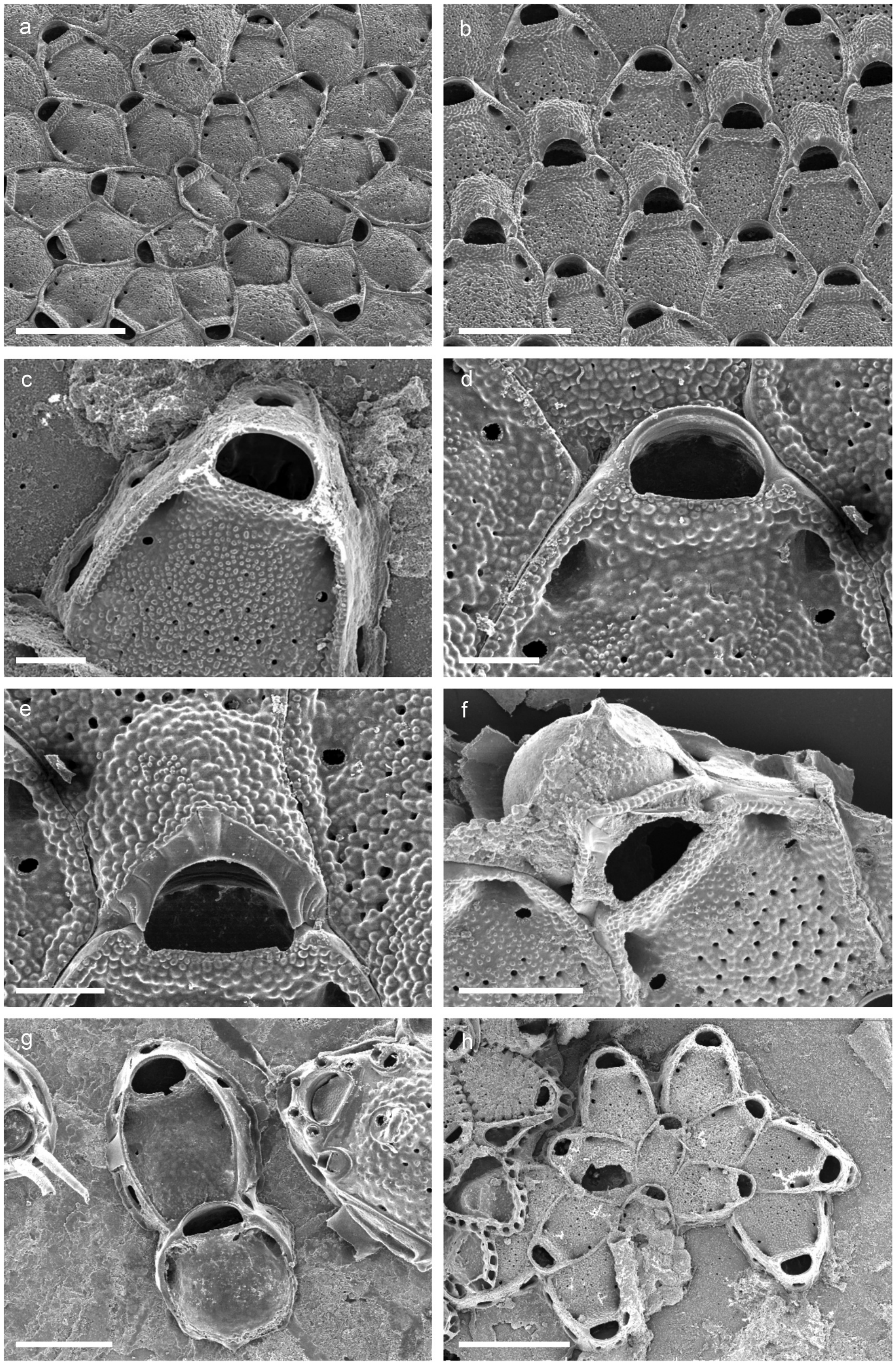

Figure 10. *Micropora biopesiula* sp. nov. (paratype). (a) Colony centre (SEM stub n°50). (b) Zooid arrangement (SEM stub n°50). (c) Zooid at the colony margin with oval pore-chamber windows (SEM stub n°15). (d) Close-up of autozooidal opesia and opesiules (SEM stub n°50). (e) Maternal zooid with ovicell (SEM stub n°50). (f) Ovicell with the cryptocystal cover of the ovicell-producing distal zooid broken, showing the globular structure of the ooecium underneath (SEM stub n°36). (g) Ancestrula with first-generation autozooid (SEM stub n°40). (h) Ancestrula and early autozooids (SEM stub n° 15). Scale: (a, h) 500 μm; (c–e) 100 μm; (f, g) 200 μm.

Material examined

Holotype

MSNG 62409: unbleached ovicellate colony, Gallipoli, Lecce (Italy), 40°0′56.20″N, 17°55′17.84″ E, depth 60 m, 16 Jul. 2015.

Paratypes

Same data as for holotype. MSNG 62410: unbleached colony with ancestrula; MSNG 62411: small unbleached colony; MSNG 62412: small unbleached colony; MSNG 62413: SEM stub n° 15, bleached colony; MSNG 62414: SEM stub n° 36, bleached ovicellate colony; MSNG 62415: SEM stub n°40, bleached ancestrula and first zooid; MSNG 62416: SEM stub n°50, bleached colony with ovicells and ancestrula.

Description

Colony encrusting unilaminar, multiserial (Figure 10(a)), forming patches of up to 2 cm in diameter. Dried specimens light brown. Zooids irregular in shape (L: 631 ± 57, 551–767, 20; W: 456 ± 71, 343–544, 20), more or less hexagonal to irregular oval (Figure 10(b)), slightly longer than wide (L/W = 1.4), separated by a narrow groove or suture; marginal walls slightly rising distal to mid-distance of zooid, mostly composed of granulated cryptocyst except for a distal gymnocystal part where a pair of relatively small rounded bosses are occasionally formed lateral to the proximal opesia (Figure 10(b)). Oval pore-chamber windows visible at the colony growing edge, usually two per neighbouring zooid (Figure 10(c)). Cryptocyst finely granulated, flat to slightly convex, gently dipping distolaterally before suddenly rising toward the opesia, densely perforated by 25–50 pseudopores (Figure 10(b,d)). A pair of deeply recessed opesiules, elongated in shape is placed proximolateral to the orifice (L: 69 ± 11, 51–102, 27; W: 36 ± 7, 20–49, 27) (Figure 10(b–d)). A second pair of small rounded opesiules (L: 24 ± 4, 17–33, 27) proximally to the large opesiules (Figure 10(c,d)). Opesia (L: 99 ± 6, 89–110, 20; W: 162 ± 7, 150–176, 20) slightly raised above the zooid surface, D-shaped and wider than long (L/W = 0.6), with a narrow gymnocyst forming the distolateral margin (Figure 10(d)). Spines and avicularia absent.

Ovicell (L: 291 ± 12, 276–313, 12; W: 260 ± 15, 233–289, 12) semi-immersed in the frontal shield of the distal zooid (Figure 10(e,f)), ooecium hemispherical, about as wide as long (L/W = 1.1), opesia dimorphic, slightly larger than in autozooids (L: 114 ± 6, 107–128, 13; W: 180 ± 9, 172–194, 13), closure type cleithral. Proximal ooecial margin bordered by a smooth broad rim with a thin, central, longitudinal suture line and an apex forming above it (Figure 10(e)).

Ancestrula similar in shape to adult zooid (Figure 10(g)), but approximately as long as wide (310 × 280 µm), opesia about twice as wide as long (OpL 60 µm, OpW 130 µm).

First asexually produced zooid budded from distal end of ancestrula, the two second-generation autozooids are produced by both the ancestrula and the 1st generation zooid, oriented at a c. 90° angle; the 3rd-generation zooids grow in the interspaces of this cross-shaped formation, establishing growth of the colony in an opposite direction respect to the polarity of the ancestrula (Figure 10(h)).

Remarks

Three *Micropora* species are known from the modern Mediterranean Sea and eastern Atlantic. *Micropora coriacea* (Esper, 1791) is the most frequently cited species with an alleged worldwide distribution, which, however, most likely represents a species complex. The species differs from *Micropora biopesiula* sp. nov. in having only the single distal pair of funnel-shaped opesiules, and usually more pronounced bosses lateral to the proximal orifice margin (e.g. Hayward & Ryland 1998: 288, figs 97, 99C–D). Besides having interzooidal avicularia, *Micropora normani* Levinsen, 1909 from the Atlantic coast of Europe has smaller zooids, fewer pores in the cryptocyst, and also only a single pair of opesiules (Hayward & Ryland 1998: 290, figs. 98, 99B). Finally, the West African *Micropora robusta* Cook, 1985 also has interzooidal avicularia and just a single pair of opesiules.

Three other *Micropora* species may exist in the region (see Bock & Gordon 2021): *Micropora depressa* (Moll, 1803) and *Micropora aculeata* (d'Orbigny, 1852), which are both considered as *taxa inquirenda*, as well as *Micropora africana* (d'Orbigny, 1852). To our knowledge, none of these species have ever been cited or redescribed since their original description, and their status, as well as their generic assignments, are unclear at present.

As it will be difficult to clarify the status and systematic placement of these three species any time soon, we have decided to describe the present species as new to science in order to raise awareness among biologists that the oft-cited *M. coriacea* is not the only *Micropora* species present in the Mediterranean Sea.

Micropora biopesiula sp. nov. has so far only been reported from Italian coasts (Rosso 1996; Chimenz Gusso et al. 2014). Whether the new species is also present in the eastern Mediterranean cannot be decided at present as images and descriptions are wanting (e.g. Hayward 1974).

Genus ***Mollia*** Lamouroux, 1816
Mollia circumcincta (Heller, 1867)
Fig. 11a-d

Membranipora circumcincta Heller, 1867: 96, pl. 6, fig. 5.
Mollia circumcincta: Zabala & Maluquer 1988: 91, pl. 2, figs. C–D; Hayward & McKinney 2002: 34, figs. 13D–H; Berning 2006: 36, figs. 32, 33; Ayari-Kliti et al. 2012: 85, pl. 2 fig. 3; Chimenz Gusso et al. 2014: 106, figs. 42a–f; Rosso et al. 2019a: fig. 5c.

Material examined

Pica coll: SEM stub n°49, one bleached colony; two additional unbleached colonies.

Remarks

Mollia circumcincta [for a recent description based on type material from the Adriatic see Hayward and McKinney (2002: 34)] has been reported only a few times since its discovery, and all records from beyond the central Mediterranean Sea have to be regarded as doubtful. For instance, in the colony from the western Mediterranean figured by Zabala and Maluquer (1988: pl. 2, figs. C, D), the ooecium differs in producing a relatively large area of smoothly calcified ectooecium proximally and laterally that encircles a distally positioned area of exposed nodular endooecium. In Adriatic and NE Ionian *M. circumcincta*, in contrast, the ectooecium is extremely reduced and restricted to the proximolateral corners of the ooecium. Moreover, the salient distolateral rim framing the zooids is thicker and the nodules covering the cryptocystal surface larger in central Mediterranean populations.

The peculiar calcified ridge on the interior basal wall that was noted in fossil specimens (Berning 2006: figs. 32 and 33) are here shown to be present also in the Recent species (Figure 11(c)). It is unclear what function the ridge fulfils, and if it is present in all *Mollia* species or restricted to *M. circumcincta*.

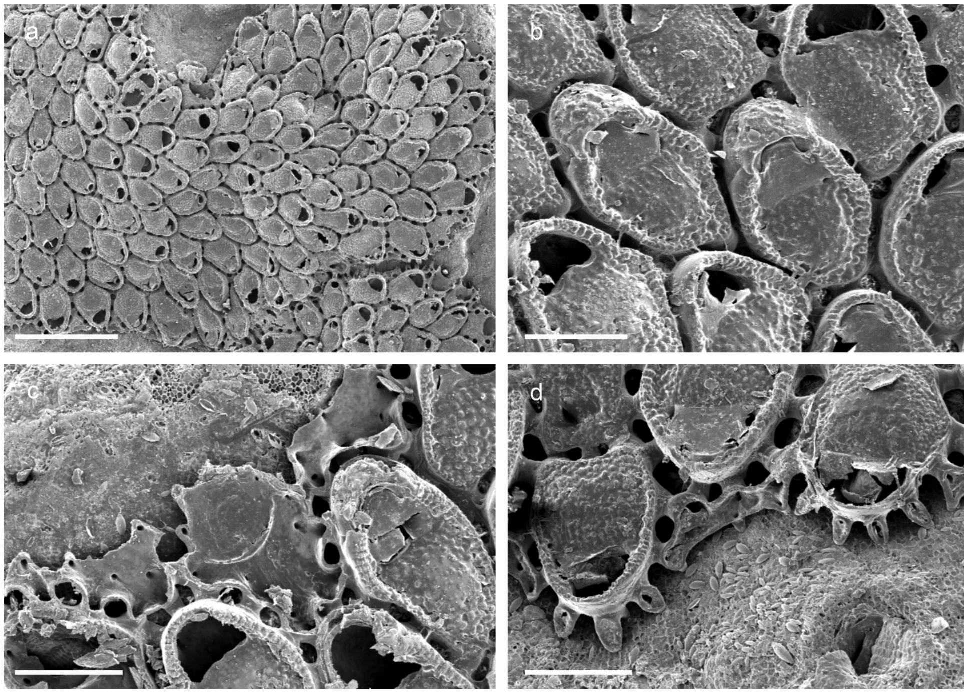

Figure 11. *Mollia circumcincta*. (a) Colony. (b) Maternal zooids. (c) Calcified ridge on the interior basal wall of a zooid; note the pores in the basal wall, indicating the position of calcified basal attchment tubes. (d) Zooids at the colony growth margin showing the formation of the connecting tubules. Scale: (a) 1 mm; (b–d) 200 µm.

Family Onychocellidae Jullien 1882
Genus ***Onychocella*** Jullien, 1882
Onychocella marioni Jullien, 1882
Fig. 12a-b

Onychocella marioni Jullien, 1882: 277.
Onychocella marioni: Zabala & Maluquer 1988: 87, pl. 2, fig. A; Rosso 1996: pl. 2, fig. b; Ayari-Kliti et al. 2012: 86, pl. 2, fig. 5; Chimenz Gusso et al. 2014: 110, figs. 45a–c; Achilleos et al. 2020: fig. 2; Rosso et al. 2020b: 3, figs. 1–3.
Onychocella angulosa: Taylor et al. 2018: fig. 1a–c.

Material examined

Pica coll: SEM stub n°44, one bleached colony; one additional unbleached colony.

Remarks

While Taylor et al. (2018) have recently summarised the problems existing around the type species of the genus *Onychocella*, and discussed the potential synonymy of the fossil *Onychocella angulosa* (Reuss, 1848) and the present-day *Onychocella marioni* Jullien, 1882, Rosso et al. (2020b) thoroughly redescribed and figured the Recent species, to which we assign the Apulian specimens.

Superfamily Cribrilinoidea Hincks, 1879
Family Cribrilinidae Hincks, 1879
Genus ***Cribrilaria*** Canu & Bassler, 1929
Cribrilaria* cf. *hincksi (Friedl, 1917)
Fig. 13a-f

cf. *Cribrilina radiata* var. *hincksi* Friedl, 1917: 236.
Colletosia hincksi: Prenant & Bobin 1966: 595, figs. 207–I, –II.
Puellina (*Cribrilaria*) *hincksi*: Harmelin 1988: 31, figs. 5, 9; Zabala & Maluquer 1988: 107, text-fig. 216, pl. 6, figs. C–D.
Cribrilaria hincksi: Rosso et al. 2019b: fig. 5B.
non *Puellina hincksi*: Hayward & McKinney 2002: 38, figs. 17A–C.

Material examined

Pica coll: SEM stubs n°47, 72, each with one ovicellate colony.

Remarks

There is quite a confusion concerning the morphology of *Cribrilaria hincksi*. When introducing the species, Friedl (1917) mentioned (without figuring the material) that his specimens from the northern Adriatic Sea are characterised by "sehr langen dolchförmigen Avicularien" (transl.: very long, dagger-shaped avicularia) that he considered similar to specimens reported from Madeira by Hincks (1880a: 74, pl. 10, fig. 1) as *Cribrilina radiata* var. (Moll 1803). According to Hincks' figure, the Madeiran species has indeed very long rostra that are apparently positioned between zooids (which is, however, not quite clear from the drawing). In subsequent works (e.g. Prenant & Bobin 1966; Harmelin 1988; Zabala & Maluquer 1988), *C. hincksi* was regarded as having an extremely elongate avicularium and a serrated rostrum that is recumbent on the distal zooid. The present specimens comply with these characters, but neither ours nor any of the colonies recorded in the above-mentioned publications were from the type locality, the northern Adriatic. Recently, Hayward and McKinney (2002: 38, figs. 17A–C)) did identify specimens from the type locality as *P. hincksi*, which have, however, comparatively short avicularia that are wedged between zooids, and are therefore unlikely to be conspecific. Thus, without having seen the type material, which is beyond the scope of this paper, it is impossible to define the exact morphology of *C. hincksi*.

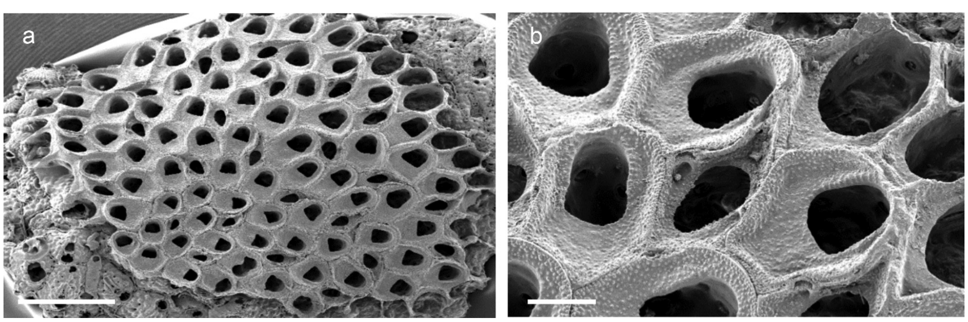

Figure 12. *Onychocella marioni*. (a) Colony. (b) Zooids with an onychocellarium. Scale: (a) 1 mm; (b) 200 μm.

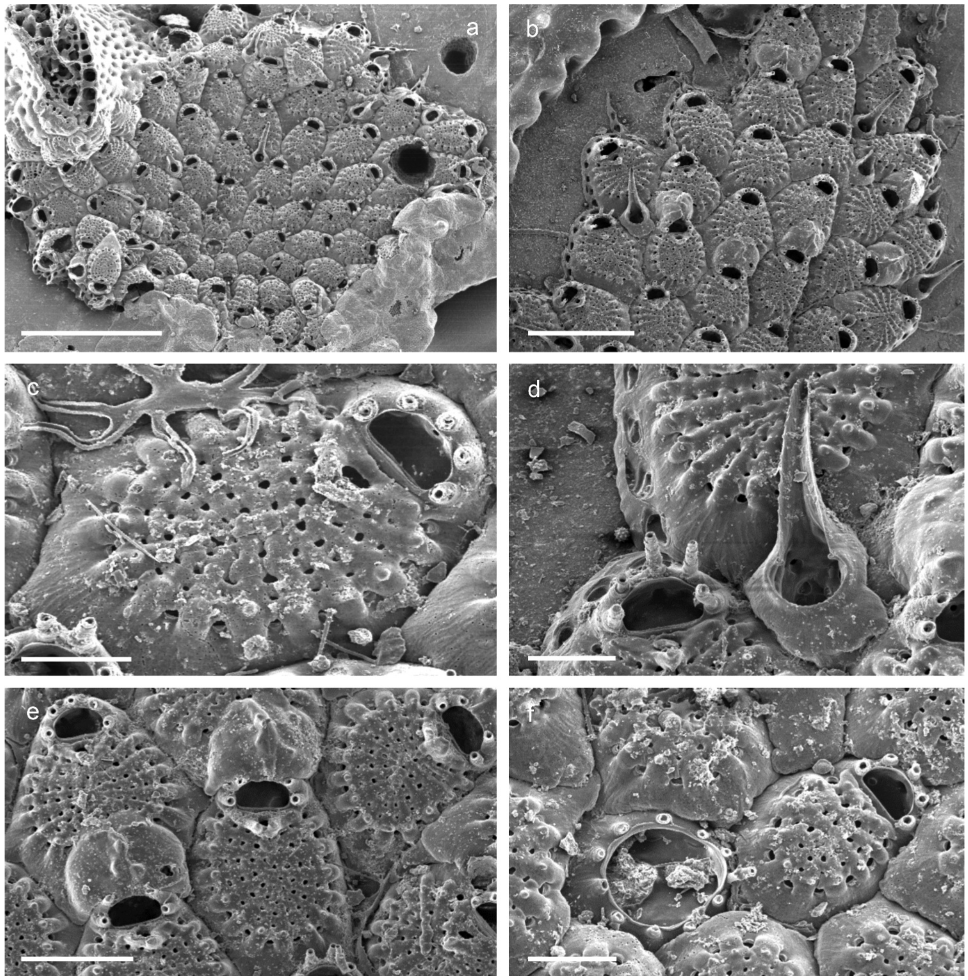

Figure 13. *Cribrilaria* cf. *hincksi*. (a) Colony, (b) Zooids with avicularia and ovicells. (c) Zooid, (d) Interzooidal avicularium, (e) Maternal zooids, (f) Ancestrula and the firstly budded autozooid. Scale: (a) 1 mm; (b) 500 μm; (c, d, f) 100 μm; (e) 200 μm.

Cribrilaria* cf. *venusta (Canu & Bassler, 1925)
Fig. 14a-e

cf. *Puellina venusta* Canu & Bassler, 1925: 22, pl. 2, fig. 5.
Puellina venusta: Harmelin & d'Hondt 1993: 68, fig. 6; Hayward & Ryland 1998: 336, figs. 119C–D.
Cribrilaria crenulata: Harmelin 1970: 91, figs. 1i–k, pl. 2 figs. 1–3.
Cribrilaria venusta: Harmelin 1978: 180, pl. 2, figs. 3–5.
Puellina (*Cribrilaria*) *venusta*: Bishop & Househam 1987: 28, figs. 43–49, 99; Zabala & Maluquer 1988: 107, text-fig. 215, pl. 7C–D; Chimenz Gusso et al. 2014: 221, figs. 120a–e.

Material examined

Pica coll: SEM stubs n°12, 23, each with one colony with ancestrula; SEM stub n°37, one bleached ovicellate colony; two additional unbleached colonies.

Remarks

The present specimens are within the morphological range observed in other Mediterranean populations referred to *Cribrilaria venusta*. The original description and image of the species by; Canu and Bassler (1925), however, suggest that both the orifice and ovicell are distinctly smaller in relation to zooid size. A revision of the type material is therefore necessary before the Mediterranean specimens can unequivocally be synonymised with Canu & Bassler's species from the southern Gulf of Cádiz.

Cribrilaria* cf. *innominata (Couch, 1844)
Fig. 15a-h

cf. *Lepralia innominata* Couch, 1844: 114, pl. 22, fig. 4.
cf. *Cribrilaria innominata*: Bishop 1986: 96, figs. 1–8.

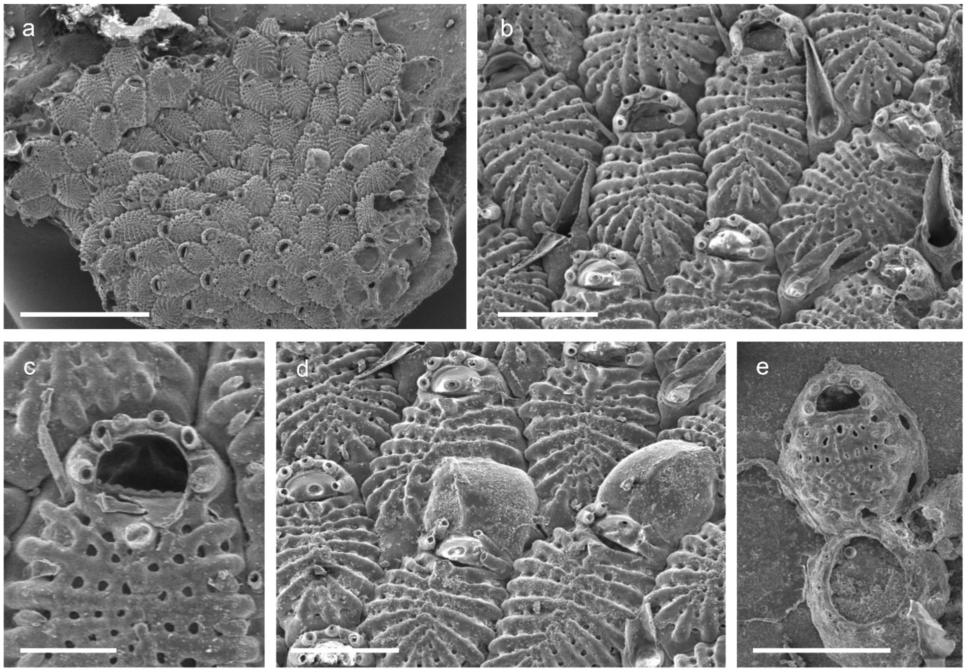

Figure 14. *Cribrilaria* cf. *venusta*. (a) Colony. (b) Zooids. (c) Orifice with the proximal border denticulated. (d) Maternal zooids. E. Ancestrula and first-generation autozooid. Scale: (a) 1 mm; (b, d, e) 200 µm; (c) 100 µm.

cf. *Puellina* (*Cribrilaria*) *innominata*: Bishop & Househam 1987: 33, figs. 5 0–58.
Puellina (*Cribrilaria*) *innominata*: Zabala & Maluquer 1988: 108, text-fig. 220, pl. 6E, F; Harmelin 1988: 29, fig. 4; Chimenz Gusso et al. 2014: 213, figs. 115a–e.

Material examined

Pica coll: SEM stubs n°16, 55, bleached ovicellate colony; SEM stub n°63, bleached colony with ancestrula; seven additional unbleached colonies.

Remarks

Several slight morphological differences exist between the British *Cribrilaria innominata* (Couch, 1844), as redescribed by Bishop (1986), and Mediterranean specimens attributed to this species. For instance, the apophyses that occur at the base of (some of) the oral spines in Mediterranean populations (Harmelin 1988; Chimenz Gusso et al. 2014) have not been reported in British specimens. Also, in Mediterranean colonies only a single costal pair contributes to the formation of the suboral umbo that proximally frames the lacuna, and there is no median ridge on the costate frontal shield, whereas in British specimens the two distal pairs of costae form the umbo that proximally turns into a short median carina (Bishop 1986; Hayward & Ryland 1998). Additional comparative SEM studies and genetic analyses are needed before a conclusion as to the status of the Mediterranean specimens can be drawn.

Cribrilaria radiata (Moll, 1803)

Fig. 16a-d

Eschara radiata Moll, 1803: 63, pl. 4, fig. 17.
Cribrilaria radiata: Harmelin 1970: 80, figs. 1a–c, 3a; pl. 1, figs. 1–3.
Puellina (*Cribrilaria*) *radiata*: Zabala & Maluquer 1988: 107, text-fig. 214, pl. 7. fig. A; Chimenz Gusso et al. 2014: 218, figs. 118a–e; Rosso et al. 2019a: fig. 5g.

Material examined

Pica coll: SEM stubs n°15, 43, each with one bleached ovicellate colony; five additional unbleached colonies.

Remarks

The Apulian specimens are identical with other Mediterranean records of *Cribrilaria radiata*.

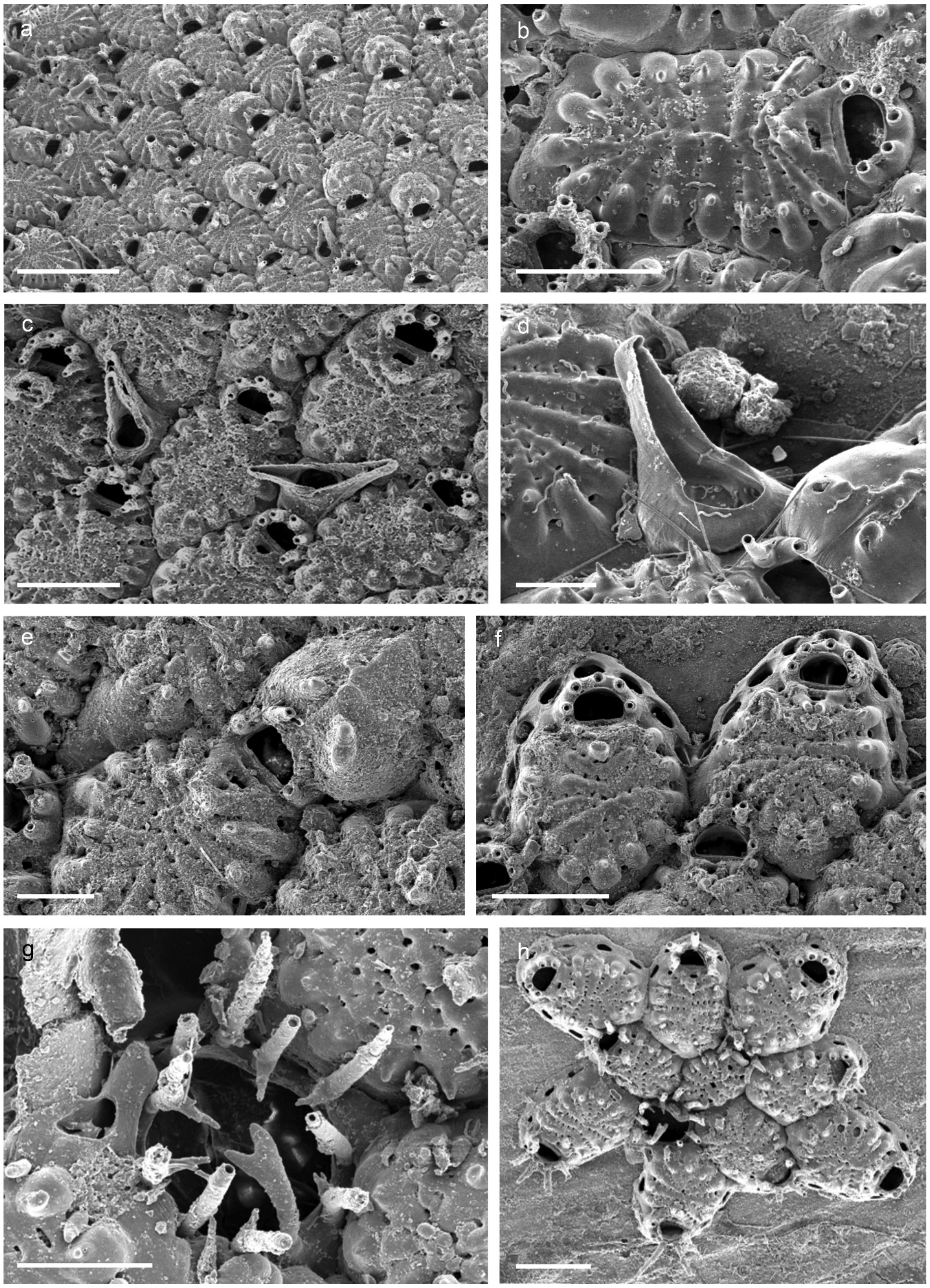

Figure 15. *Cribrilaria* cf. *innominata*. (a) Zooidal arrangement. (b) Autozooid. (c) Zooids and avicularia with inatramural buds, the one to the right with reversed polarity. (d) Avicularium. (e) Maternal zooid with ovicell. (f) Growth margin of colony with newly formed zooids. (g) Ancestrula. (h) Ancestrula and early autozooids. Scale: (a) 500 µm; (b, c, f, h) 200 µm; (d, e, g) 100 µm.

Genus ***Glabrilaria*** Bishop & Househam, 1987
Glabrilaria pedunculata (Gautier, 1956)
Fig. 17a-f

Puellina pedunculata Gautier, 1956: 203, fig. 2.
Cribrilaria pedunculata: Harmelin 1970: 93, figs. 1g–h, pl. 2, fig. 6.
Puellina pedunculata: Harmelin 1988: 33, figs. 10–11; Harmelin & d'Hondt 1993: 69, fig. 9.
Puellina (*Glabrilaria*) *pedunculata*: Bishop & Househam 1987: 55, figs. 95–97; Zabala & Maluquer 1988: 107, text-fig. 209, pl. 7, figs. E–F: Chimenz Gusso et al. 2014: 215, figs. 116a–c: Rosso et al. 2019a: 711, figs. 5e–f.

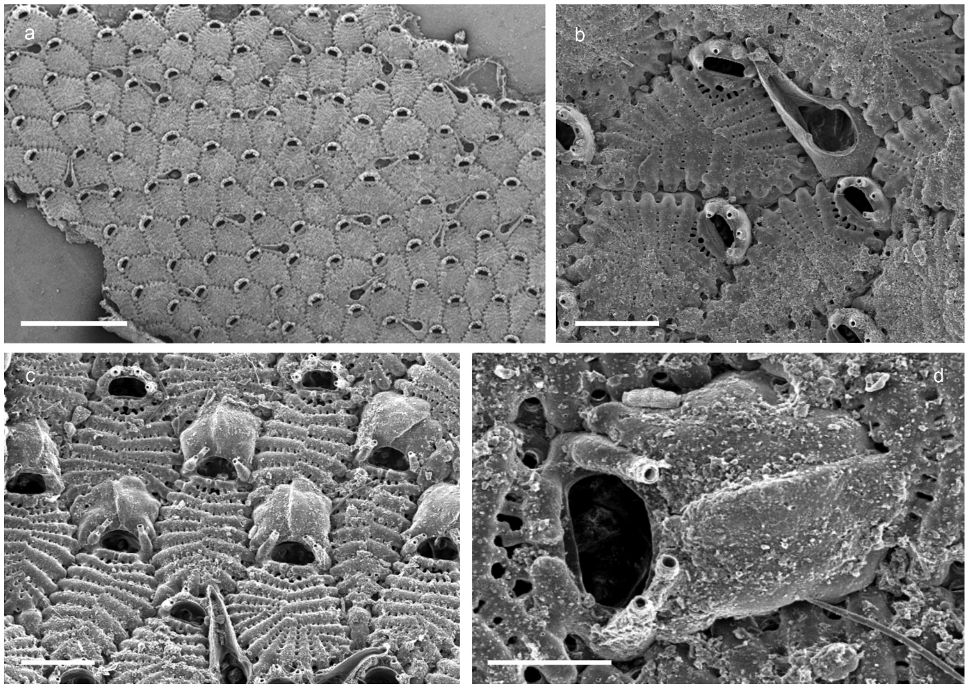

Figure 16. *Cribrilaria radiata*: (a) Colony. (b) Detail of zooids and avicularium. (c) Maternal zooids with ovicells. (d) Ovicell. Scale: (a) 1 mm; (b, c) 200 µm; (d) 100 µm.

non *Cribrilaria pedunculata*: Harmelin 1978: 188, figs. 5–6.
Glabrilaria pedunculata: Rosso et al. 2021, fig. 5g.

Material examined

Pica coll: SEM stub n°5 unbleached colony; SEM stub n° 52 unbleached colony with ancestrula; SEM stubs n°8, 9, 10, each with one bleached ovicellate colony; six additional unbleached colonies.

Remarks

The pedunculate avicularia and the kenozooidal ovicell are typical for the genus, and the present specimens fully conform with previous records of *Glabrilaria pedunculata*.

Superfamily Hippothooidea Busk, 1859
Family Hippothoidae Busk, 1859
Genus ***Hippothoa*** Lamouroux, 1821
Hippothoa flagellum Manzoni, 1870
Fig. 18a-b

Hippothoa flagellum Manzoni, 1870: 328, pl. 2, fig. 5.
Hippothoa flagellum: Hayward & Ryland 1999: 88, fig. 18; Hayward & McKinney 2002: 42, figs. 18F–I.

Material examined

Pica coll: SEM stub n°64, one bleached dead colony; one additional unbleached colony.

Remarks

The colonies encrust a sponge and were, *post mortem*, covered by a thin veneer of sponge tissue and numerous spicules in turn, giving the colonies a peculiar appearance.

Family Chorizoporidae Vigneaux, 1949
Genus ***Chorizopora*** Hincks, 1880
Chorizopora brongniartii auctt. (Audouin 1826)
Fig. 19a-d

Chorizopora brongniartii: Zabala & Maluquer 1988: 141, pl. 19, fig. D; Hayward & McKinney 2002: 42, figs. 19A–C; Chimenz Gusso et al. 2014: 151, figs. 72a–d.

Material examined

Pica coll: SEM stub n°CHO1 one bleached colony; two additional unbleached colonies.

Remarks

A variety of morphotypes from around the world have been attributed to *Chorizopora brongniartii*

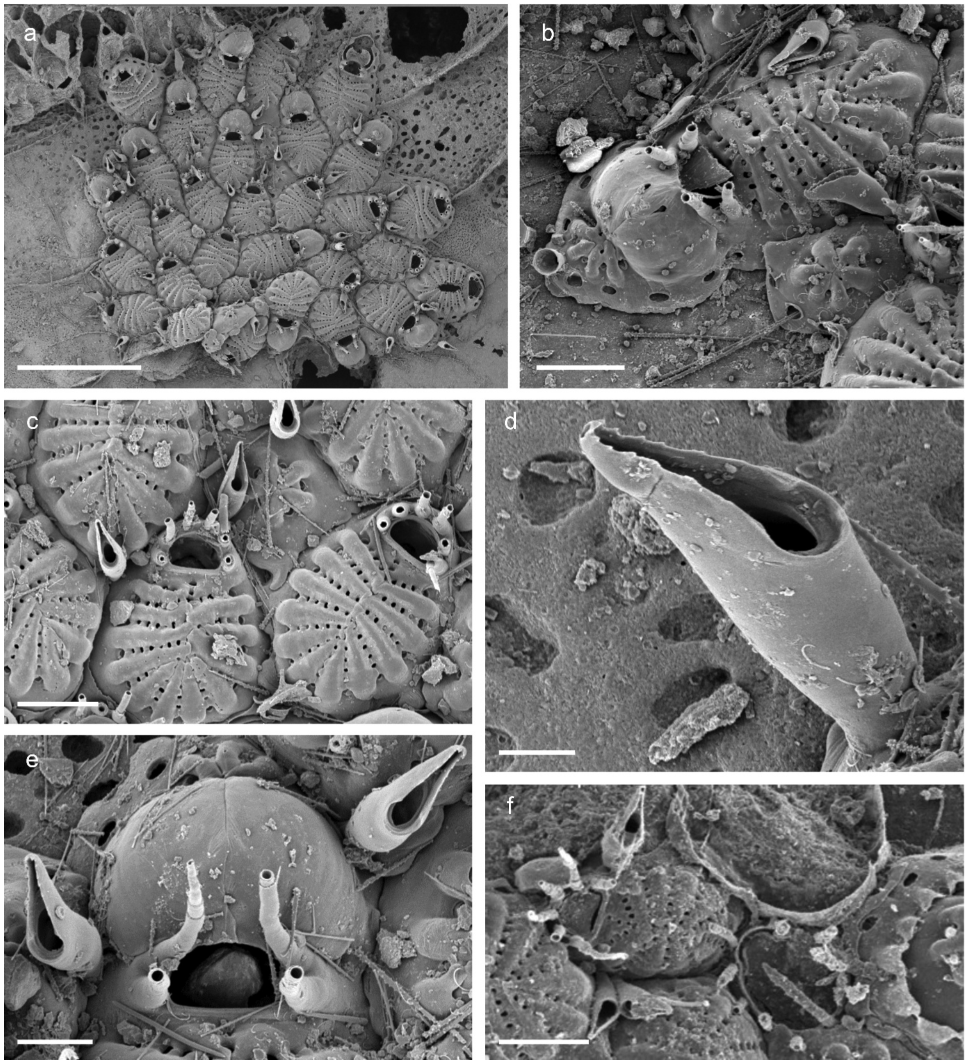

Figure 17. *Glabrilaria pedunculata*. (a) Colony. (b) Edge of the colony showing a kenozooid and a maternal zooid with kenozooidal ovicell. (c) Zooids and a kenozooid with pedunculate avicularia. (d) Avicularium. (e) Maternal zooid with avicularia. F. Ancestrula with early autozooids. Scale: (a) 500 μm; (b, c, f) 100 μm; (d) 20 μm; (e) 50 μm.

(Audouin, 1826). This species complex thus requires revision after fixation of a neotype as the original material has been lost.

Family Haplopomidae Gordon in de Blauwe 2009
Genus ***Haplopoma*** Levinsen, 1909
Haplopoma celeste Pica & Berning sp. nov.
Fig. 20a-d

Diagnosis

Haplopoma with an evenly perforated frontal shield except for an area around the ascopore, pseudopores bevelled but simple, shield surface smooth but transversely wrinkled and often with a distinct median crest of variable length produced by jointed knobs; orifice broader than long, with a pair of small round condyles; ovicellate zooids of similar size as autozooids; ooecial surface evenly perforated by pseudopores, occasionally with a low median ridge.

Etymology

Named after the first author's niece, Celeste Beatrix Pica; used as a noun in apposition.

Material examined
Holotype

MSNG 62417: one unbleached colony with ovicells, Gallipoli, Lecce (Italy), 40°0′56.20″N, 17°55′17.84″ E, depth 60 m, 16 Jul. 2015.

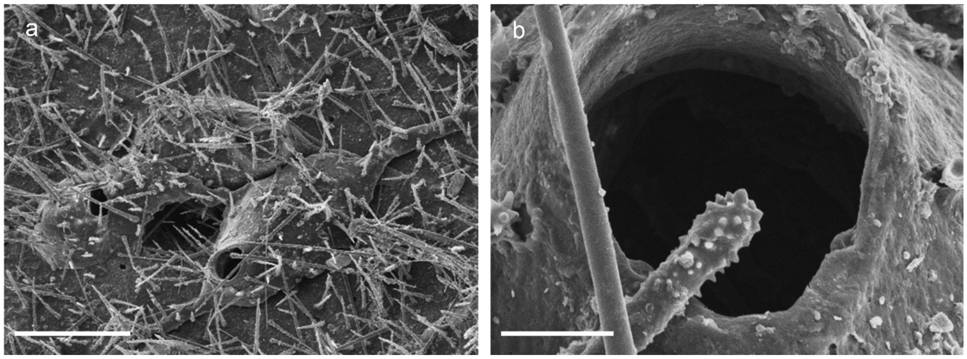

Figure 18. *Hippothoa flagellum*. (a) Zooids covered by spicules of sponges. (b) Orifice. Scale: (a) 200 μm; (b) 20 μm.

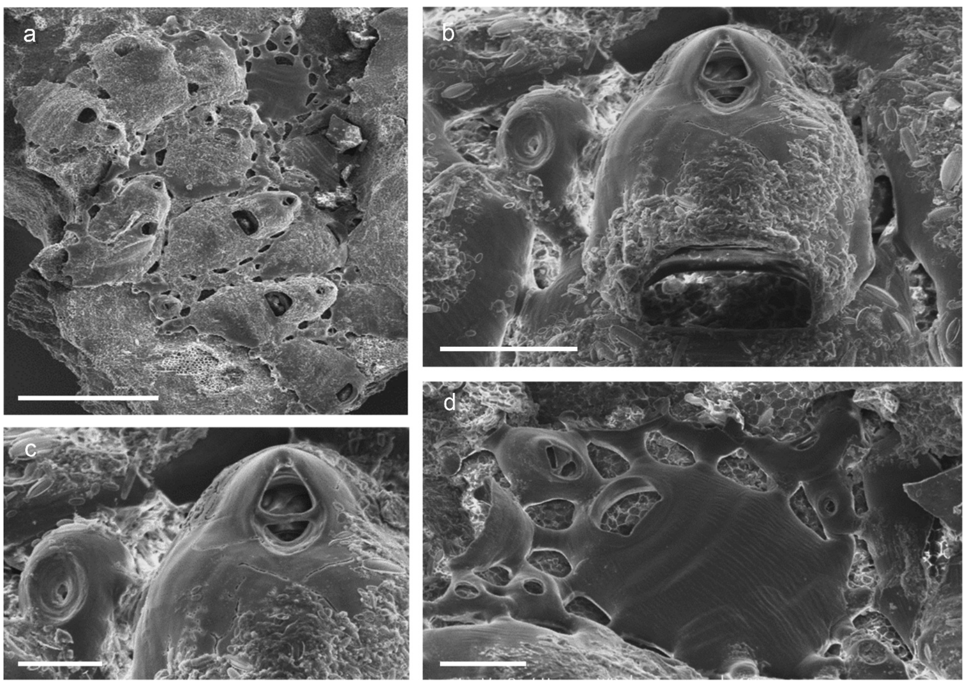

Figure 19. *Chorizopora brongniartii*. (a) Colony. (b) Ovicell. (c) Avicularium and kenozooid. (d) Newly formed zooid. Scale: (a) 500 μm; (b, d) 100 μm; (c) 50 μm.

Paratypes

Same data as for holotype. MSNG 62418: unbleached ovicellate colony; MSNG 62419: unbleached ovicellate colony; MSNG 62420: unbleached colony; MSNG 62421: SEM stub n°1, bleached ovicellate colony; MSNG 62422: SEM stub n°12, bleached colony; MSNG 62423: SEM stub n°81, bleached ovicellate colony; MSNG 62424: SEM stub n°84, bleached colony.

Description

Colony encrusting, unilaminar, multiserial (Figure 20 (a)), forming small patches of up to 4 mm in diameter. Zooids (L: 569 ± 54, 455–669, 16; W: 326 ± 31, 278–419, 16) elongated pentagonal to hexagonal with a rounded distal end, separated by shallow grooves (Figure 20(a,b)). Gymnocystal frontal shield translucent, slightly convex, surface smooth but with transverse wrinkles and uniformly perforated by some 28–36 bevelled round pseudopores except for an area around the ascopore (Figure 20(b)), a short slit is visible distal to each pore using an optical microscope; ascopore circular (23 μm), only slightly larger than the frontal pores (Figure 20(b)); proximal to the ascopore a distinct narrow crest of variable length formed by a linear series of more or less jointed knobs is present in most zooids (Figure 20(b)). Five oval basal pore chambers on each zooid side, communication pores round and

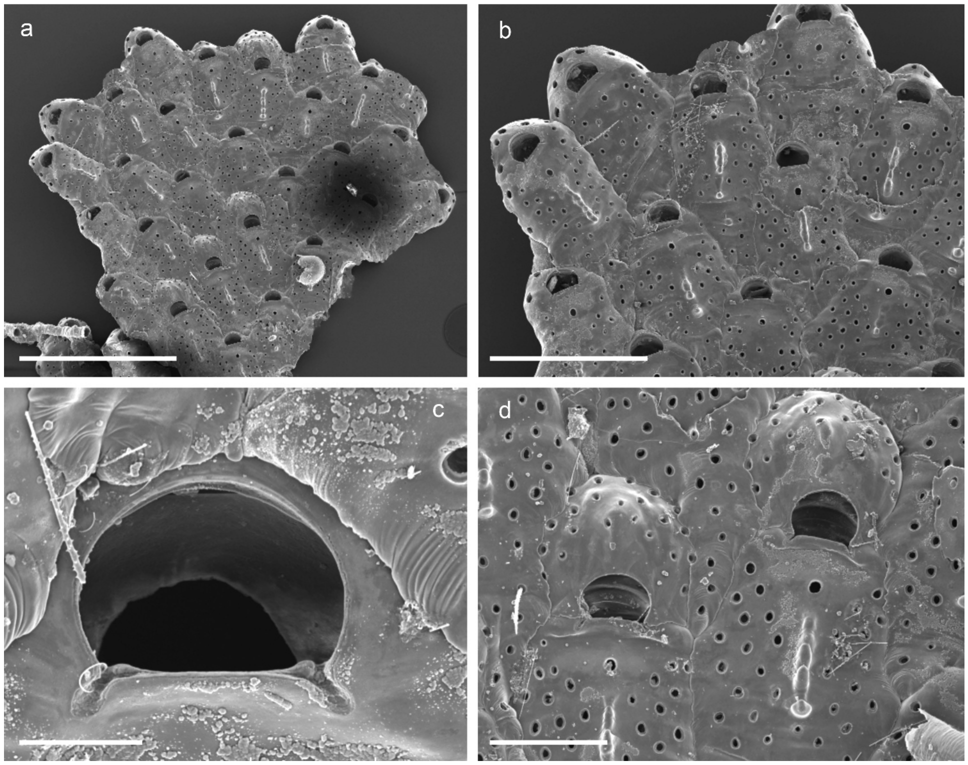

Figure 20. *Haplopoma celeste* sp. nov. (paratype, SEM stub n°1). (a) Colony. (b) Autozooids. (c) Orifice. (d) Maternal zooids with ovicells. Scale: (a) 1 mm; (b) 500 µm; (c) 50 µm; (d) 200 µm.

large, widely spaced, three or four per neighbouring zooid (Figure 20(b)), basal wall only marginally calcified. Orifice semicircular (L: 66 ± 3, 61–72, 16; W: 102 ± 3, 98–108, 16), wider than long and widest at about mid-distance, proximal margin straight with a pair of small rounded condyles near each corner and distinct notches extending proximolaterally (Figure 20(c)).

Ovicellate zooids about the same size as autozooids, ovicells kenozooidal, ooecium hemispherical, partly immersed below colony surface, slightly wider than long (L: 238 ± 8, 229–247, 5; W: 245 ± 15, 230–266, 5), closure type cleithral; smooth ectooecial calcification resembling the frontal shield of the zooid with scattered pores, occasionally with a low central ridge (Figure 20(d)).

Ancestrula not observed.

Remarks

The new species is very similar to *Haplopoma planum* Ryland, 1963 as regards the pseudoporous frontal shield, the non-stellate pore type, and the orifice with its condyles, while *H. planum* lacks the central crest on the zooidal surface, and has distinctly larger zooids, orifices and ovicells (cf. Hayward & Ryland 1999: 312, figs. 141A–B, 144). *Haplopoma planum* is a northern species, however, occurring from Shetland to the Arctic.

The other existing species from the Mediterranean Sea and warm-temperate eastern Atlantic differ more significantly in having only a single row of frontal pseudopores, [*Haplopoma impressum* (Audouin, 1826); *Haplopoma sciaphilum* Silén & Harmelin, 1976], or stellate pores [*Haplopoma bimucronatum* (Moll, 1803); *Haplopoma graniferum* (Johnston, 1847)], among other character differences.

Together with *H. bimucronatum*, *H. planum* and *H. sciaphilum*, *Haplopoma celeste* sp. nov. is among the species that are recorded from waters below 50 m depth (or from caves in shallower waters), while the other species are mostly restricted to in the shallow subtidal. To our knowledge, *H. celeste* has not been recorded before in previous works and is thus only known from the central Mediterranean Sea at depths of 60 m.

Family Romancheinidae Jullien, 1888
Genus **Escharella** Gray, 1848
Escharella* cf. *variolosa (Johnston, 1838)

cf. *Lepralia variolosa* Johnston, 1838: 278, pl. 34 fig. 4.
cf. *Escharella variolosa*: Zabala & Malaquer 1988: 125, pl. 13, fig. C; Hayward & Ryland 1999: 132, figs. 41,

42B; Chimenz Gusso et al. 2014: 158, figs. 77a–d; Souto et al. 2014: 140, fig. 4F.

Material examined

Pica coll: two unbleached colony fragments.

Remarks

Only two poorly preserved colony fragments were found, which makes it difficult to precisely identify the species.

Superfamily Smittinoidea Levinsen 1909
Family Smittinidae Levinsen 1909
Genus ***Prenantia*** Gautier, 1962
Prenantia ligulata (Manzoni, 1870)
Fig. 21a-f

Lepralia ligulata Manzoni, 1870: 334, pl. 3, fig. 17.
Smittia inerma: Calvet 1907: 437, pl. 28, fig. 3.
Prenantia inerma: Zabala & Maluquer 1988: 122, text-fig. 271, pl. 11, figs. D–E.
Prenantia ligulata: Poluzzi 1975: 62, pl. 20, fig. 11; Rosso 2004, figs. 16–18; Chimenz Gusso et al. 2014: 207, figs. 111a–c.

Material examined

Pica coll: SEM stub n°23, small bleached colony; SEM stub n°54, bleached ovicellate colony; SEM stub n°67, bleached colony with ancestrula; one additional unbleached colony.

Remarks

For the sake of consistency, we here continue to follow the most recent works and refer the modern species to the fossil *Prenantia ligulata* (Manzoni, 1870), which would have priority if it should turn out to be synonymous with *Prenantia inerma* (Calvet, 1907), as suggested by Poluzzi (1975). However, the types of both species need to be consulted before this decision can be finalised.

The ancestrula has been observed before but was only incompletely described owing to the peri-ancestrular zooids covering the proximal and lateral gymnocyst (Rosso 2004). Here we provide additional information on the morphology of the ancestrula (Figure 21(e,f)). It is about 420 µm long and 290 µm wide, with steep marginal walls rising to an elevated oval area that comprises about the distal two-thirds of the ancestrula. The distinctly raised margin demarcating this area is tightly framed and indented by nine spines that are more or less arching over the frontal surface, the six distal ones of which are relatively closely spaced. The area comprises a broad proximal shelf of smooth cryptocyst that gently slopes towards the centre and narrows distolaterally, and a relatively small, distal, suborbicular opesia. The proximal cryptocystal shelf exhibits a central longitudinal suture.

Family Bitectiporidae MacGillivray, 1895
Genus ***Schizomavella*** Canu & Bassler, 1917
Schizomavella (Schizomavella) cornuta
(Heller, 1867)
Fig. 22a-f

Lepralia cornuta Heller, 1867: 110, pl. 6, fig. 6.
Schizomavella cuspidata: Hayward & Thorpe 1995: 665, pl. 2; Reverter Gil & Fernández Pulpeiro 1996: 263, figs. 4A–C (only); Hayward & Ryland 1999: 286, figs. 131 A, C (not 131B, D).
Schizomavella cornuta: Hayward & McKinney 2002: 57, figs. 26A–C Reverter-Gil et al. 2016: 283, figs. 2–3.

Material examined

Pica coll: SEM stubs n°35, 48, each with one bleached ovicellate colony; seven additional unbleached colonies.

Remarks

The present specimens fully conform with the characters of *Schizomavella* (*Schizomavella*) *cornuta*.

Schizomavella (Schizomavella) cf. linearis
(Hassall, 1841)
Fig. 23a-d

cf. *Lepralia linearis* Hassall, 1841: 368, pl. 9, fig. 8.
cf. *Schizomavella linearis*: Hayward & Thorpe 1995: 671, pl. 4, figs. a–d; Hayward & Ryland 1999: 282, figs. 127–128; Hayward & McKinney 2002: 59, figs. 26E–G; Chimenz Gusso et al. 2014: 252, figs. 138a–f; Reverter-Gil et al. 2016: 304, fig. 11.

Material examined

Pica coll: SEM stub n°69, one bleached ovicellate colony; five additional unbleaced colonies.

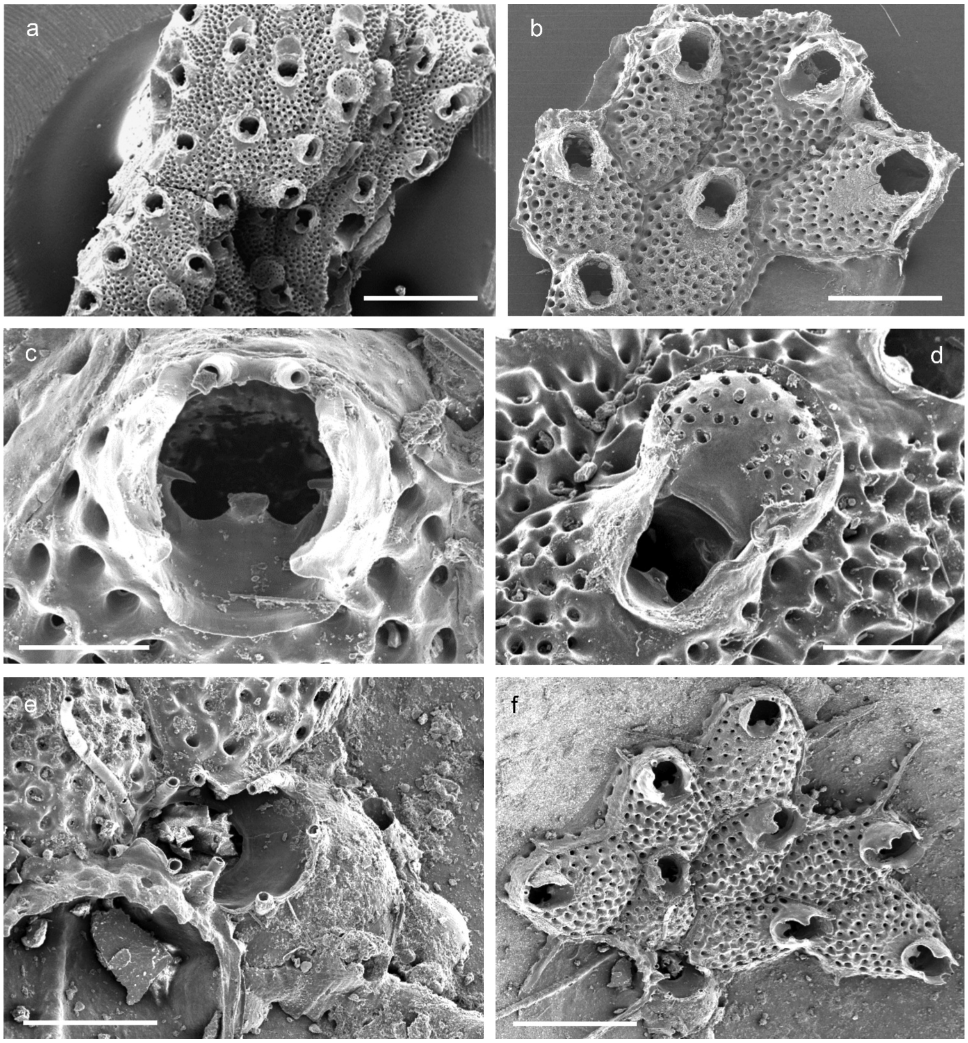

Figure 21. *Prenantia ligulata*. (a) Colony. (b) Autozooids. (c) Orifice showing two distal oral spines, the lyrula and condyles in an early astogenetic zooid. (d) Maternal zooid with ovicell. (e) Ancestrula. (f) Ancestrula with early autozooids Scale: (a) 1 mm; (b, f) 500 µm; (c, e) 100 µm; (d) 200 µm.

Remarks

The Apulian specimens belong to the *Schizomavella linearis* species complex but differ from all populations hitherto described. Most closely related is the form referred to by Reverter-Gil et al. (2016) as the "*pseudolinearis*" morphotype from the Adriatic Sea, which has a relatively narrow sinus and avicularia that were reported to be often directed distally (Reverter-Gil et al. 2016: 308), although their fig. 11f exclusively shows medially directed avicularia. In the present specimens, the sinus is even narrower, and the avicularia are oriented distomedially to distolaterally. However, despite the large morphological differences between some of the Mediterranean populations and those from the type locality, the British Isles (see Hayward & Thorpe 1995; Hayward & Ryland 1999), Reverter-Gil et al. (2016) were reluctant to introduce new species owing to the transitional nature of some of the characters, and also because of an absence of a clear geographic pattern in the morphotypes. We have, accordingly, decided to add the present specimens to the species complex and wait for genetic analyses to tackle the issue of their relatedness.

Schizomavella (Schizomavella) subsolana
(Hayward & McKinney, 2002)
Fig. 24a-d

Schizomavella subsolana Hayward & McKinney, 2002: 61, figs. 28A–D.

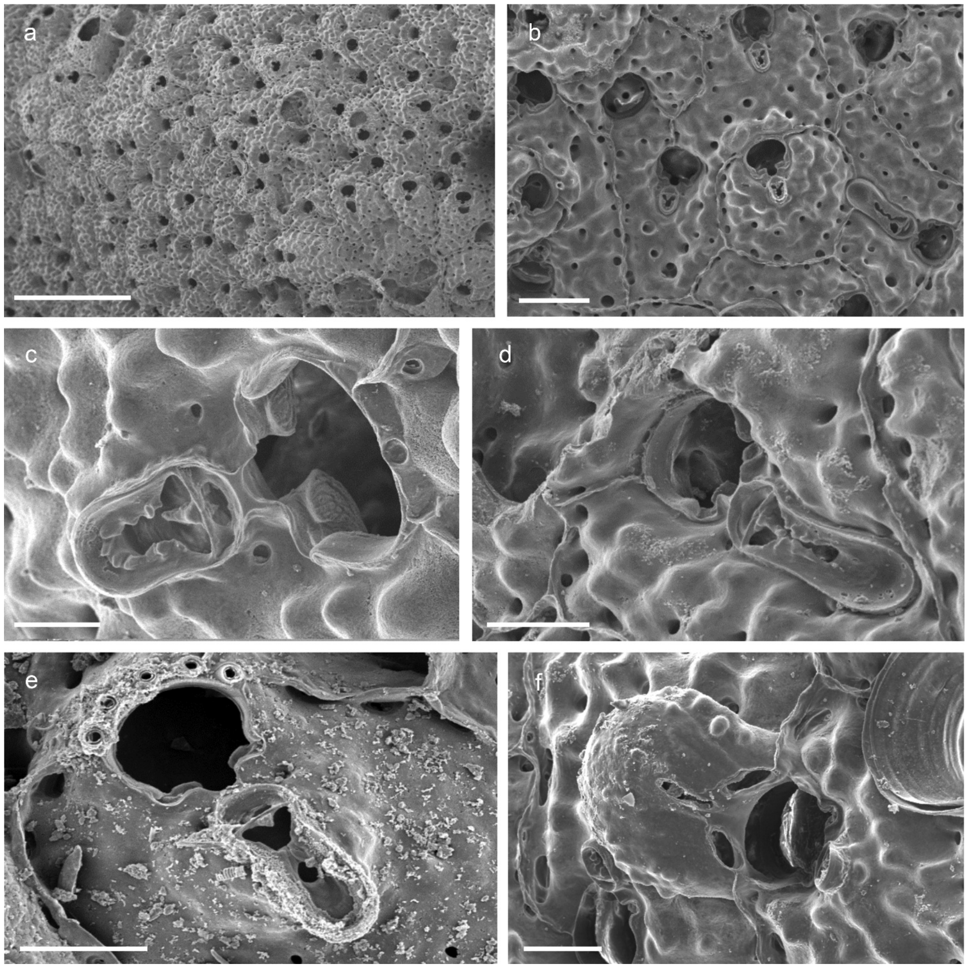

Figure 22. *Schizomavella* (*Schizomavella*) *cornuta*. (a) Colony. (b) Zooids. (c) Orifice with condyles and an oblong suboral avicularium. (d) Spatulate suboral avicularium. (e) Early ontogenetic orifice with with five spines and spatulate suboral avicularium. (f) Ovicell. Scales: (a) 1 mm; (b) 200 μm; (c) 500 μm; (d–f) 100 μm.

Material examined

Pica coll: SEM stub n°19, one bleached ovicellate colony; one additional unbleached colony.

Remarks

The present specimen slightly differs from those from the type locality, Rovinj, in the northern Adriatic Sea (Hayward & McKinney 2002), in having a less rugose frontal shield with somewhat smaller pores. As all other characters are identical, we consider these differences to have been caused by environmental conditions at greater depth in which the Apulian population was found (60 m *vs*. 5–20 m off Rovinj).

Schizomavella (Schizomavella) cerranoi Pica & Berning sp. nov.

Fig. 25a-f

Diagnosis

Schizomavella with unilaminar colonies. Zooids rectangular in outline, frontal shield perforated by numerous, relatively small pores. Orifice proximally and laterally surrounded by a thin peristome; primary orifice suborbicular, with a narrowly U-shaped sinus occupying about one-fourth of the proximal margin, condyles relatively long and narrow, with sloping shoulders or running parallel to proximal orifice margin and stopping short of the sinus, no additional structures; distal orifice margin usually with 4 spines persisting

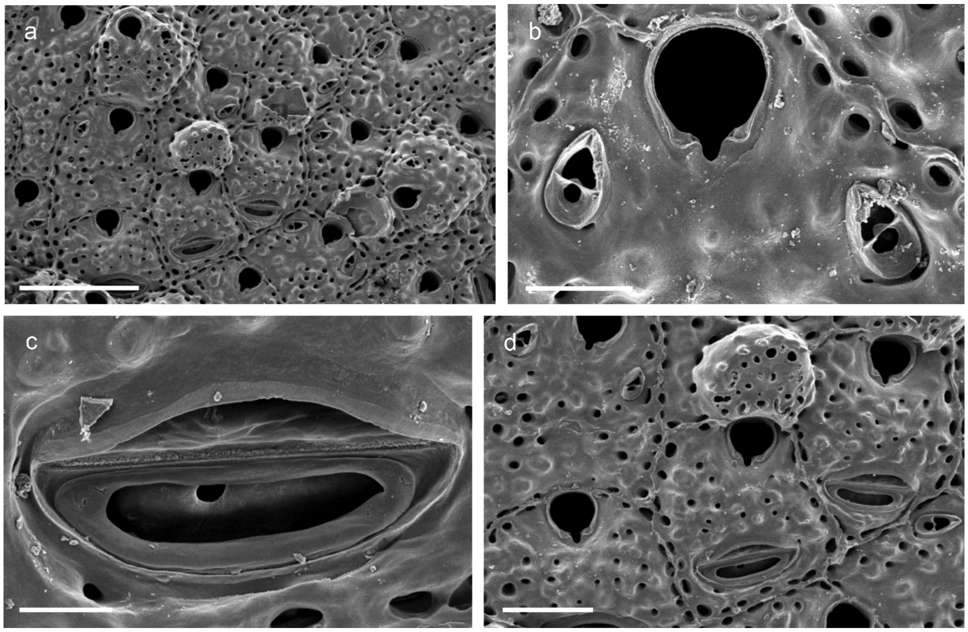

Figure 23. *Schizomavella* (*Schizomavella*) cf. *linearis*. (a) Zooids. (b) Orifice and avicularia. (c) Large adventitious avicularium. (d) Maternal zooid with ovicell and large proximal avicularia. Scale: (a) 500 µm; (b) 100 µm; (c) 50 µm; (d) 200 µm.

thoughout ontogeny in non-ovicellate zooids. Suboral avicularium forning a tall umbo, oriented almost perpendicular to frontal plane, rostrum elongate triangular, crossbar with a small rounded columella. Ovicell marginally covered by secondary calcification of the distal zooid, forming a rugged crest around a small central area of exposed ectooecium that is regularly perforated by small pseudopores.

Etymology

Named after the person who collected the material studied in this paper, Prof. Carlo Cerrano.

Material examined

Holotype

MSNG 62425: SEM stub n°29, one bleached ovicellate colony, Gallipoli, Lecce (Italy), 40°0′56.20″ N, 17°55′17.84″E, depth 60 m, 16 Jul. 2015.

Paratypes

Same data as for holotype. MSNG 62426: SEM stub n°58, one bleached colony; MSNG 62427: portion of one bleached ovicellate colony.

Description

Colony encrusting, unilaminar and multiserial (Figure 25(a,b)), developing into a small rounded patch. Autozooids rectangular or irregularly polygonal (L: 460 ± 54, 358–559, 20; W: 414 ± 76, 327–535, 20), in regular radiating lines, separated by fine sutures (Figure 25(b)). Frontal shield convex, uniformly perforated by relatively small pores, distally umbonate incorporating a suboral avicularium (Figure 25(b)). Orifice partially immersed during ontogeny, surrounded laterally and proximally by a thin, raised peristome that abuts the cystid of the suboral umbo (Figure 25 (c)); primary orifice rounded, slightly wider than long (L: 116 ± 7, 107–127, 7; W: 101 ± 5, 91–113, 15), sinus narrowly U-shaped (L: 18 ± 2, 16–20, 6; W: 26 ± 3, 22–31, 7), occupying a little less than one fourth of the proximal border (W: 88 ± 5, 81–95, 6), condyles long and relatively narrow, ending short of the sinus, edge sloping or parallel to proximal orifice margin, no proximolateral notches or other structures (Figure 25(c,d)). Usually, three to occasionally four distal oral spines on the distal orifice margin in non-ovicellate zooids, persisting thoughout ontogeny (Figure 25(c)). Suboral avicularium (L: 110 ± 0.7, 110–111, 2; W: 50 ± 4, 47–53, 2) almost perpendicular to the frontal plane, the cystid forming a tall structure; rostrum elongate triangular (L: 83 ± 3, 81–86, 3), crossbar complete with small rounded columella, palatal foramen Y-shaped (Figure 25(e)). Ovicell acleithral, almost covering the entire frontal shield of the succeeding zooid, about as long as wide or slightly elongated (L: 238 ± 15, 193–314, 20; W:

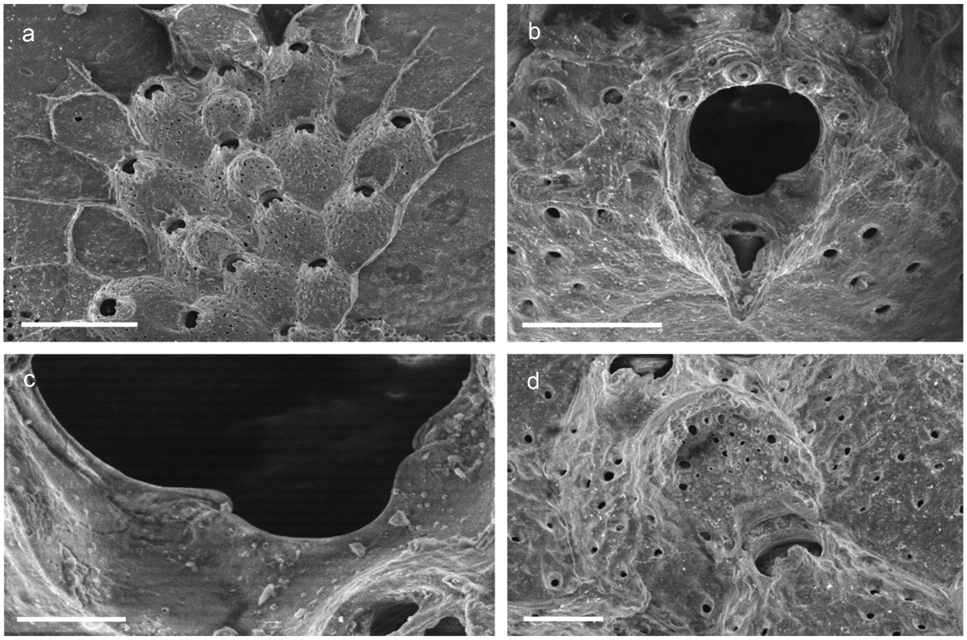

Figure 24. *Schizomavella* (*Schizomavella*) *subsolana*. (a) Colony. (b) Orifice and suboral avicularium. (c) Zooidal orifice showing the sinus. (d) Ovicell. Scales: (a) 500 µm; (b, d) 100 µm; (c) 200 µm.

238 ± 15, 192–260, 20); its margins (particularly distally) covered by relatively smooth secondary calcification of the distal zooid, producing a distinctly raised rugged rim around the exposed ectooecium, which is relatively flattened and regularly perforated by variably shaped pseudopores (Figure 25(f)).

Ancestrula unknown.

Remarks

The new species is very closely related to *Schizomavella* (*Schizomavella*) *subsolana* (see above) but differs from it in having a distinctly narrower and deeper sinus. Moreover, *Schizomavella* (*Schizomavella*) *cerranoi* sp. nov. is characterised by larger zooids (particularly their width) and orifices, by a smaller area of exposed ectooecium as well as by having a maximum number of four oral spines. As the two morphotypes apparently occur sympatrically, and as intermediate morphologies were not found in any of the colonies, we have decided to introduce a new species for the present material.

Schizomavella (Schizomavella) cf. tubulata
Reverter-Gil, Souto, Novosel & Tilbrook, 2015
Fig. 26a-d

cf. *Schizomavella* (*Schizomavella*) *tubulata*: Reverter-Gil et al. 2016 (nomenclatural availability: 2015): 298, fig. 8; Rosso et al. 2019a: fig. 6a.

Material examined

Pica coll: SEM stub n°23, one bleached colony; SEM stub n°30, bleached colony with ancestrula.

Remarks

Only two small immature colonies were obtained. The specimens are very similar to the recently introduced species *Schizomavella* (*Schizomavella*) *tubulata* Reverter-Gil, Souto, Novosel & Tilbrook, 2015 from the Adriatic Sea. Both species have similarly shaped orifice -ith four to five distal spines and a spatulate suboral avicularium oriented almost perpendicular to the frontal plane. In our specimens the early astogenetic zooids show more spines, up to seven, decreasing in number toward the zone of astogenetic repetition. The present colonies differ slightly in lacking a finely denticulate rostrum (cf. Reverter-Gil et al. 2016: fig. 8E), in the absence of a peristome encircling the entire orifice, and in the frontal shields with far fewer and smaller pores than in the holotype. However, our colonies are relatively young and immature, in contrast to the originally described mature colonies that showed multilaminar growth. Reference of the Apulian colonies to *S. tubulata* is thus somewhat doubtful.

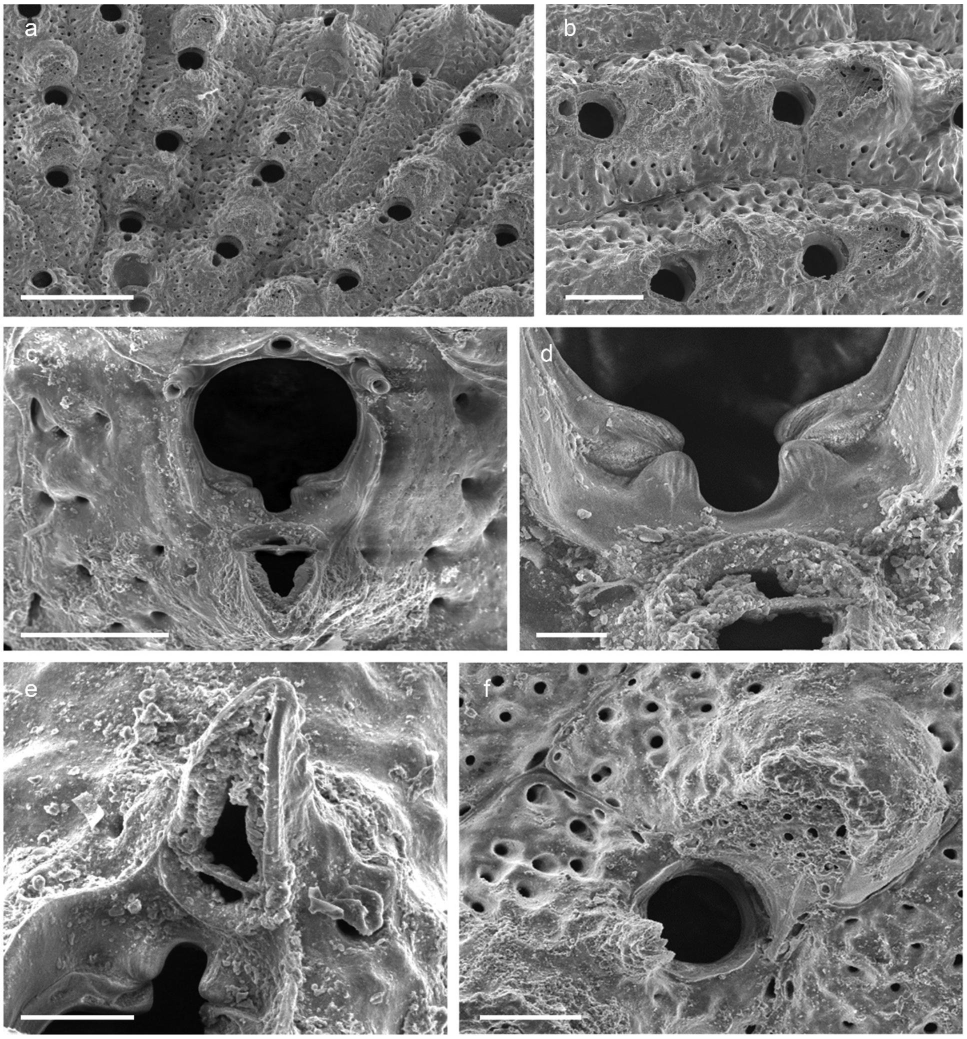

Figure 25. *Schizomavella* (*Schizomavella*) *cerranoi* sp. nov. (holotype). (a) Colony. (b) Ovicellate zooids. (c) Orifice and suboral avicularium. (d) Zooidal orifice showing the sinus and condyles. (e) Avicularium. (f) Ovicell. Scales: (a) 500 μm; (b) 200 μm; (c, f) 100 μm; (d) 20 μm; (e) 50 μm.

Schizomavella (Calvetomavella) biancae Pica & Berning sp. nov.

Fig. 27a-f

Schizomavella discoidea: Hayward & Ryland 1999: 280, figs. 123C–D, 126A–C (part, not 126D); López de la Cuadra & García-Gómez 2001: figs. 2C–D; De Blauwe 2009: 364, figs. 387–388; Chimenz Gusso et al. 2014: 249, figs. 136a–c.

Diagnosis

Schizomavella (*Calvetomavella*) with encrusting unilaminar colonies. Autozooidal frontal shield with a coarsely granular to nodular surface and few small pores around a central imperforate area. Orifice suborbicular in shape and with a narrow and deeply U-shaped sinus as well as broad condyles sloping towards sinus, six or seven oral spines. Avicularia dimorphic: large avicularia often paired and situated along distolateral margins though single latero-suboral ones also occur; oblong in outline, i.e. rostrum distally rounded with slightly raised and serrated edges, palate mostly calcified by a pair of cryptocystal shelves forming central ridges and an elongate foramen at about mid-distance, crossbar with tiny columella. Small avicularia single and usually (latero)suboral though distolateral ones also occur, oval to oblong in outline, slightly raised distal part of rostrum serrated, distal foramen Y-shaped, crossbar with tiny columella. Ovicells relatively large, often covering over half the frontal area of the distal zooid, ooecia flattened

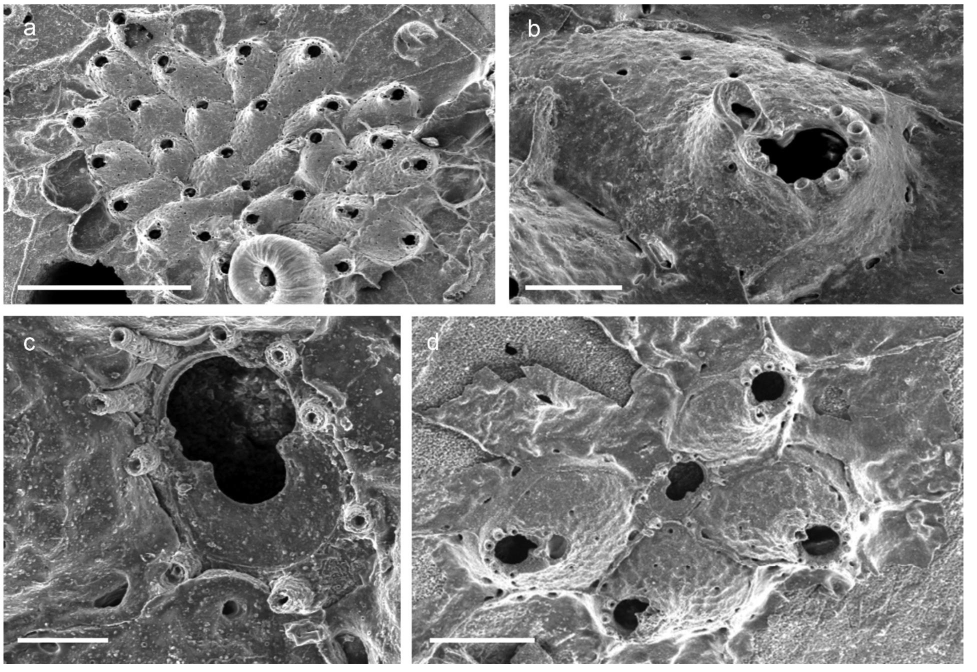

Figure 26. *Schizomavella* (*Schizomavella*) cf. *tubulata*. (a) Colony. (b) Zooid. (c) Ancestrula. (d) Ancestrula with early autozooids. Scales: (a) 1 mm; (b) 100 µm; (c) 50 µm; (d) 200 µm.

globular, ectooecium almost entirely exposed apart from a narrow peripheral rim and with c. 25 rimmed tubaeform pores, ovicellate zooids forming a peristome a with a large U-shaped suboral notch.

Etymology

Named after one of the first author's nieces, Bianca Colapaoli.

Material examined

Holotype

MSNG 62428: SEM stub n°21, with a bleached ovicellate colony, Gallipoli, Lecce (Italy), 40° 0′56.20″N, 17°55′17.84″E, depth 60 m, 16 Jul. 2015.

Paratypes

Same data as for holotype. MSNG 62429: SEM stub n°68, bleached colony with ancestrula; MSNG 62430: bleached ovicellate colony.

Description

Colony encrusting, unilaminar, multiserial (Figure 27(a)). Autozooids rectangular to irregular polygonal in shape (L: 433 ± 50, 351–490, 8; W: 328 ± 67, 236–434, 12), slightly convex and separated by a fine suture (Figure 27(a)). Frontal shield coarsely granular to nodular, perforated by small round pores (up to 15) mainly located laterally near the suture, suboral area imperforate (Figure 27(b)).

Primary orifice slightly elevated (L: 96 ± 3, 91–99, 12; W: 81 ± 3, 75–85, 12) and with six or seven spines in autozooids, about as long as wide, anter suborbicular, proximal margin straight with a narrow and deeply U-shaped sinus (L: 23 ± 2, 21–25, 8; W: 21 ± 3, 13–21, 8) occupying approximately one-fifth to one-fourth of the proximal width (W: 73 ± 4, 64–78, 12) (Figure 27(b,d)). Condyles broad and as long as the proximolateral margin, sloping towards corners of the sinus that are marked by slightly raised and obliquely positioned ridges (Figure 27(c)).

Avicularia adventitious, dimorphic: large avicularia usually paired and positioned lateral to the orifice though single and suboral ones also frequently occur, and usually single and small suboral avicularia that may occasionally be positioned distolaterally (Figure 27(b,d, e)). Large avicularia (L: 157 ± 2, 136–196, 9; W: 42 ± 6, 32–49, 8) (Figure 22(b,e)), pointing proximolaterally, oblong in outline, i.e. rostrum (L: 134 ± 15, 117–167, 9) with parallel margins and distally rounded with a slightly elevated serrated rim; palate mostly calcified by a pair of lateral shelves that form central ridges, producing an elongated enclosed foramen at about

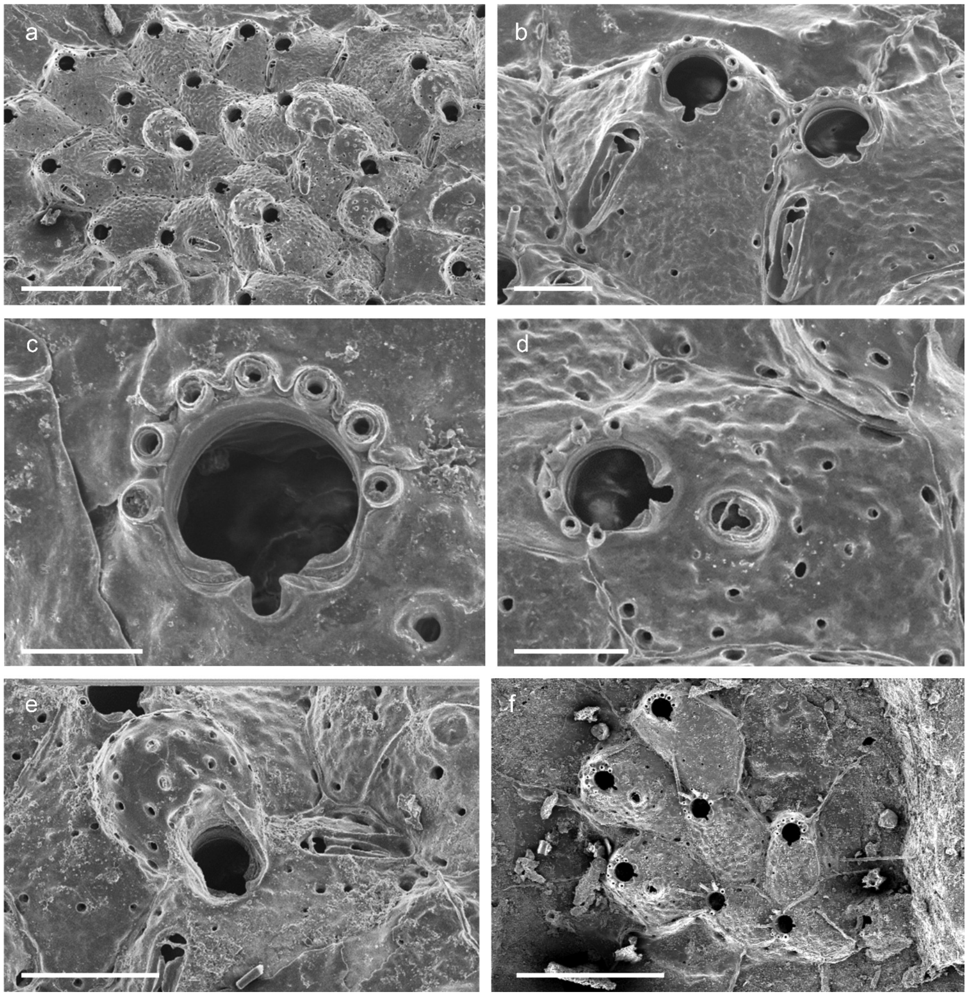

Figure 27. *Schizomavella* (*Calvetomavella*) *biancae* sp. nov. (a) Colony (holotype). (b) Zooids with laterofrontal avicularia (holotype). (c) Orifice (holotype). (d) Zooid with small suboral avicularium (holotype). (e) Maternal zooid with ovicell and paired avicularia (holotype). (f) Ancestrula with early astogenetic zooids (paratype). Scales: (a, f) 0.5 mm; (b, d) 100 µm; (c) 50 µm; (e) 200 µm.

mid-distance, foramen immediately distal to crossbar of various irregular shapes, foramen proximal to crossbar D-shaped or oval, complete crossbar usually with a tiny columella. Small avicularia (L: 58 ± 8, 47–66, 5; W: 36 ± 11, 20–47, 5) (Figure 27(d)) oval to oblong in outline, rostrum (L: 39 ± 8, 30–49, 5) with a slightly raised and serrated distal margin, Y-shaped distal foramen, foramen proximal to crossbar oval or D-shaped, complete crossbar with a small columella.

Ovicells hyperstomial, relatively large (L: 189 ± 15, 165–208, 6; W: 213 ± 10, 199–227, 6), ooecium somewhat flattened-globular with the ectooecium almost entirely exposed apart from a peripheral rim of frontal calcification by the distal zooid, perforated by about 25 rimmed tubaeform pores (Figure 27(e)). Ovicellate zooids develop a peristome with the lateral walls attached to the proximolateral ooecial margins, terminal peristomial margins straight lateral to orifice while proximally abruptly sloping to form a large U-shaped suboral notch (Figure 27(e)).

Ancestrula not well preserved, oval in shape, longer than wide, opesia mushroom-shaped surrounded by nine or ten mural spines (Figure 27(f)).

Remarks

As noted by Reverter-Gil et al. (2015: 40), who figured material of *Schizomavella* (*Calvetomavella*) *discoidea* (Busk, 1859) from its Madeiran type locality using SEM for the first time, the species is specifically distinct from eastern Atlantic continental shelf and Mediterranean Sea populations, which were historically assigned to that species. *Schizomavella* (*C.*) *discoidea* differs from the present colonies in having larger pores in the frontal shield, a differently shaped peristome in ovicellate

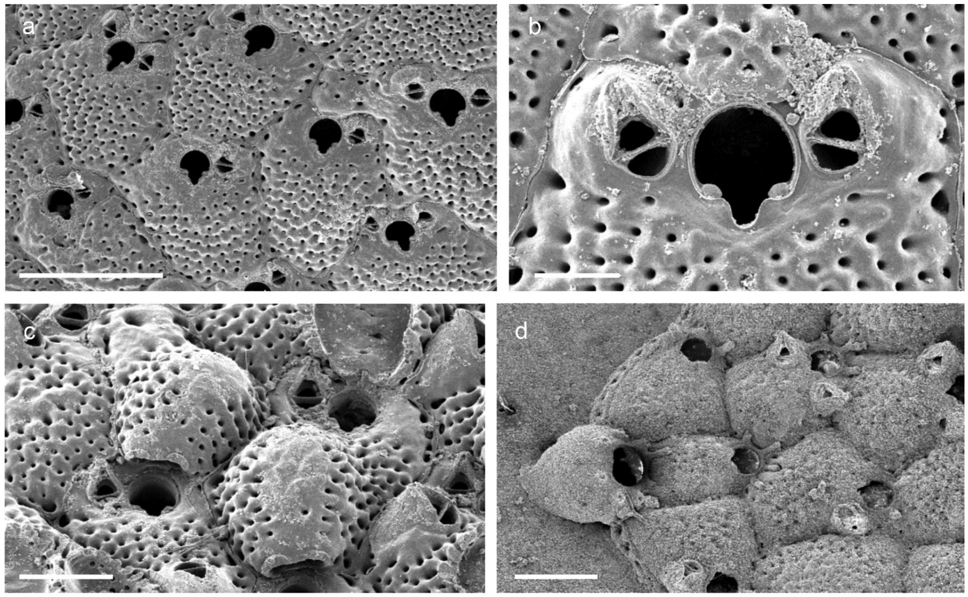

Figure 28. *Schizoporella magnifica*. (a) Autozooids. (b) Orifice and lateral avicularia. (c) Ovicells. (d) Ancestrula with early astogenetic autozooids. Scales: (a) 500 μm; (b) 100 μm; (c, d) 200 μm.

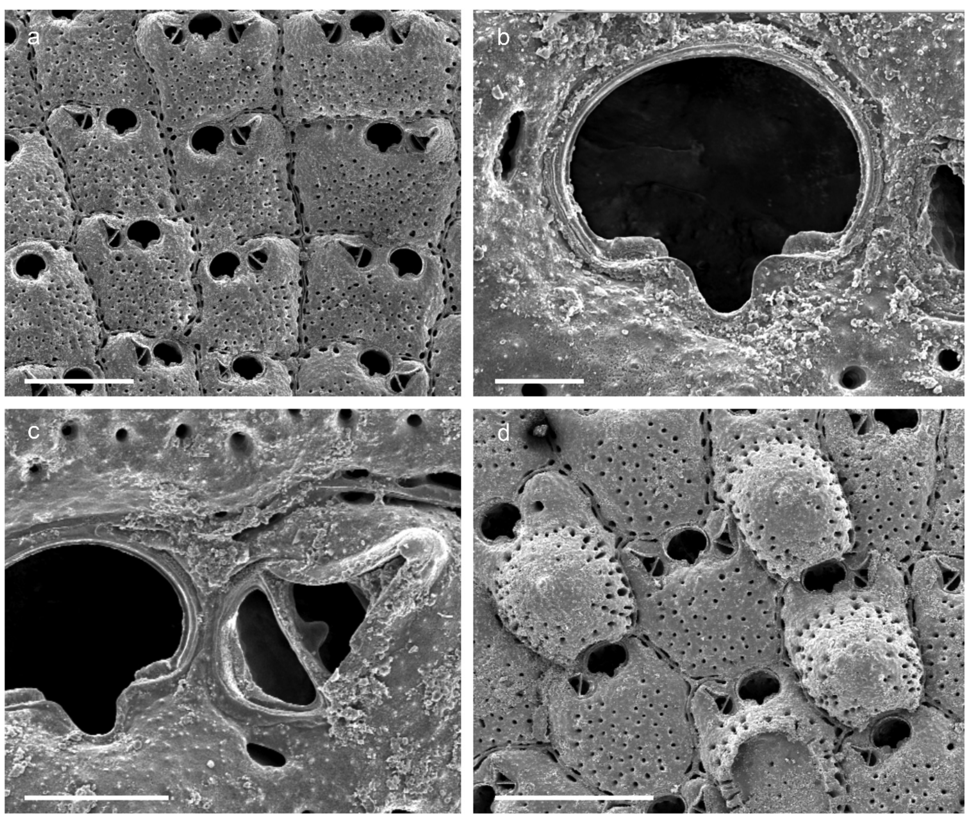

Figure 29. *Schizoporella adelaide* sp. nov. (holotype). (a) Autozooids. (b) Orifice. (c) Avicularium. (d) Maternal zooids. Scales: (a, b, d) 500 μm; (c) 100 μm.

zooids (with sloping lateral margins, i.e. the U-shaped proximal notch is not developed), a broader orificial sinus, and in the shape of the avicularian rostrum, which is tapering distally (cf. Reverter-Gil et al. 2015: fig. 2). At the present state of knowledge, *Schizomavella*

(*Calvetomavella*) *biancae* sp. nov. occurs in the central and western Mediterranean Sea, and along the Atlantic continental shelf of Europe, with the Shetland Islands as its northernmost limit of distribution (cf. Hayward & Ryland 1999; Reverter-Gil et al. 2015). However, in the absence of SEM images from most publications, the distinction between the new species and the morphologically closely related *Schizomavella* (*Schizomavella*) *halimedae* (Gautier, 1955) is rendered difficult. The two species differ in having large spatulate (even gigantic) avicularia [*S.* (*S.*) *halimedae*] *vs.* elongated lateral avicularia [*S.* (*C.*) *biancae* sp. nov.], which may, however, be missing in certain colony regions (see also López de la Cuadra & García-Gómez 2001: 1723; Reverter-Gil et al. 2016: 313). Also, the ooecium is covered by nodular secondary calcification in the former species, whereas the pseudoporous ectooecium is entirely exposed in the latter. As the depth ranges of these species are also largely overlapping, with *S.* (*S.*) *halimedae* likely to occur shallower than *S.* (*C.*) *biancae* sp. nov., which was reported from caves at 13 m to a depth of about 100 m (López de la Cuadra & García-Gómez 2001: 1724), it may be that some records of *S.* (*S.*) *halimedae* actually correspond to *S.* (*C.*) *biancae* sp. nov.

Superfamily Schizoporelloidea Jullien 1882
Family Schizoporellidae Jullien, 1882
Genus ***Schizoporella*** Hincks, 1877
Schizoporella magnifica (Hincks, 1886)
Fig. 28a-d

Schizoporella magnifica: Hincks 1886: 268, pl. 10, fig. 1; Zabala & Maluquer 1988: 133, text-fig. 313, pl. 18, fig. E; Hayward & Ryland 1999: 216, figs. 89, 90A; Hayward & McKinney 2002: 71, figs. 31F–J; Chimenz Gusso et al. 2014: 266, figs. 146a–d.

Material examined

Pica coll: SEM stub n°39, bleached colony with ancestrula; SEM stub n°62, bleached ovicellate colony; two additional unbleached colonies.

Remarks

Schizoporella magnifica (Hincks, 1886) occurs throughout the Mediterranean Sea and north to the SW British Isles (Hayward & Ryland 1999: 216). The sinus in the present colonies seems to be relatively wide but nevertheless within the range observed in other populations (e.g. Hayward & McKinney 2002: fig. 31F, H). Another similar yet specifically distinct *Schizoporella* species is also present on the *Neopycnodonte* shells (see below).

Schizoporella adelaide Pica & Berning sp. nov.
Fig. 29a-d

Diagnosis

Schizoporella with rectangular to oval zooids; frontal shield perforated by c. 40 small round pores, imperforate suboral area prominent but without umbo; orifice slightly wider than long, the short sinus narrowly U-shaped, condyles small, somewhat faceted and short with rounded shoulders. Adventitious avicularia single or double, situated in distolateral corner(s) of zooid, rostrum elongate triangular and gently concave, distal half narrow and with a hooked tip; crossbar with rounded columella. Ovicells occupying almost the entire frontal shield of distal zooid, ooecia marginally perforated, central imperforate area usually with an umbo.

Etymology

Named after the first author's nephew, Adelaide Colapaoli; used as a noun in apposition.

Material examined

Holotype

MSNG 62431: SEM stub n°80, with one bleached ovicellate colony, Gallipoli, Lecce (Italy), 40° 0′56.20″N, 17°55′17.84″E, depth 60 m, 16 Jul. 2015.

Paratypes

Same data as for holotype. MSNG 62432: one bleached colony.

Description

Colony encrusting, multiserial and unilaminar (Figure 29(e)). Zooids rectangular to slightly irregular or even oval in shape (L: 545 ± 30, 485–600, 17; W: 495 ± 120, 315–830, 21), separated by a deep groove that is closely juxtaposed by often elongated marginal areolar pores (Figure 29(e)).

Frontal shield slightly convex, surface relatively smooth yet covered by indistinct granules, pierced by c. 40 small round and irregularly arranged pores, suboral region free of pores and forming the greatest elevation of the autozooid but without producing an umbo (Figure 29(e)). Primary orifice slightly broader than long (L: 130 ± 10, 100–160, 28; W: 145 ± 10, 125–175, 27), anter transversely elliptical, proximolateral border straight (W: 115 ± 15, 95–150, 26) with rounded shoulders leading into a short and narrowly U-shaped sinus (L: 30 ± 5, 20–40, 20; W: 30 ± 7, 20–45, 20) that occupies almost one quarter to one third of the entire proximal margin; condyles small but distinctive, edge slightly crenellate and disposed parallel to the proximal border, with rounded or sloping shoulders stopping short of the sinus (Figure 29(f)).

Adventitious avicularia single or paired (L: 150 ± 20, 120–180, 11; W: 80 ± 10, 60–105, 13), placed laterally to the orifice and directed distolaterally to laterally, positioned acute to frontal plane; proximal opesia D-shaped, rostrum elongate triangular (L: 100 ± 15, 70–120, 11) with concave margins and a hooked tip, calcified palate restricted to the distinctly narrower distal half; crossbar complete with a well-developed rounded median columella (Figure 29(e,g)).

Ovicells hyperstomial, ooecia globular, slightly longer than wide (L: 440 ± 40, 390–490, 6; W: 390 ± 40, 340–460, 6), occupying almost the entire frontal shield of distal zooid, ooecia marginally perforated by round to slit-like pores except centrally where an umbo is usually developed (Figure 29(h)). Ancestrula not observed.

Remarks

Schizoporella adelaide sp. nov. is morphologically similar to *Schizoporella magnifica* (see above) but can be distinguished from that species owing to a more elongated orifice with a distinctly shorter sinus and condyles, and a crossbar in the avicularium that has a prominent columella. Similarities also exist with the British *Schizoporella cornualis* Hayward & Ryland, 1995, the only other European species that has an avicularium with a columella. While its orifice is rather similar as well (about as long as wide; see Hayward & Ryland, 1995: 46), it has distinctly larger condyles than the new species, and also produces a suboral umbo on its frontal shield. Two undescribed species, *Schizoporella* sp. 2 and sp. 3, which were recorded by Chimenz Gusso et al. (2014) from the southern Italian Island of Ustica are also similar to *S. adelaide* sp. nov. with regards to the distal pair of avicularia (see also Rosso et al. 2019b: fig, 5I). Both species differ from the new species, however, in having a broader sinus, non-crenellate and shorter condyles, and in the absence of a columella in the avicularian crossbar, among other characters.

As no other records could confidently be assigned to *Schizoporella adelaide* sp. nov., the species must be regarded as endemic to the central Mediterranean Sea at present.

Family Cheiloporinidae Jullien, 1888
Genus ***Hagiosynodos*** Bishop & Hayward, 1989
Hagiosynodos latus (Busk, 1856)
Fig. 30a-d

Lepralia lata Busk, 1856: 309, pl. 10, figs. 1–2.
Lepralia kirchenpaueri: Heller 1867: 105, pl. 2, fig. 11.
Hippopodinella lata: Zabala & Maluquer 1988: 136, text-fig. 31 8; Lippi Boncambi et al. 1997: 401, fig. 1.
Hippopodinella kirchenpaueri: Zabala & Maluquer 1988: 136, text-fig. 319, pl. 19, fig. A.
Hagiosynodos latus: Hayward and McKinney 2002: figs. 35A–D; De Blauwe 2009: 380, figs. 406–408; Chimenz Gusso et al. 2014: 168, figs. 85a–f.
Hagiosynodos kirchenpaueri: Hayward & McKinney 2002: 76, figs. 35E–H.
Hagionsynodos latus: Berning 2006: 97, figs. 123–124

Material examined

Pica coll: SEM stubs n°66, 82, each with one bleached ovicellate colony.

Remarks

The number and identity of *Hagiosynodos* species present in the Mediterranean Sea is unclear and a matter of debate, and genetic analyses are certainly needed in order to solve this problem. Most of the interspecific differences given to justify the distinction between *Hagiosynodos latus* (Busk, 1856), *H. kirchenpaueri* (Heller, 1867) and *H. hadros* Hayward & McKinney, 2002 are the dimensions of certain characters. However, the more (fossil) material is looked at, the more difficult it is to differentiate between interspecific differences and intraspecific variability in response to (micro)environmental conditions, and to draw a clear line between these species (Schmid 1989; Berning 2006). Accordingly, the present material is adding to this problem (see Table I). Whereas some of the characters show dimensions similar to those of *H. hadros* (zooid length) or *H. kirchenpaueri* (width of poster),

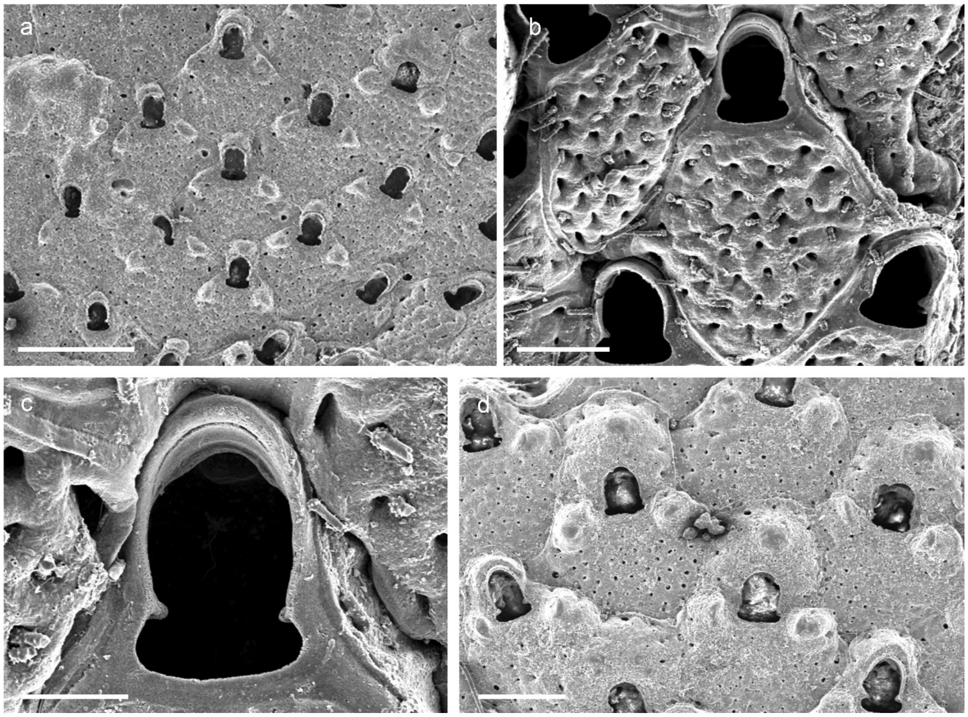

Figure 30. *Hagiosynodos latus*. (a) Colony. (b) Autozooid. (c) Close up of the orifice. (d) Maternal zooids with ovicells. Scales: (a) 500 µm; (b) 100 µm; (c) 50 µm; (d) 200 µm.

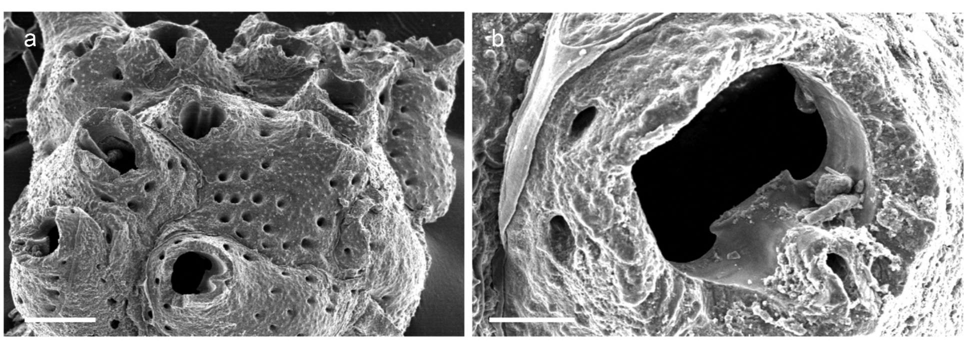

Figure 31. *Phoceana* cf. *tubulifera*. (a) Colony; (b) Lyrula and condyle. Scales: (a) 200 µm; (b) 50 µm.

most of the others are intermediate between either *H. kirchenpaueri* and *H. hadros* (distance between orifices, orifice length, ovicell width), between *H. kirchenpaueri* and *H. latus* (width of anter, distance between frontal shield pores), or in between all of the three (ovicell length). Zooid width, on the other hand, is distinctly greater in the present material than in all of the species reported by Hayward and McKinney (2002).

Concerning qualitative character differences, the present colonies resemble *H. latus* in the presence of a distal lip (or occasionally a pair of distolateral teeth connected by a narrow shelf), while this character is apparently absent in *H. kirchenpaueri* and *H. hadros* (Hayward & McKinney, 2002: 79). Thus, whereas skeletal dimensions and relative proportions would vaguely support an assignment of the present colonies to either *H. kirchenpaueri* or *H. hadros*, the only distinct character difference argues against this decision. Thus, while we do not reject the likelihood of three distinct species being present in the NE Atlantic and Mediterranean Sea as such, we here stress the inability of distinguishing the species based on morphometry and morphology, and hope that genetic analyses may aid in solving the issue. Accordingly, we here assign the specimens to *H. lata* and treat the other species as synonymous for now.

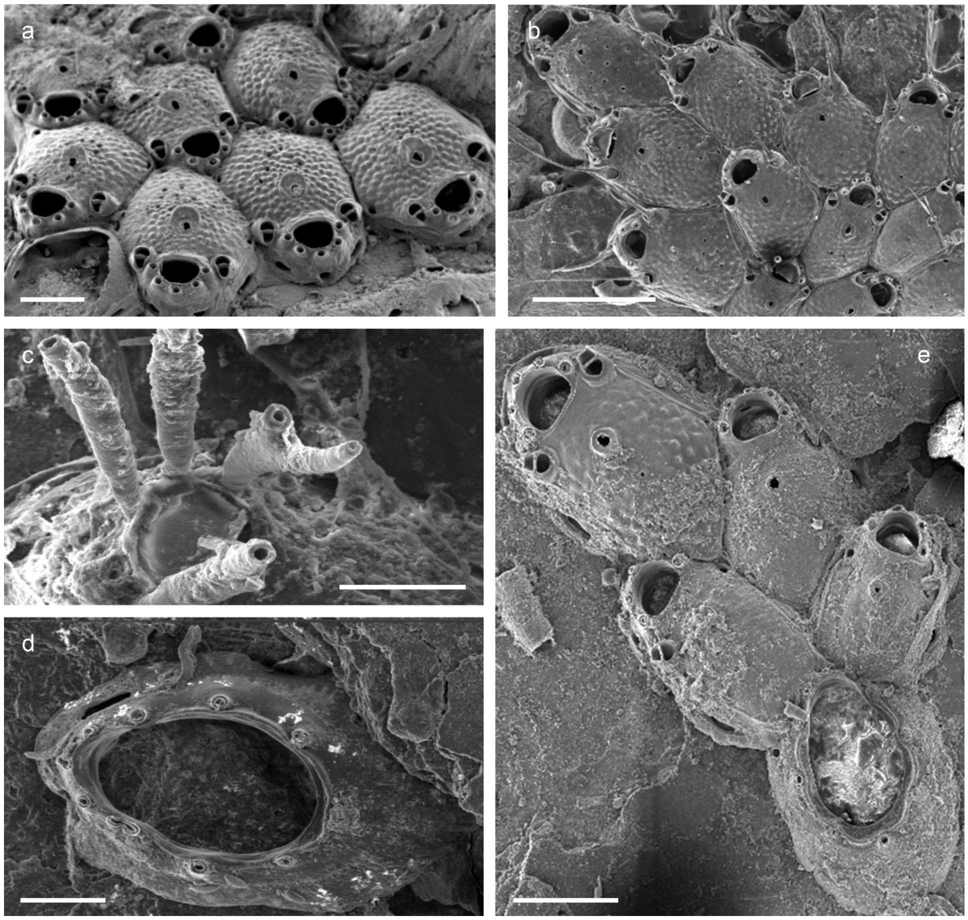

Figure 32. *Microporella appendiculata*. (a) Autozooids at the colony growth margin. (b) Zooid. (c) Oral spines. (d) Ancestrula. (e) Ancestrula with early astogenetic autozooids. Scales: (a, e) 200 μm; (b) 500 μm; (c, d) 100 μm.

Table I. Comparison between character dimensions (means, in μm) of the present specimens with the three species reported by Hayward and McKinney (2002).

Character	This work	*H. kirchenpaueri*	*H. latus*	*H. hadros*
Distance between orifices	390	342	317	425
Zooid length	550	485	428	559
Zooid width	390	350	293	351
Orifice length	130	125	107	135
Width of anter	75	78	74	88
Width of poster	90	95	75	102
Ovicell length	275	316	248	246
Ovicell width	290	309	239	288
Distance between frontal shield pores	38	41	36	48

Family Phoceanidae Vigneaux, 1949
Genus ***Phoceana*** Jullien, 1903
Phoceana* cf. *tubulifera (Heller, 1867)
Fig. 31a-b

cf. *Eschara tubulifera* Heller, 1867: 116.
cf. *Phoceana tubulifera*: Hayward and McKinney 2002: 51, figs. 23A–D.

Material examined

Pica coll: SEM stub n°60, one bleached colony.

Remarks

The colony recovered is presumably a part of the encrusting base of an erect colony. Although the zooids are chaotically arranged, possibly as a result of damage to the colony and subsequent reparative budding, the zooids look similar to *Phoceana tubulifera* (Heller, 1867), which has been described from the Adriatic Sea though seldom reported thereafter. The frontal shield is perforated proximally by pseudopores and forms a prominent peristome around the orifice, while the surface is finely granular. Differences to *P. tubulifera* exist, however, in characters of the orifice. While a lyrula is also present in our material, it is distinctly longer and broader than that figured by Hayward and McKinney (2002: fig. 23c) from the erect portion of the colony. Moreover, condyles were not figured nor reported to be present by these authors, while short and rounded ones exist in our material (Figure 31(b)). We have therefore decided to merely confer our colonies to *P. tubulifera*.

Family Microporellidae Hincks, 1879
Genus ***Microporella*** Hincks, 1877
Microporella appendiculata (Heller, 1867)
Fig. 32a-e

Lepralia appendiculata Heller, 1867: 31, pl. 2, fig. 8.
Microporella pseudomarsupiata: Zabala and Maluquer 1988: 141, text-fig. 3 35, pl. 19, fig. C
Microporella appendiculata: Hayward and Ryland 1999: 294, figs. 134a–b, 135; Chimenz Gusso et al. 2014: 187, figs. 100a–b; Di Martino & Rosso 2021: 5, fig. 2.

Material examined

SEM stubs n°2, 13, 40, each with one bleached colony with ancestrula; SEM stub n°16, bleached colony; SEM stubs n°32, 49, each with one unbleached colony; five additional unbleached colonies.

Remarks

The present specimens, though mostly small colonies, seem to agree with previous records of *M. appendiculata* from the Mediterranean Sea (see Di Martino & Rosso 2021).

Microporella verrucosa (Peach, 1868)
Fig. 33a-e

Eschara verrucosa Peach, 1868: 116.
Diporula verrucosa: Zabala & Maluquer 1988: 137, text-fig. 3 23, pl. 19, fig. B; Pouyet & Moissette 1992: 66, pl. 10, figs. 1–2; Rosso 1996: 216, pl. 5, fig. b; Hayward & Ryland 1999: 302, figs. 138C–D, 139; Rosso et al. 2014: 202, figs. 3A–C; Achilleos *et al*. 2019: fig. 2E.
Microporella verrucosa: Di Martino & Rosso 2021.

Material examined

Pica coll: SEM stub n°53, one unbleached colony; SEM stub n°57, one bleached colony.

Remarks

The fragments here reported are exclusively from the encrusting base of the erect *M. verrucosa* and lack ovicells. Mediterranean material of this species has recently been redescribed (Di Martino & Rosso 2021), yet the types of *M. verrucosa* as well as of a Pliocene species from Sicily, *Eschara lunaris* Waters, 1878, need to be revised to test for synonymy between the fossil and Recent forms on the one hand, and the Mediterranean and Atlantic populations on the other hand.

Family Escharinidae Tilbrook, 2006
Genus ***Escharina*** Milne Edwards, 1836
Escharina cf. ***protecta*** Zabala, Maluquer & Harmelin, 1993 comb. nov.
Fig. 34a-h

cf. *Escharina dutertrei protecta*: Zabala, Maluquer & Harmelin, 1993: 73, figs. 12a–c, figs. 13–16.
Escharina dutertrei protecta: Chimenz Gusso et al. 2014: 160, figs. 78a–c.
?*Escharina dutertrei protecta*: Hayward & McKinney 2002: 74, figs. 33A–C.

Material examined

Pica coll: SEM stub n°41, unbleached ovicellate colony with ancestrula; SEM stub n°59, bleached ovicellate colony; one additional unbleached colony.

Description

Zooids oval to hexagonal (Figure 34(a)), longer than wide (L: 624 ± 86, 487–770, 10; W: 407 ± 81, 315–593, 10), frontal shield slightly convex and vaguely to distinctly nodular, forming a crescent of gymnocystal calcification around proximolateral orifice that is almost level proximally while rising towards the proximal pair of spines to produce a pair of triangular flaps (Figure 34 (b,c)); a single row of distinct pores present along the zooecial margin (Figure 34(b)); zooecia separated by grooves between slightly raised ridges, each zooid connected via several basal pore chambers. Orifice longer

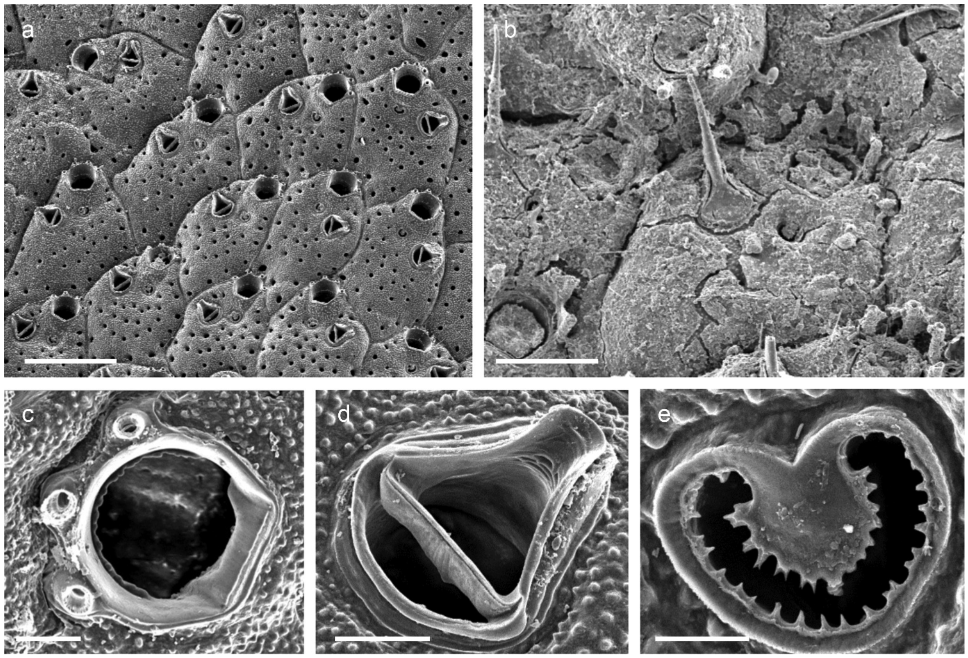

Figure 33. *Microporella verrucosa*. (a) Autozooids in the encrusting part of the colony. (b) Mandible of the avicularium. (c) Orifice. (d) Avicularium. (e) Ascopore. Scales: (a) 500 μm; (b) 200 μm; (c, d) 50 μm; (e) 200 μm.

than wide (L: 90 ± 9, 80–104, 5; W: 113 ± 11, 97–123, 5) (Figure 34(d)); proximal margin straight or very slightly upturned with very narrow crenellate condyles that parallel the edges; sinus drop-shaped, anter horseshoe-shaped (Figure 34(e)). Orifice in ovicellate zooids dimorphic, only little longer but distinctly wider (L: 92–105, 2; W: 128–134, 2); five or seven spines on autozooidal distal margin, two in ovicellate zooids (Figure 34(f,g)).

Avicularia paired, small (L: 70 ± 8, 58–73, 6; W: 34 ± 2, 30–37, 6), positioned in distolateral corners of zooecium, rostrum short and funnel-shaped, directing distomedially, mandible setiform, very long and slender (ML 398 ± 43, 315–439, 6); crossbar complete, straight distally, with a thickened rounded-triangular pivot proximally (Figure 34(b–d,f)).

Ovicell kenozooidal, ooecium globular but appearing semi-immersed as soon as the distal zooid has formed (Figure 34(c,g)), wider than long (L: 205 ± 17, 187–220, 3; W: 332 ± 7, 326–340, 3); surface as frontal shield with a narrow proximal band of thickened calcified ectooecium, presumably closed by the operculum; suboral crescent distinctly raised also around proximal aperture while rising lateral to orifice to produce an entire peristome that abutts the proximolateral ooecium.

Ancestrula tatiform (Figure 34(h)), longer than wide (L: 377; W: 228), gymnocyst well-developed proximally and abruptly narrowing laterally, opesia pear-shaped (L: 198; W: 142), mural rim with 11 spines, the five proximal ones wider spaced. First autozooid budded distally, which then forms a pair of 2nd generation autozooids laterally.

Remarks

Escharina dutertrei Audouin, 1826 was originally described from the Red Sea. As its types are lost, and a neotype has not been selected yet, the species remains ill-defined. This problem led; Zabala et al. (1993) to introduce three new subspecies characterised by a pair of small distal avicularia: the nominotypical *Escharina dutertrei dutertrei*, *Escharina dutertrei haywardi* from the boreal Atlantic, and *Escharina dutertrei protecta* from the Mediterranean Sea and the Azores. At least the Atlanto-Mediterranean subspecies only occur offshore, which, together with the contrast in water temperatures between the boreal Atlantic and the tropical Red Sea, suggests that they are not Lessepsian species. This, in turn, argues against their status as subspecies as they must be regarded as evolutionary entities that are geographically separated from the Red Sea population. Therefore, and in concert with the modern species taxon concept in Bryozoa, in which subtle differences are often considered species-specific, we here regard the three taxa as

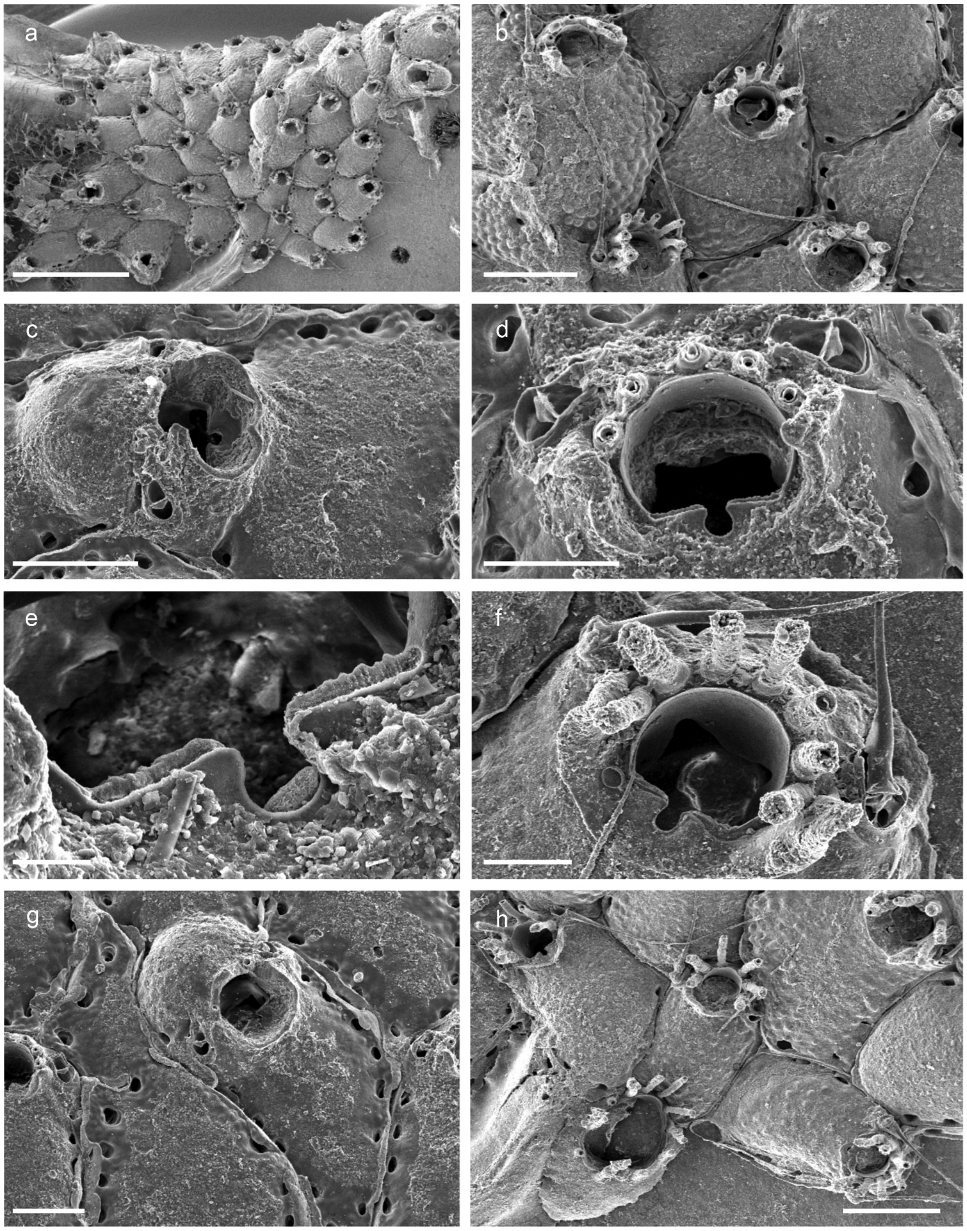

Figure 34. *Escharina* cf. *protecta*. (a) Colony. (b) Autozooids. (c) Ovicellate zooid with extensive peristome. (d) Orifice and avicularia. (e) Crenellate condyles. (f) Spines on autozooid. (g) Maternal zooid. (h) Ancestrula with early astogenetic autozooids. Scales: (a) 1 mm; (b, c, g, h) 200 µm; (d) 100 µm; (e) 20 µm; (f) 50 µm.

distinct at species level. Accordingly, while *E. dutertrei* still needs to be redefined, *Escharina haywardi*; Zabala, Maluquer & Harmelin, 1993 comb. nov. from W Britain is distinguished from the Mediterranean *Escharina protecta* Zabala, Maluquer & Harmelin, 1993 comb. nov. in lacking protective structures around the orifice and in having a different orifice morphology. Based on the image of a specimen of *E. protecta* from the Azores provided by; Zabala et al. (1993: fig. 14), and owing to the sheer distance between the localities that inhibit a genetic exchange, the central Atlantic population is also likely to be specifically distinct.

The present specimens are very similar to *E. protecta* but may not be conspecific for the following reasons: there is a distinct area of gymnocystal calcification around the proximolateral orifice of autozooids that forms the outer rim of the protective structure, which is little elevated in the centre while rising distally towards the proximal pair of

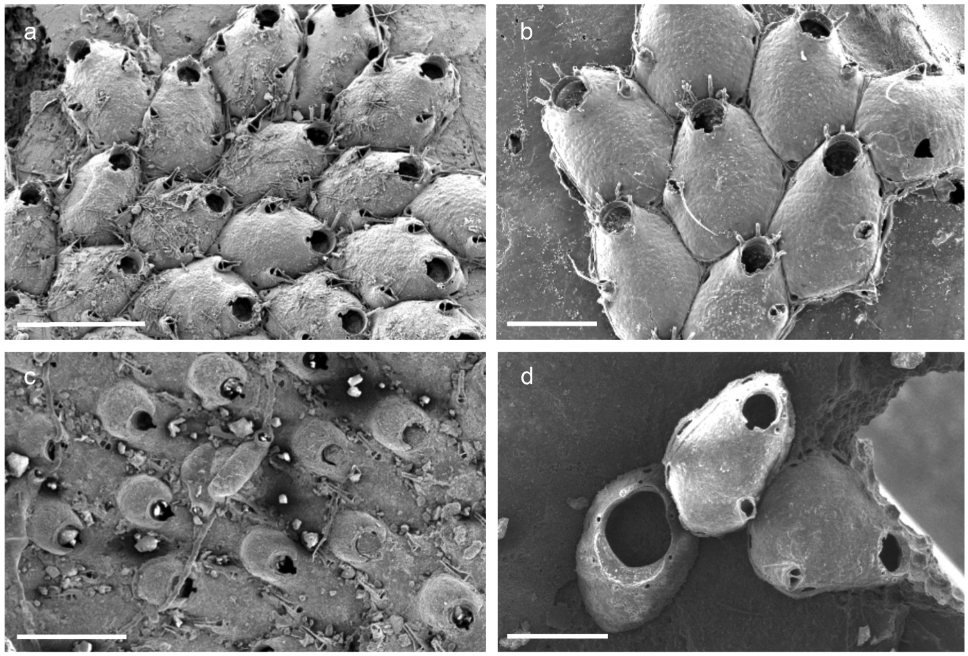

Figure 35. *Escharina vulgaris*. (a) Colony. (b) Avicularia with mandibles. (c) Maternal zooids with ovicells. (d) Ancestrula with early astogenetic autozooids. Scales: (a, c) 500 µm; (b) 250 µm; (d) 200 µm.

spines where it forms a pair of small flaps. The flaps are much larger and thicker as well as more distinctly raised and irregularly conical in the autozooids of *E. protecta*, and apparently not connected by a peristomial rim proximally, and the gymnocystal area also seems to be missing. Only in ovicellate zooids is the peristome similarly developed in both species, although the lateral flaps also appear to be larger in *E. protecta*. Moreover, the condyles are even narrower and the avicularian mandibles are distinctly longer the present specimens when compared with the images provided by Zabala and Maluquer (1988: pl. 15, fig. C) and Zabala et al. (1993: fig. 12b), respectively. We have therefore decided to describe this morphotype in detail, while an analysis of additional material from different habitats and regions is necessary to test where the boundaries between intra- and interspecific differences lie in this species complex.

Escharina protecta has been reported from the western Mediterranean Sea between depths of 105 and 350 m, as well as in cryptic habitats in shallow waters (6–25 m). The specimens from the central Mediterranean reported by Hayward and McKinney (2002) and Chimenz Gusso et al. (2014), all seem to be of the same morphotype as the colonies presented here while their preferred habitat is similar tot he nominal species, occurring in cryptic environments in shallow waters and down to at least 90 m (Chimenz Gusso et al. 2014).

Escharina vulgaris (Moll, 1803)
Fig. 35a-d

Eschara vulgaris var. a Moll 1803: 55, pl. 3, figs. 10A–B.
Escharina vulgaris: Zabala & Maluquer 1988: 129, text-fig. 290; Rosso 1996: 212, pl. 4, fig. e; Hayward & Ryland 1999: 236, figs. 100C–D, 101; Hayward & McKinney 2002: 72, figs. 32E–I; Chimenz Gusso et al. 2014: 161, figs. 79a–d; Rosso et al. 2014: 203, figs. 4A–B.

Material examined

Pica coll: SEM stubs n°4, 7, 8 10, each with one bleached ovicellate colony; SEM stub n°24, bleached ovicellate colony with ancestrula; five additional unbleached colonies.

Remarks

There are no apparent differences between the colonies recovered here and other records of *Escharina vulgaris* from the Mediterranean Sea.

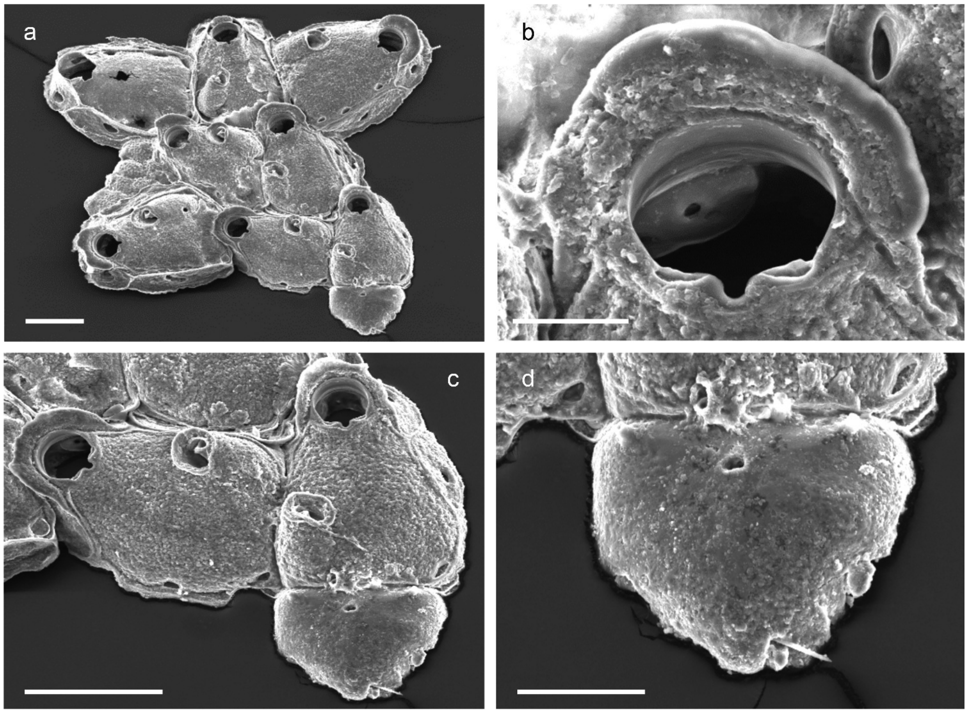

Figure 36. *Herentia majae*. (a) Early astogenetic colony. (b) Orifice. (c) Ancestrula and firstly budded zooids. (d) Close up of the kenozooidal ancestrula. Scales: (a, c) 200 μm; (b) 50 μm; (d) 100 μm.

Genus ***Herentia*** Gray, 1848
Herentia majae Berning, Tilbrook & Rosso, 2008
Fig. 36a-d

Herentia majae Berning *et al.* 2008: 1519, fig. 2.

Material examined

Pica coll: SEM stub n°33, bleached colony with ancestrula; two additional unbleached colonies.

Remarks

Only early astogenetic colonies were recovered, in which the characters of the adult zooids described by Berning et al. (2008) are not fully developed yet. Based on the small U-shaped sinus as well as on the absence of an areolar pore between the vibraculum and orifice, however, we consider the colonies to belong to *H. majae*. The ancestrula and early astogeny has not been described before, and we here figure these stages for the first time. The ancestrula is, as in the type species of the genus, *Herentia hyndmanni* (Johnston, 1847), a dome-shaped kenozooid with a completely calcified frontal shield, apart from a central pore and a pair of distolateral spines, the bases of which can vaguely be observed (Figure 36(c,d)). As in *H. hyndmanni*, the first-generation autozooid is budded distally, which then buds another zooid laterally, while the third-generation zooid is formed in between the two. Even at this stage, differences between *H. hyndmanni* and *H. majae* are evident as the early astogenetic zooids in the former already produce the drop-shaped sinus (Berning et al. 2008: fig. 1B).

Genus ***Therenia*** David & Pouyet, 1978
Therenia rosei Berning, Tilbrook & Rosso, 2008
Fig. 37a-d

Escharina porosa: Rosso 1996: pl. 4, fig. f.
Therenia rosei Berning, Tilbrook & Rosso, 2008: 1530, fig. 6; Rosso et al. 2013: 172, fig. 3e; Sokolover et al. 2016: fig 11; Rosso et al. 2019a: fig. 6d.

Material examined

Pica coll: SEM stub n°61, bleached ovicellate colony; two additional unbleached colonies.

Remarks

The present colonies can unequivocally be assigned to *Therenia rosei* Berning Tilbrook & Rosso, 2008. Their occurrence on shells at 60 m

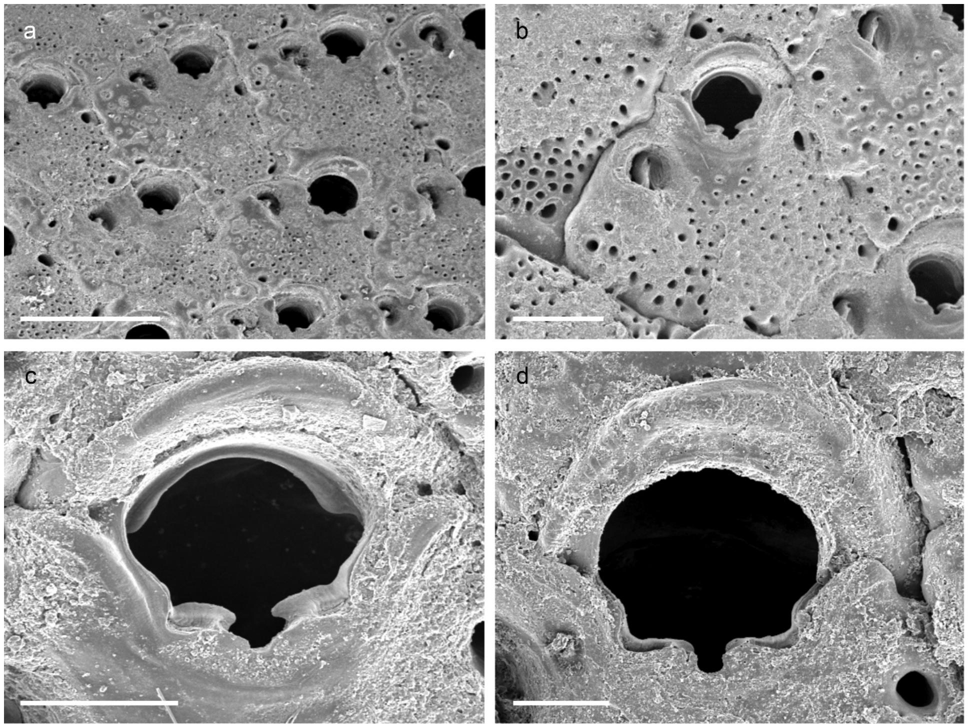

Figure 37. *Therenia rosei*. (a) Zooid arrangement. (b) Autozooid. (c) Autozooidal orifice. (d) Orifice in ovicellate zooid. Scales: (a) 500 μm; (b) 200 μm; (c, d) 100 μm.

depth falls within the previously reported habitat range.

Genus ***Hippomenella*** Canu & Bassler, 1917
Hippomenella mucronelliformis (Waters, 1899)
Fig. 38a-f

Lepralia mucronelliformis Waters, 1899: 11, pl.3, figs. 15, 21;
Hippomenella mucronelliformis: Brown 1949: 513, figs. 1, 2a, b, d, e; Zabala & Maluquer 1988: 117; Berning 2013: 10, fig. 3; Chimenz Gusso et al. 2014: 176, figs. 92a–e; Rosso et al. 2019a: fig. 6f; Rosso et al. 2021: fig. 5f.

Material examined

Pica coll: SEM stub n°22, bleached colony with ancestrula; SEM stub n°65, bleached ovicellayte colony; two additional unbleached colonies.

Remarks

The present specimens are morphologically indistinguishable from *Hippomenella mucronelliformis* (Waters, 1899) from Madeira, the types of which have recently been imaged and described by Berning (2013). As only little and unbleached material was available for that study, and owing to the few published records and images, we here present additional characters of the species. The ancestrula is tatiform, oval in outline (L: 465; W: 322), with the gymnocyst well-developed and gently sloping proximally while narrowing and steepening distally. The opesia is also oval (L: 262; W: 208) and the mural rim carries some 12 spines. The 1st-generation autozooid is budded distally, which then gives rise to another zooid laterally. The avicularian rostrum is serrated along its entire length in both the long and short forms.

Superfamily Celleporoidea Johnston 1838
Family Celleporidae Johnston, 1838
Genus ***Celleporina*** Gray, 1848
Celleporina* cf. *canariensis Arístegui Ruiz, 1989
Fig. 39a-d

cf. *Celleporina canariensis* Aristegui Ruiz, 1989: 147, figs. 3, 7–9.
Celleporina canariensis: Hayward & McKinney 2002: 86, figs. 39E–G; Rosso et al. 2019a: fig. 6g.

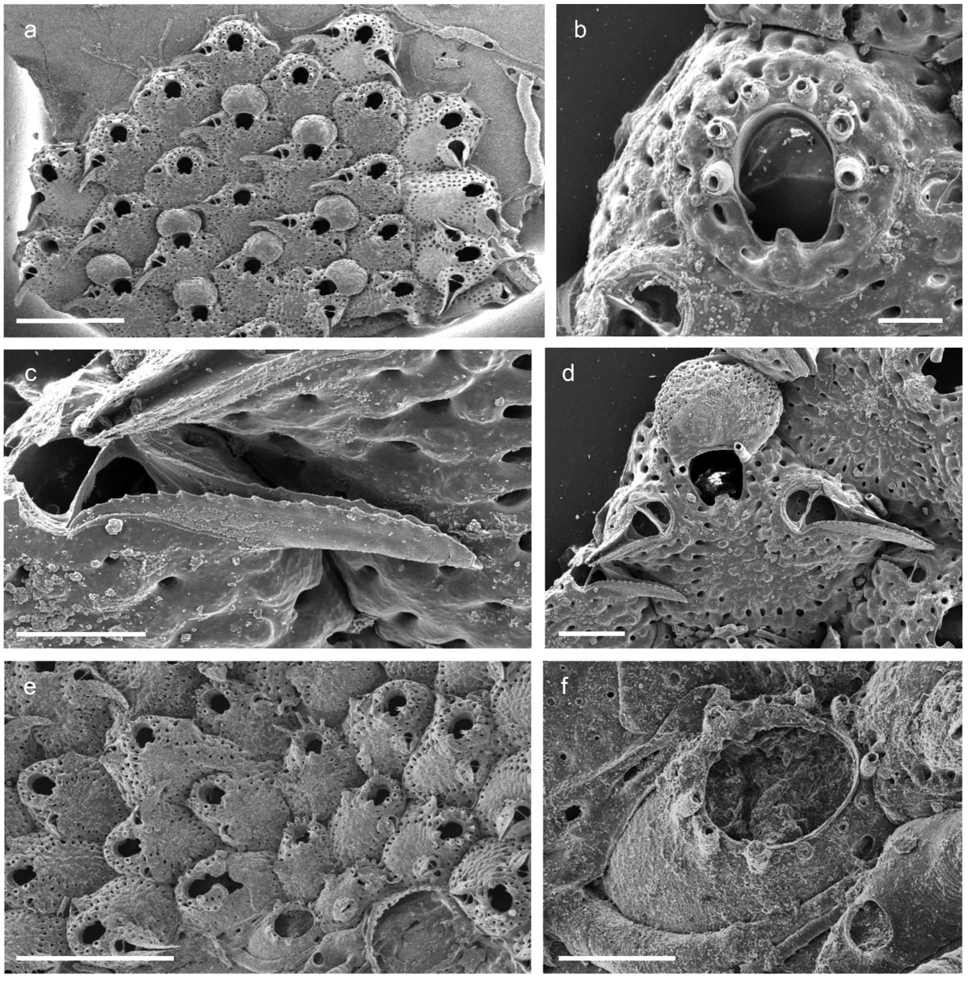

Figure 38. *Hippomenella mucronelliformis*. (a) Colony. (b) Orifice. (c) Avicularium. (d) Maternal zooid. (e) Ancestrula with early astogenetic autozooids. (f) Close up of the ancestrula. Scale: (a, e) 1 mm; (b, c) 100 µm; (d, f) 200 µm.

Material examined

Pica coll: SEM stub n°11, bleached ovicellate colony; six additional unbleached colonies.

Remarks

The present specimens, all of which small colonies, are identical with the species recorded as *Celleporina canariensis* Arístegui, 1989 from the Adriatic Sea by Hayward and McKinney (2002). While the large frontal avicularia are lacking in our material, which may be due to the small colony size, all other characters coincide. We have doubts, however, if the Mediterranean population is indeed conspecific with the nominal species from the Canary Islands as the frontal avicularia are not spatulate and the ovicells smaller in relation to zooid size in the Mediterranean population (compare with; Arístegui Ruiz 1989: figs 3, 7–9).

Genus ***Buskea*** Heller, 1867
Buskea nitida Heller, 1867
Fig. 40a-d

Buskea nitida: Heller 1867: 89, pl. 1, figs. 2–3; Zabala & Maluquer 1988: 156, text-figs. 422–424, pl. 24, figs- C – D; Rosso 1996: pl. 6, fig. d; Hayward & McKinney 2002: 85, figs. 38E–G.
Eschara quincuncialis: Norman 1867: 204.
Buskea quincuncialis: Hayward & Ryland 1999: 350, figs. 162C–D, 164.

Material examined

Pica coll: SEM stub n°71, bleached ovicellate colony.

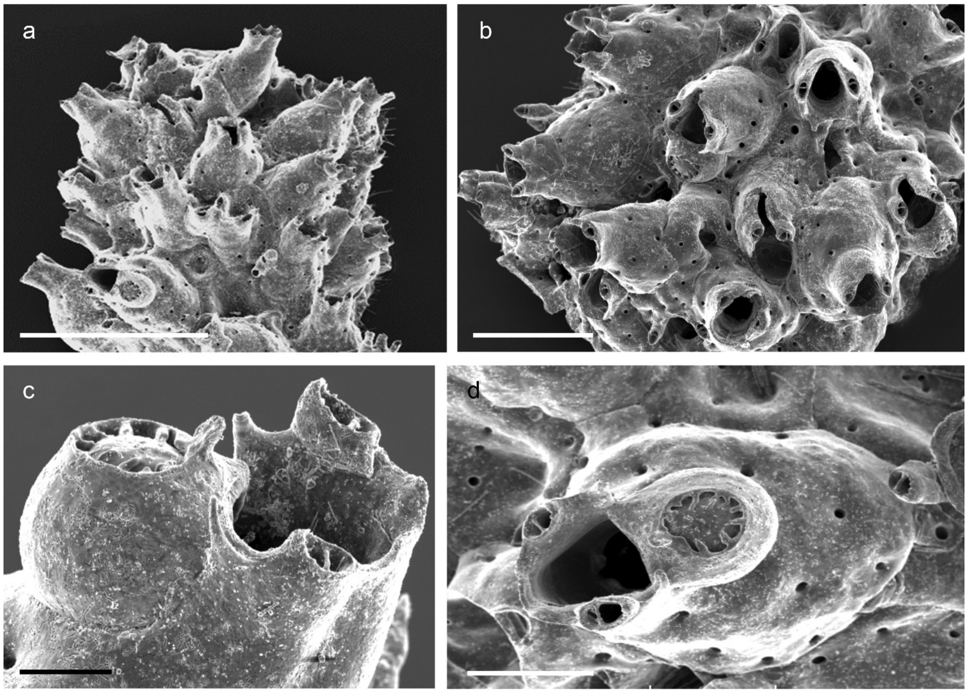

Figure 39. *Celleporina* cf. *canariensis*. (a) Colony. (b) Zooids. (c, d) Maternal zooid with ovicell. Scale: (a) 1 mm; (b) 500 μm; (c) 100 μm; (d) 200 μm.

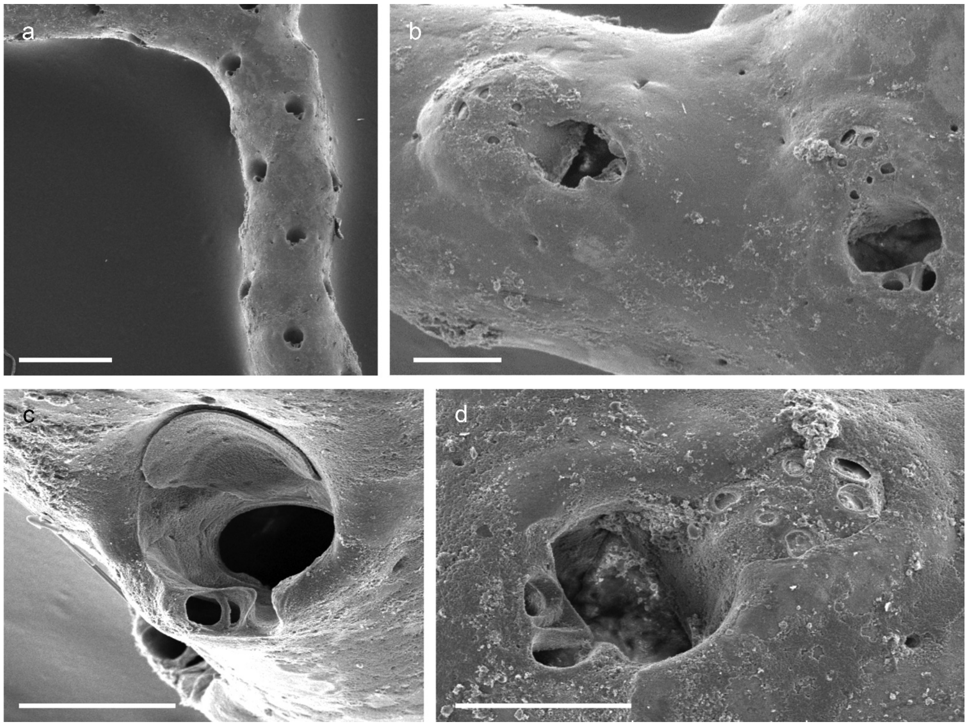

Figure 40. *Buskea nitida*. (a) Colony. (b) Zooids. (c) Close up of the orifice. (d) Maternal zooid. Scales: (a) 500 μm; (b–d) 100 μm.

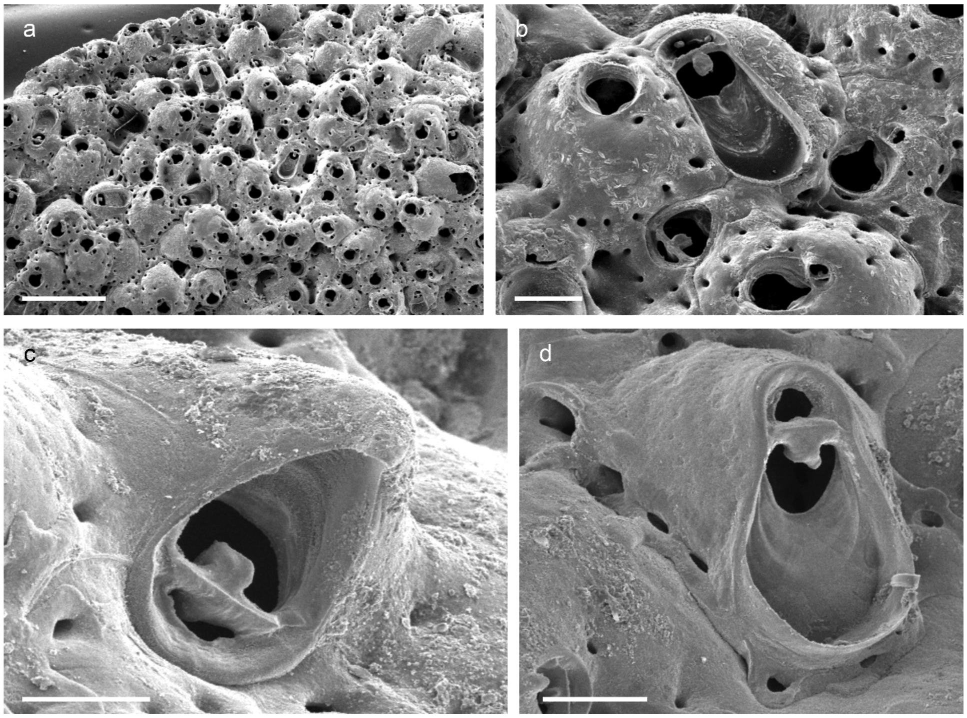

Figure 41. *Turbicellepora avicularis*. (a) Colony. (b) Zooids and avicularia of variable size and shape. (c, d) Avicularia. Scales: (a) 1 mm; (b) 200 μm; (c) 50 μm; (d) 100 μm.

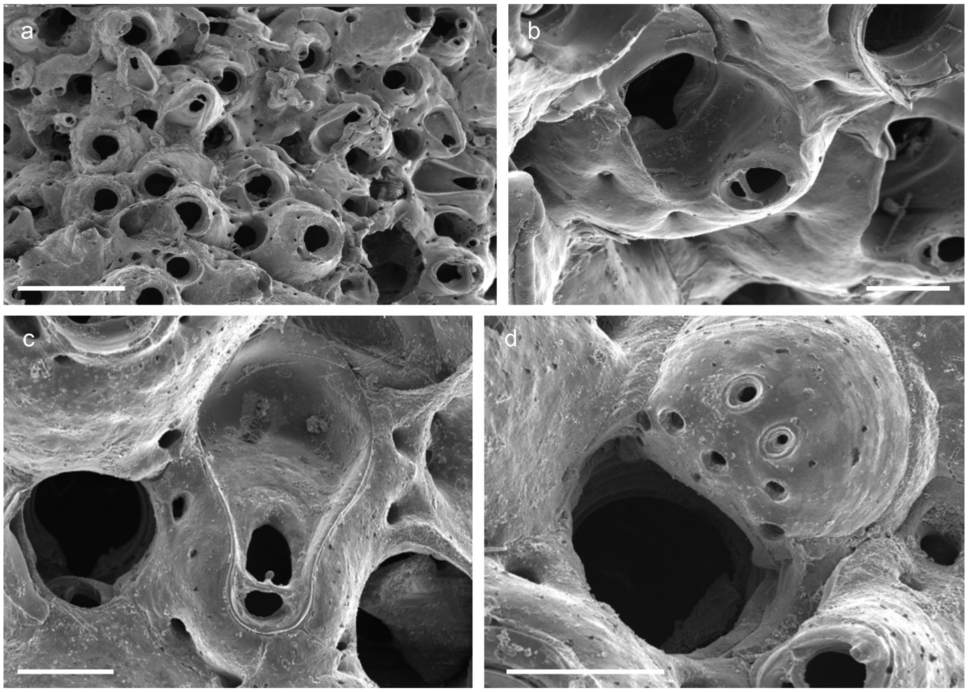

Figure 42. *Turbicellepora* cf. *coronopus*. (a) Colony. (b) Orifice and small avicularium. (c) Large spatulate avicularium. (d) Maternal zooid. Scales: (a) 500 μm; (b–d) 100 μm.

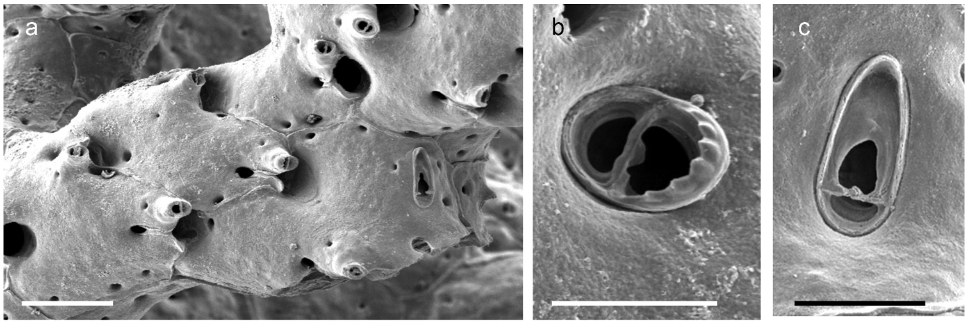

Figure 43. *Reteporella* cf. *couchii*. (a) Colony. (b, c) Avicularia. Scales: (a) 200 µm; (b) 50 µm; (c) 100 µm.

Remarks

The only recovered specimen is a delicate branch fragment composed of 4 alternating series of zooids, and is identical with *Buskea nitida* Heller, 1867 from the Adriatic as reported by Hayward and McKinney (2002), which is arguably regarded as conspecific with *Buskea quincuncialis* Norman, 1867 from Great Britain.

Genus ***Turbicellepora*** Ryland, 1963
Turbicellepora avicularis (Hincks, 1860)
Fig. 41a-d

Cellepora avicularis Hincks, 1860: 278.
Turbicellepora avicularis: Hayward 1978: 566, figs. 1, 2A, B, 3, 4I–K, 5A–E, 8, 9; Hayward & Ryland 1979: 284, fig. 124; Zabala & Maluquer 1988: 161, text figs. 449–451, pl. 27, figs. E–F; Hayward & Ryland 1999: 336, figs. 15 5C–D, 156; Hayward & McKinney 2002: 90, fig. 41A–D; Chimenz Gusso et al. 2014: 295, figs. 164a–f.

Material examined

SEM stubs n°78, 79, each with a fragments of the same bleached ovicellate colony.

Remarks

Only a single, large yet immature colony was recovered, which, based on zooidal and avicularian characters, nevertheless allows us to assign it to *Turbicellepora avicularis* (Hincks, 1860) as reported by Hayward and Ryland (1999) and Hayward and McKinney (2002).

Turbicellepora* cf. *coronopus (Wood, 1844)
Fig. 42a-d

cf. *Cellepora coronopus*: Wood 1844: 18.
cf. *Turbicellepora coronopus*: Hayward 1978: 575, figs. 2E, F, 4L, M, 5F, G, 13; Zabala & Maluquer 1988: 161, text-figs. 452–454; Chimenz Gusso et al. 2014: 298, figs. 166a–d.

Material examined

SEM stubs n°20, 28, 31, each with a bleached ovicellate colony; two additional unbleached colonies.

Remarks

As the species is not well defined, it is difficult to unambiguously assign the present specimens to *Turbicellepora coronopus* Wood, 1844. The type of the nominal species is a Pliocene fossil from Great Britain, which has never been examined using SEM, while the alleged Recent records of the species are confined to the Mediterranean region (Hayward 1978). Lagaaij (1952: 137, pl. 15, fig. 8) designated a lectotype and provided an optical image of it, from which details of the orifice and ovicell cannot be observed. At least one character given in the description, however, differs from Recent specimens assigned to *T. coronopus*: the "normal", oval, suboral avicularium is reported to be occasionally replaced by a small spatulate one in the type; these avicularia have not yet been recorded in Mediterranean specimens.

Moreover, the only Recent specimens that have been imaged before using SEM (Chimenz Gusso et al. 2014) apparently differ in having the suboral avicularium in the centre of the peristome (if single), i.e. directly proximal to the sinus, or on the lateral margin (if paired). In our specimens, as well as in the type of *T. coronopus*, they are always single (occasionally even absent) and usually slightly offset to the right or left from the proximal peristomial centre. We believe that, besides the lectotype, more material needs to be studied to determine what is to be regarded as intraspecific variability in this

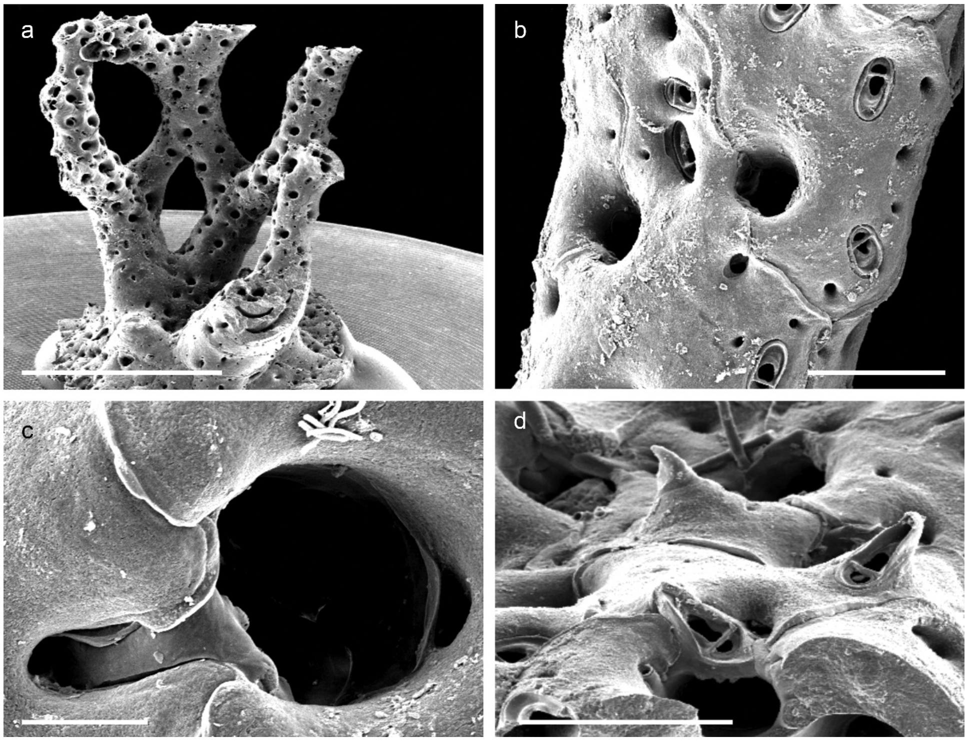

Figure 44. *Reteporella* cf. *harmeri*. (a) Adult colony; (b) Frontal avicularia. (c) Orifice. (a) Avicularia. Scales: (a) 2 mm; (b, d) 200 μm; (c) 50 μm.

species, and if the Mediterranean populations are indeed conspecific with *T. coronopus*.

Family Phidoloporidae Gabb & Horn, 1862
Genus ***Reteporella*** Busk, 1884
Reteporella* cf. *couchii (Hincks, 1878)
Fig. 43a-c

cf. *Retepora couchii* Hincks, 1878: 355, pl. 18, figs. 1–6.
Sertella couchii: Zabala & Maluquer 1988: 154, text-figs. 414–415, pl. 23, figs. E–F.
cf. *Reteporella couchii*: Hayward & Ryland 1996: 107, fis. 1D–E; Hayward & Ryland 1999: 370, figs. 173–174; Reverter-Gil et al. 2019: 244, figs. 7e–f.
Reteporella couchii: Chimenz Gusso et al. 2014: 228, figs. 124a–e.

Material examined

Pica coll: SEM stub n°76, bleached colony.

Remarks

While lacking ovicells, the single colony fragment found suggests it may be specifically distinct from *Reteporella couchii* (Hincks, 1878), which was originally described from Great Britain. Although the distinct peristome with its lateral flaps forming a median suture as well as the typical suboral avicularium, which is positioned on an erect cylindrical cystid, are present, both are distinctly shorter than in *R. couchii*. Whereas these differences may be related to secondary thickening of the frontal surface during ontogeny, the SEM images of additional specimens from the Mediterranean Sea provided by Zabala and Maluquer (1988) and Chimenz Gusso et al. (2014) show the same features. It may thus be possible that a sister species of *R. couchii* inhabits the Mediterranean Sea.

The species reported as *R. couchii* by Reverter-Gil et al. (2019) may represent yet another species as the frontal plane of the suboral avicularium is not facing distally but frontally, among other differences.

Reteporella* cf. *harmeri (Hass, 1948)
Fig. 44a-d

cf. *Sertella harmeri*: Hass 1948: 129, pl. 1, figs. 1–10, pl. 6, fig. 30, pl. 8, fig. 31; Zabala & Maluquer 1988: 154, text-figs. 408–409.

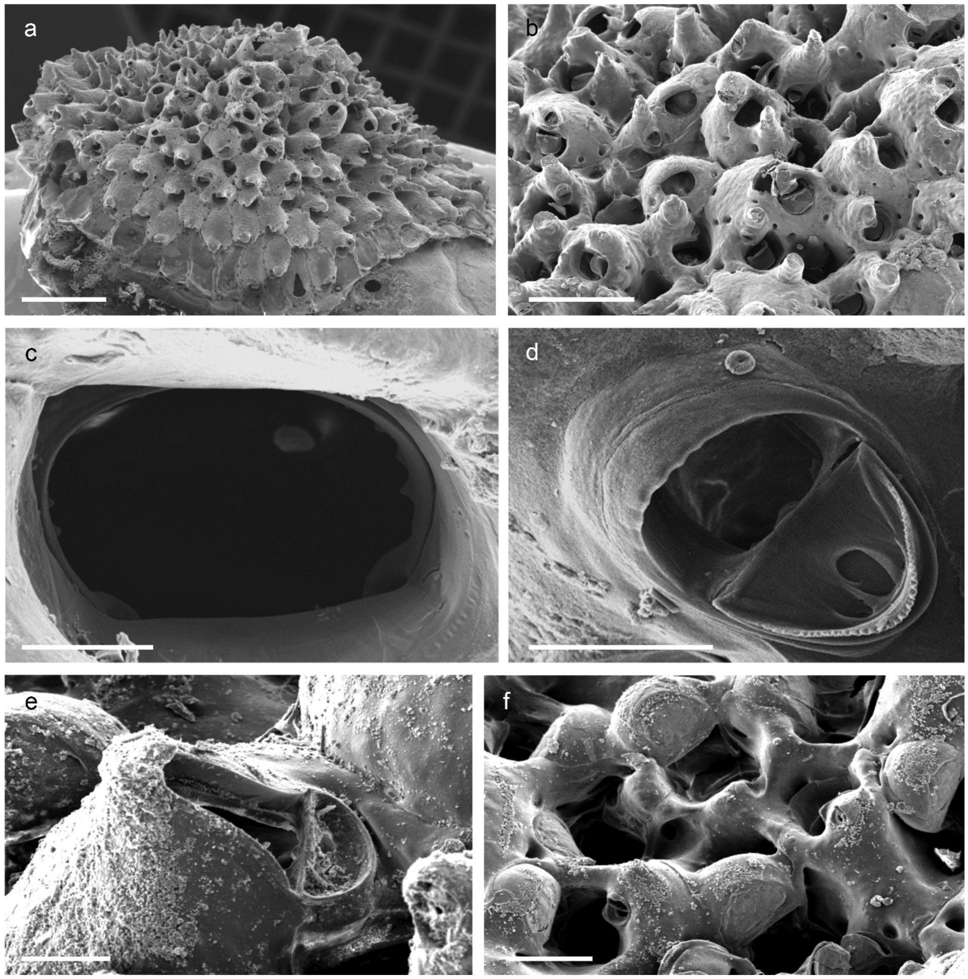

Figure 45. *Dentiporella sardonica*. (a) Colony. (b) Zooids. (c) Orifice. (d) Adventitious avicularium. (e) Interzooidal avicularium. (f) Maternal zooids. Scales: (a) 1 mm; (b) 500 μm; (c, d) 50 μm; (e) 100 μm; (f) 200 μm.

Material examined

Pica coll: SEM stub n°45, 75, 74, each with a bleached colony fragments.

Remarks

The only three specimens available, a fragment from close to the colony growth margin as well as two colony bases, are lacking ovicells and are difficult to assign to a species. The species comes closest to the drawings of specimens referred to *Reteporella harmeri* (Hass, 1948) by Zabala and Maluquer (1988). As in *Reteporella* cf. *couchii* above, the peristome is well-developed, forming two lateral flaps that merge in the centre, producing a long suture leading to a proximal labial pore. One of the flaps either develops a pointed umbo during early ontogeny or produces a large, elongate triangular and distally hooked avicularium that is facing rather distally and pointing in a frontal to lateral direction. Both the umbo and the avicularian cystid form a slightly protruding and relatively straight edge with three knobs along the proximal peristomial rim. The lateral orifice margins initially carry six spines, while these are lost during ontogeny and the bases gradually covered by secondary calcification. Two additional types of dimorphic avicularia are present and formed during later ontogeny: oblong avicularia on the frontal as well as elongate-triangular ones on the abfrontal surface. Both types are medium-sized, budded anywhere on the surface during ontogeny, and point in various directions. None of the crossbars in the three avicularium types bear a columella. The abfrontal surface is granular.

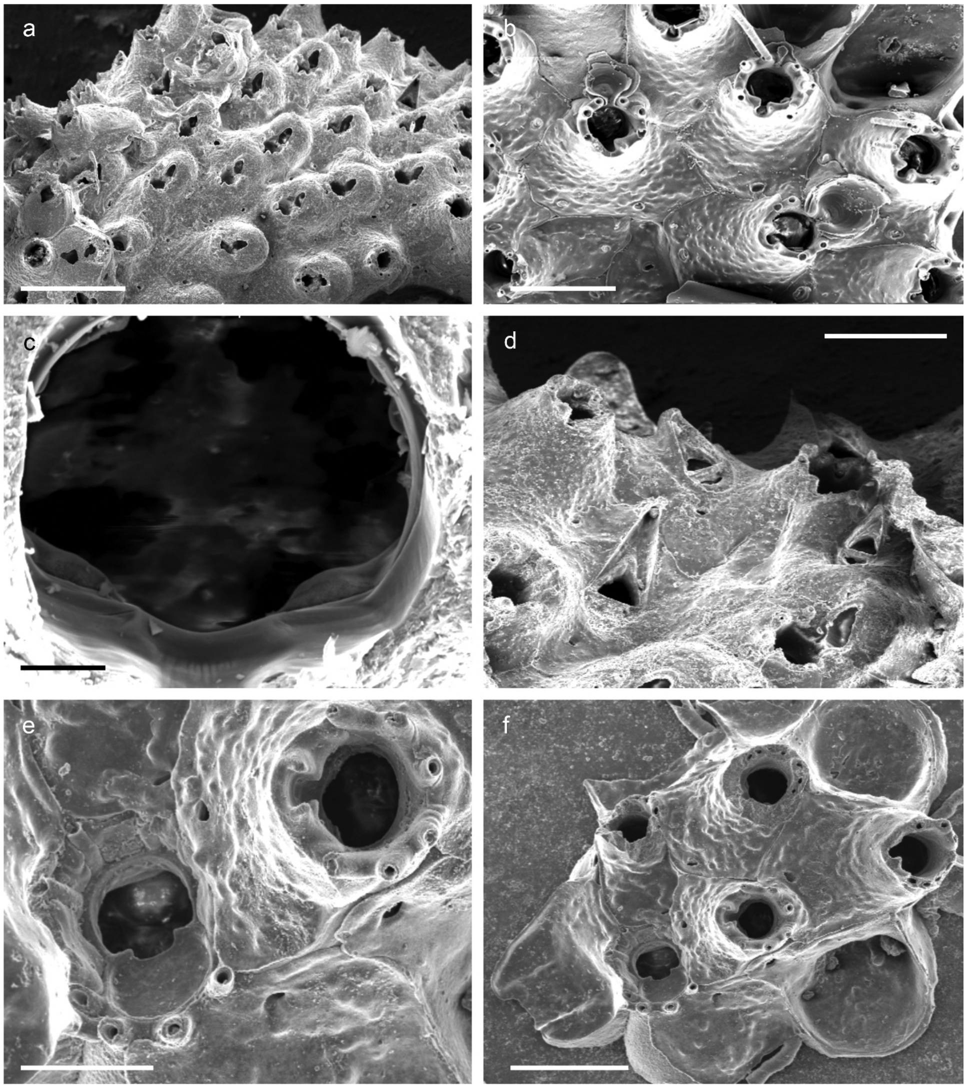

Figure 46. *Schizotheca fissa*. (a) Colony. (b) Zooids. (c) Orifice. (d) Avicularia. (e) Ancestrula. (f) Ancestrula with early astogenetic autozooids. Scales: (a) 500 μm; (b, d, f) 200 μm; (c) 20 μm; (e) 100 μm.

Whereas most of these characters are shared with the species figured by Zabala and Maluquer (1988), *R. harmeri* needs revision. As Hass' types are apparently lost, a neotype needs to be selected, and the species redescribed and imaged using SEM.

Genus ***Dentiporella*** Barroso, 1926
Dentiporella sardonica (Waters, 1879)
Fig. 45a-f

Cellepora sardonica Waters, 1879b: 196, pl. 14, figs. 2, 5, 6.
Rhynchozoon revelatus: Hayward & McKinney 2002: 96, figs. 4 4A–D.
Dentiporella sardonica: Zabala & Maluquer 1988: 157, text-fig. 432, pl. 27A, B; Souto et al. 2010b: fig. 8.

Material examined

Pica coll: SEM stubs n°3, 17, 27, 42, 46, each with one bleached ovicellate colony; two additional unbleached colonies.

Remarks

The present specimens conform with the characters of the lectotype of *Dentiporella sardonica*, which was recently imaged by Souto et al. (2010b).

Genus ***Schizotheca*** Hincks, 1877
Schizotheca fissa Busk, 1856
Fig. 46a-f

Lepralia fissa: Busk 1856: 308, pl. 9, figs. 8–10.
Schizotheca fissa: Zabala & Maluquer 1988: 150, text-fig. 392, pl. 23, fig. A; Hayward & Ryland 1999: 382, figs. 180D, 181; Reverter Gil & Fernández Pulpeiro 1998: 48, pl. 2, fig. C; Hayward & McKinney 2002: 98, figs. 4 4E–H; Reverter Gil & Fernández Pulpeiro 2007: 1935, fig. 3; Chimenz Gusso et al. 2014: 278, figs. 153a–e; Rosso et al. 2019, fig. 6i.

Material examined

Pica coll: SEM stubs n°4, 18, 25, each with one bleached colony; three additional unbleached colonies.

Remarks

The present specimens conform in all aspects with *Schizotheca fissa* (Busk, 1856), which is widespread in the Mediterranean Sea and NE Atlantic.

Conclusive remarks

The shell aggregations of *Neopycnodonte cochlear* collected in the mesophotic zone of the Apulian coast display a relatively large associated biodiversity. We identified 48 cheilostomatid bryozoan species, six of which are newly described in the present paper: *Crassimarginatella matildae* sp. nov., *Micropora biopesiula* sp. nov., *Haplopoma celeste* sp. nov., *Schizomavella* (*Schizomavella*) *cerranoi* sp. nov., *Schizomavella* (*Calvetomavella*) *biancae* sp. nov., and *Schizoporella adelaide* sp. nov. This number is particularly remarkable when compared with the species richness of other mesophotic habitats from southern Apulia, which were recently presented by Giampaoletti et al. (2020) and Cardone et al. (2020). These authors reported 22 bryozoan species from the site of Monopoli (30–55 m depth) and 18 species from Otranto (45–64 m), both located in the southern Adriatic Sea, as well as 26 species from Santa Maria di Leuca (45–70 m), which is a little south of the locality Gallipoli (60 m) in the Ionian Sea studied herein. The number of species from Gallipoli is even slightly greater than the total number of the three localitites (47 spp.) studied until now (Table SI).

Giampaoletti et al. (2020) already noted a high rate of exclusivity among sites in terms of species composition, which is corroborated by our study as only 12 shared species were reported from Gallipoli, while 35 are restricted to this site and were not recorded by Giampaoletti et al. (2020). Thus, a total of 83 cheilostomatid species have been reported from the southern Apulian mesophotic habitats to date.

A comparison of the data needs to be done with caution, however, as Giampaoletti et al. (2020) did not provide images of the species, and the taxa were apparently identified by optical means only. Without SEM images it is difficult to judge whether morphologically closely related taxa were correctly identified by them. For instance, *Microporella marsupiata* (Busk, 1860) may be confused with *M. appendiculata*, and it cannot be ruled out that the colonies they assigned to *Schizoporella magnifica* belong to that species or to the very similar *S. adelaide* sp. nov. Moreover, the species Giampaoletti et al. (2020) reported as *C. crassimarginata* (Hincks, 1880) from Santa Maria di Leuca is likely synonymous with *C. matildae* sp. nov., and their *Schizomavella discoidea* (Busk, 1859), reported from all three stations, is probably identical with *S.* (*C.*) *biancae* sp. nov.

The differences in faunal composition between similar and geographically relatively proximate sites in the mesophotic zone, and particularly the presence of several new species discovered at Gallipoli, show once more that our knowledge of the bryozoan fauna in certain Mediterranean habitats, such as the outer shelf and upper slope, is still uncomplete and warrants further studies (Rosso & Di Martino 2016).

Acknowledgements

The MESOMED expedition has been led by Carlo Cerrano (Polytechnic University of Marche) in collaboration with Antonio Terlizzi (Salento University), and the logistic support of Andrea Costantini (Costa del Sud Diving Service) Bruno Borrelli, Nicolò Crespi (Portofino Divers) and Ubaldo Pantaleo (Ubica srl).

Funding

The MESOMED expedition has been funded by the National Flag Project RITMARE (Marine Italian Research) coordinated by the CNR. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Supplementary material

Supplemental data for this article can be accessed here

ORCID

D. Pica http://orcid.org/0000-0001-7823-0488
B. Berning http://orcid.org/0000-0002-0068-9739

References

Achilleos K, Jiménez C, Berning B, Petrou A. 2020. Bryozoan diversity of Cyprus (eastern Mediterranean Sea): First results from census surveys (2011–2018). Mediterranean Marine Science 21(2):228–237. DOI: 10.12681/mms.21201.

Albano PG, Azzarone M, Amati B, Bogi C, Sabelli B, Rilov G. 2020. Low diversity or poorly explored? Mesophotic molluscs highlight undersampling in the Eastern Mediterranean. Biodiversity and Conservation 29(14):4059–4072. DOI: 10.1007/s10531-020-02063-w.

Angeletti L, Taviani M. 2020. Offshore *Neopycnodonte* oyster reefs in the Mediterranean Sea. Diversity 12(3):92. DOI: 10.3390/d12030092.

Arístegui Ruiz J. 1989. Consideraciones sobre el género *Celleporina* Gray, 1848 (Ectoprocta: Cheilostomata) en Canarias y descripción de tres especies nuevas: *C. canariensis* sp. n., *C. fragilis* sp. n. y *C. labiata* sp. n. Cahiers de Biologie Marine 30:143–165.

Audouin JV. 1826. Explication sommaire des planches de polypes de l'Égypte, et de la Syrie, publiées par Jules-César Savigny. Description de l'Égypte, ou recueil des observations et des recherches qui ont été faites en Égypte pendant l'Expédition de l'Armée francaise. Jomard, E.F. C.L.F. Pancoucke, Paris. Description de l'Égypte Histoire Naturelle 1:225–244.

Ayari-Kliti R, Afli A, Aissa P. 2012. Diversité taxonomique des Bryozoaires Cheilostomes au large du Golfe de Tunis. Bulletin de l'Institut National Des Sciences Et Technologies Mer de Salammbô 39:73–116.

Berning B. 2006. The cheilostome bryozoan fauna from the Late Miocene of Niebla (Guadalquivir Basin, SW Spain): Environmental and biogeographic implications. Mitteilungen aus dem Geologisch-Paläontologischen Institut der Universität Hamburg 90(7):11–56.

Berning B. 2013. New and little-known Cheilostomata (Bryozoa, Gymnolaemata) from the NE Atlantic. European Journal of Taxonomy 44:1–25.

Berning B, Achilleos K, Wisshak M. 2019. Revision of the type species of *Metroperiella* (Bryozoa, Cheilostomatida), with the description of two new species. Journal of Natural History 53 (3–4):141–158. DOI: 10.1080/00222933.2019.1582725.

Berning B, Tilbrook KJ, Rosso A. 2008. Revision of the north-eastern Atlantic and Mediterranean species of the genera *Herentia* and *Therenia* (Bryozoa: Cheilostomata). Journal of Natural History 42(21–22):1509–1547. DOI: 10.1080/00222930802109140.

Bishop JDD. 1986. The identity of *Cribrilaria innominata* (Couch, 1844) (Bryozoa, Cheilostomata). Bulletin of the British Museum (Natural History) Zoology 50(2): 93–102.

Bishop JDD, Househam BC. 1987. *Puellina* (Bryozoa; Cheilostomata; Cribrilinidae) from British and adjacent waters. Bulletin of the British Museum (Natural History), Zoology 53(1):1–63.

Bock P, Gordon DP. 2021. World list of Bryozoa. *Micropora* Gray, 1848. World Register of Marine Species. Available: http://www.marinespecies.org/aphia.php?p=taxdetails&id=110944. Accessed Jan 2021 13.

Brown DA. 1949. On the polyzoan genus *Hippomenella* Canu & Bassler and its genotype *Lepralia mucronelliformis* Waters. Journal of the Linnean Society, London (Zoology) 41:513–520. DOI: 10.1111/j.1096-3642.1940.tb02419.x.

Busk G. 1856. Zoophytology. Quarterly Journal of Microscopical Science 4(16):308–312.

Calvet L. 1907. Bryozoaires. Expéditions scientifiques du "*Travailleur*" et du "*Talisman*" pendant les années 1880–1883. Vol. 8. Paris: Masson et Cie. pp 355–495.

Canu F, Bassler RS. 1925. Les Bryozoaires du Maroc et de Mauritanie, 1[er] Mémoire. Mémoires de La Société des Sciences Naturelles du Maroc 10:1–79.

Cardone F, Corriero G, Longo C, Mercurio M, Tarantini SO, Gravina MF, Pierri C. 2020. Massive bioconstructions built by *Neopycnodonte cochlear* (Mollusca, Bivalvia) in a mesophotic environment in the central Mediterranean Sea. Scientific Reports 10(1):1–16. DOI: 10.1038/s41598-020-63241-y.

Cerrano C, Bastari A, Calcinai B, Di Camillo C, Pica D, Puce S, Valisano L, Torsani F. 2019. Temperate mesophotic ecosystems: Gaps and perspectives of an emerging conservation challenge for the Mediterranean Sea. The European Zoological Journal 86 (1):370–388. DOI: 10.1080/24750263.2019.1677790.

Chimenz Gusso C, Nicoletti L, Bondanese C. 2014. Briozoi. Biologia Marina Mediterranea 21(suppl.):1–366.

Cook PL. 1985. Bryozoa from Ghana. A preliminary survey. Annales / Musée Royal de l'Afrique Centrale, Sciences Zoologiques, Tervuren 238:1–315.

Corriero G, Pierri C, Mercurio M, Nonnis Marzano C, Tarantini SO, Gravina MF *et al*. 2019. A Mediterranean mesophotic coral reef built by non-symbiotic scleractinians. Scientific Reports 9:3601. DOI: 10.1038/s41598-019-40284-4.

Couch RQ. 1844. A Cornish fauna: Being a compendium of the natural history of the country, intended to form a companion to the collection in the Royal Institution of Cornwall … part 3. The zoophytes and calcareous corallines. Truro: Royal Institution of Cornwall.

D'Onghia G, Capezzuto F, Cardone F, Carlucci R, Carluccio A *et al*. 2015. Macro- and megafauna recorded in the submarine Bari Canyon (southern Adriatic, Mediterranean Sea) using different tools. Mediterranean Marine Science 16(1):180–196. DOI: 10.12681/mms.1082.

de Blauwe H. 2009. Mosdiertjes van de Zuidelijke bocht van de Noordzee: Determinatiewerk voor België en Nederland. Oostende: Vlaams Instituut voor de Zee. pp 443.

Di Martino E, Rosso A. 2021. Seek and ye shall find: New species and new records of *Microporella* (Bryozoa, Cheilostomata) in the Mediterranean. Zookeys 1053:1–42. DOI: 10.3897/zookeys.1053.65324.

Fernández Pulpeiro E, Reverter Gil O. 1993. Le genre *Ellisina* (Bryozoa, Cheilostomida) sur les côtes européennes: Description d'*Ellisina gautieri* sp. nov. Cahiers de Biologie Marine 34(1):93–101.

Friedl H. 1917. Bryozoen der Adria. Zoologischer Anzeiger 49 (9):225–240.

Gautier YV. 1956. Résultats scientifiques des campagnes de la “Calypso”. Part 5. Bryozoaires. Annales de l’Institut Océanographique 32(2):189–225.

Gautier YV. 1962. Recherches écologiques sur les bryozoaires chilostomes en Méditerranée occidentale. Recueil des Travaux de la Station Marine d’Endoume 38(24):1–434.

Giampaoletti J, Cardone F, Corriero G, Gravina MF, Nicoletti L. 2020. Sharing and distinction in biodiversity and ecological role of bryozoans in Mediterranean mesophotic bioconstructions. Frontiers in Marine Science 7:1040. DOI: 10.3389/fmars.2020.581292.

Gori A, Bavestrello G, Grinyó J, Dominguez-Carrió C, Ambroso S, Bo M. 2017. Animal forests in deep coastal bottoms and continental shelf of the Mediterranean Sea. In: Rossi S, Bramanti L, Gori A, Orejas C, editors. Marine animal forests: The ecology of benthic biodiversity hotspots. Cham, Switzerland: Springer International Publishing, pp. 207–233.

Harmelin JG. 1969. Bryozoaires des grottes sous-marines obscures de la région marseillaise. Faunistique et écologie. Tethys 1:793–806.

Harmelin JG. 1970. Les *Cribrilaria* (Bryozoaires Chilostomes) de Méditerranée; systématique et écologie. Cahiers de Biologie Marine 11:77–98.

Harmelin JG. 1973. Les bryozoaires des peuplements sciaphiles de Méditerranée: le genre *Crassimarginatella* Canu (Chilostomes Anasca). Cahiers de Biologie Marine 4:471–492.

Harmelin JG. 1978. Sur quelques Cribrimorphes (Bryozoa, Cheilostomata) de l’Atlantique Oriental. Tethys 8(2):173–192.

Harmelin JG. 1988. Espèces affines microsympatriques chez *Puellina* (Bryozoa, Cheilostomata) et description d’espèces nouvelles. Zoologica Scripta 17(1):25–38. DOI: 10.1111/j.1463-6409.1988.tb00084.x.

Harmelin JG, d’Hondt JL. 1993. Transfers of bryozoan species between the Atlantic Ocean and the Mediterranean Sea via the Strait of Gibraltar. Oceanologica Acta 16 (1):63–72.

Hass H. 1948. Beitrag zur kenntnis der Reteporiden. Zoologica 101:1–138.

Hassall AH. 1841. Supplement to a catalogue of Irish zoophytes. Annals and Magazine of Natural History 7(1):363–373. DOI: 10.1080/03745484109442710.

Hayward PJ. 1974. Studies on the cheilostome bryozoan fauna of the Aegean Island of Chios. Journal of Natural History 8 (4):369–402. DOI: 10.1080/00222937400770321.

Hayward PJ. 1978. Systematic and morphological studies on some European species of *Turbicellepora* (Bryozoa, Cheilostomata). Journal of Natural History 12:551–590. DOI: 10.1080/00222937800770411.

Hayward PJ, McKinney FK. 2002. Northern Adriatic bryozoa from the vicinity of Rovinj, Croatia. Bulletin of the American Museum of Natural History 270:1–139. DOI: 10.1206/0003-0090(2002)270<0001:NABFTV>2.0.CO;2.

Hayward PJ, Ryland JS. 1979. British Ascophoran Bryozoans. In: Kermack DM, Barnes RSK, editors. Synopses of the British Fauna. London: Academic Press for the Linnaean Society, vol. 14. pp. 1–312.

Hayward PJ, Ryland JS. 1995. The British species of Schizoporella (Bryozoa: Cheilostomatida). Journal of Zoology 237:37–47.

Hayward PJ, Ryland JS. 1996. Some British Phidoloporidae (Bryozoa: Cheilostomatida). Zoological Journal of the Linnean Society 117:103–112. DOI: 10.1111/j.1096-3642.1996.tb02150.x.

Hayward PJ, Ryland JS. 1998. Cheilostomatous Bryozoa. Part 1. Aeteoidea - Cribrilinoidea. Synopses of the British Fauna (New Series) 10:1–366.

Hayward PJ, Ryland JS. 1999. Cheilostomatous Bryozoa. Part 2. Hippothooidea - Celleporoidea. Synopses of the British Fauna (New Series) 14:1–416.

Hayward PJ, Thorpe JP. 1995. Some British species of *Schizomavella* (Bryozoa: Cheilostomatida). Journal of Zoology 235:661–676. DOI: 10.1111/j.1469-7998.1995.tb01776.x.

Heller C. 1867. Die Bryozoen des adriatischen Meeres. Verhandlungen der Kaiserlich-Königliche Zoologisch-botanischen Gesellschaft in Wien 17:77–136.

Hincks T. 1860. Zoophytology. Descriptions of new Polyzoa from Ireland. Quarterly Journal of Microscopical Science 8 (32):275–280.

Hincks T. 1878. Notes on the genus *Retepora*, with descriptions of new species. Annals and Magazine of Natural History 1 (5):353–365. DOI: 10.1080/00222937808682345.

Hincks T. 1880a. Contributions towards a general history of the marine Polyzoa. Part I. Madeiran Polyzoa. Annals and Magazine of Natural History Ser. 5 6:69–80.

Hincks T. 1880b. Contributions towards a general history of the marine Polyzoa. Part II. Foreign Membraniporina. Annals and Magazine of Natural History Ser. 5 6:81–92.

Hincks T. 1886. The Polyzoa of the Adriatic: A supplement to Prof. Heller’s ‘Die Bryozoen des Adriatischen Meeres’, 1867. Annals and Magazine of Natural History (ser. 5) 17:254–271, DOI: 10.1080/00222938609460142.

Johnston G. 1838. A history of the British zoophytes. Edinburgh: W.H. Lizars. pp 341.

Johnston G. 1840. Miscellanea Zoologica. Description of a new genus of British zoophyte. Annals and Magazine of Natural History (ser. 1) 5:272–274, DOI: 10.1080/00222934009496822.

Johnston G. 1847. A history of the British zoophytes. 2nd ed., Vol. I. London: Van Voorst. pp 488.

Jullien J. 1882. Note sur une nouvelle division des Bryozoaires Cheilostomiens. Bulletin de La Société Zoologique de France 6:271–285.

Lagaaij R. 1952. The Pliocene Bryozoa of the low countries and their bearing on the marine stratigraphy of the North Sea region. Mededelingen van de Geologische Stichting 5:6–233.

Levinsen GMR. 1909. Morphological and systematic studies on the cheilostomatous Bryozoa Vol. Copenhagen: Nationale Forfatterers Forlag. pp. 1–431.

Lippi Boncambi F, Nicoletti L, Chimenz C. 1997. Quante specie di *Hippopodinella* Barroso 1924 (Bryozoa, Cheilostomida) esistono nel Mediterraneo? Biologia Marina Mediterranea 4 (1):401–404.

López de la Cuadra CM, García-Gómez JC. 2001. New and little known ascophoran bryozoans from the Western Mediterranean, collected by ‘Fauna Ibérica’ expeditions. Journal of Natural History 35:1717–1732. DOI: 10.1080/002229301317092414.

Manzoni A. 1870. Bryozoi fossili Italiani. Quarta Contribuzione. Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften, Wien (Abteilung 1) 61(1):323–349.

Moll JPC. 1803. Eschara, ex zoophytorum, seu, phytozoorum ordine pulcherrimum ac notatu dignissimum genus, novis speciebus auctum, methodice descriptum et iconibus ad naturam delineatis illustratum. Vindobonae: Camesiniana. pp 1–70.

Norman AM. 1867. Report of the comittee appointed for the purpose of exploring the coasts of the Hebrides by means of the dredge. Part 2. On the Crustacea, Echinodermata, Polyzoa, Actinozoa and Hydrozoa. Report of the British Association for the Advancement of Science London 1866:193–206.

Ostrovsky AN, Nielsen C, Vávra N, Yagunova EB. 2009. Diversity of brood chambers in calloporid bryozoans (Gymnolaemata, Cheilostomata): Comparative anatomy and evolutionary trends. Zoomorphology 128(1):13–35. DOI: 10.1007/s00435-008-0070-8.

Ostrovsky AN, Schäfer P. 2003. Ovicell structure in *Callopora dumerilii* and *C. lineata* (Bryozoa: Cheilostomatida). Acta Zoologica 84(1):15–24. DOI: 10.1046/j.1463-6395.2003.00121.x.

Peach CW. 1868. On a new British Eschara. Journal of the Royal Institution of Cornwall 3:116–117.

Poluzzi. 1975. I Briozoi Cheilostomi del Pliocene della Val d'Arda (Piacenza, Italia). Memorie della Società italiana di scienze naturali 21(2):37–77.

Pouyet S, Moissette P. 1992. Bryozoaires du Pliocène d'Altavilla (Sicile-Italie): Révision de la collection Cipolla, nouvelles données, paléoécologie. Palaeontographica, Abteilung A 223:19–101.

Prenant M, Bobin G. 1966. Bryozoaires. 2" partie: Chilostomes Anasca. Faune de France 68:1–647.

Reverter Gil O, Fernández Pulpeiro E. 1996. Some species of *Schizomavella* (Bryozoa, Cheilostomatida) from the Atlanto-Mediterranean region. Cahiers de Biologie Marine 36:259–275.

Reverter-Gil O, Berning B, Souto J. 2015. Diversity and systematics of *Schizomavella* species (Bryozoa: Bitectiporidae) from the bathyal NE Atlantic. PLoS ONE 10(10):e0139084. DOI: 10.1371/journal.pone.0139084.

Reverter-Gil O, Fernández-Pulpeiro E. 1998. Algunos Briozoos Cheilostomados recolectados en la Ría de Ferrol (N.O. España). Boletín de La Real Sociedad Española de Historia Natural (Sección Biología) 94(1/2):51–60.

Reverter-Gil O, Fernández-Pulpeiro E. 2007. Species of genus *Schizotheca* Hincks (Bryozoa, Cheilostomata) described in the Atlantic-Mediterranean region, with notes on some species of *Parasmittina* Osburn. Journal of Natural History 41 (29–32):1929–1953. DOI: 10.1080/00222930701515520.

Reverter-Gil O, Souto J, Novosel M, Tilbrook KJ. 2016. Adriatic species of *Schizomavella* (Bryozoa: Cheilostomata). Journal of Natural History 50(5–6):281–321. DOI: 10.1080/00222933.2015.1062153.

Reverter-Gil O, Souto J, Trigo JE. 2019. New species and new recors of Bryozoa from Galicia (NW Spain). Journal of Natural History 53(3–4):221–251. DOI: 10.1080/00222933.2019.1582815.

Rosso A. 1996. Popolamenti e tanatocenosi a briozoi di fondi mobili circalitorali del Golfo di Noto (Sicilia, Italia). Naturalista Siciliano 20:189–225.

Rosso A. 2004. Two new species of *Phylactella* (Bryozoa Cheilostomatida) from the Mediterranean area belonging to the *P. labrosa* (Busk) complex of species. Journal of Natural History 38(20):2655–2668. DOI: 10.1080/00222930310001647325.

Rosso A, Di Martino E. 2016. Bryozoan diversity in the Mediterranean Sea: An update. Mediterranean Marine Science 17(2):567–607. DOI: 10.12681/mms.1706.

Rosso A, Di Martino E, Gerovasileiou V. 2020a. Revision of the genus *Setosella* (Bryozoa: Cheilostomata) with description of new species from deep-waters and submarine caves of the Mediterranean Sea. Zootaxa 4728(4):401–422. DOI: 10.11646/zootaxa.4728.4.1.

Rosso A, Di Martino E, Pica D, Galanti L, Cerrano C, Novosel M. 2018. Non-indigenous bryozoan species from natural and artificial substrata of Mediterranean submarine caves. Marine Biodiversity 48(3):1345–1355. DOI: 10.1007/s12526-016-0602-2.

Rosso A, Gerovasileiou V, Di Martino E. 2020b. Really onychocellids? Revisions and new findings increase the astonishing bryozoan diversity of the Mediterranean Sea. Journal of Marine Science and Engineering 8:904. DOI: 10.3390/jmse8110904.

Rosso A, Gerovasileiou V, Sanfilippo R, Guido A. 2019a. Bryozoan assemblages from two submatrine caves in the Aegean Sea (Eastern Mediterranean). Marine Biodiversity 49:707–726. DOI: 10.1007/s12526-018-0846-0.

Rosso A, Sanfilippo R, Guido A, Gerovasileiou V, Taddei Ruggiero E, Belmonte G. 2021. Colonisers of the dark: Biostalactite-associated metazoans from "lu Lampiùne" submarine cave (Apulia, Mediterranean Sea). Marine Ecology 42 (1):e12634. DOI: 10.1111/maec.12634.

Rosso A, Sanfilippo R, Sciuto F. 2014. Open-shelf, soft-bottom bryozoans from the Ciclopi Marine Protected Area (E Sicily, Mediterranean). In: Rosso A, Wyse J, Patrick N, Porter Joanne S, editors. Bryozoan studies 2013. Trento: Museo delle Scienze. pp. 199–211.

Rosso A, Sanfilippo R, Sciuto F, Serio D, Catra M, Alongi G, Viola A, Leonardi R. 2019b. Preliminary information on bryozoans associated with selected infralittoral algae communities from Sicily (eastern Mediterranean). Australasian Palaeontological Memoir 52:115–129.

Rosso A, Sanfilippo R, Taddei Ruggiero E, Di Martino E. 2013. Faunas and ecological groups of Serpuloidea, Bryozoa and Brachiopoda from submarine caves in Sicily (Mediterranean Sea). Bollettino della Società Paleontologica Italiana 52(3):167–176.

Rosso A, Sanfilippo R, Vertino A, Zibrowius H. 2017. Hanging coral gardens of a Tyrrhenian submarine cave from Sicily (Italy). Bollettino della Società Paleontologica Italiana 56(1):1–12.

Ryland JS. 1963. The species of *Haplopoma* (Polyzoa). Sarsia 10:9–18.

Schmid B. 1989. Cheilostome Bryozoen aus dem Badenien (Miozän) von Nußdorf (Wien). Beiträge zur Paläontologie von Österreich 15:1–101.

Schneider CA, Rasband WS, Eliceiri KW. 2012. NIH Image to ImageJ: 25 years of image analysis. Nature Methods 9:671–675. DOI: 10.1038/nmeth.2089.

Sokolover N, Taylor PD, Ilan M. 2016. Bryozoa from the Mediterranean coast of Israel. Mediterranean Marine Science 17(2):440–458. DOI: 10.12681/mms.1390.

Souto J, Fernández-Pulpeiro E, Reverter-Gil O. 2010a. The genus *Amathia* Lamouroux (Bryozoa, Ctenostomata) in Iberian waters. Cahiers de Biologie Marine 51:181–195.

Souto J, Nascimento KB, Reverter-Gil O, Vieira LM. 2018. Dismantling the *Beania magellanica* species complex (Bryozoa, Cheilostomata): Two new species in European waters. Marine Biodiversity 49:1505–1518. DOI: 10.1007/s12526-018-0925-2.

Souto J, Reverter-Gil O, De Blauwe H, Fernandez-Pulpeiro E. 2014. New records of bryozoans from Portugal. Cahiers de Biologie Marine 55(1):129–150.

Souto J, Reverter-Gil O, Fernández-Pulpeiro E. 2010b. Gymnolaemate bryozoans from the Algarve (southern Portugal): New species and biogeographical considerations. Journal of the Marine Biological Association of the United Kingdom 90:1417–1439. DOI: 10.1017/S0025315409991640.

Taylor PD, Martha SO, Gordon DP. 2018. Synopsis of 'onychocellid' cheilostome bryozoan genera. Journal of Natural History 62(25–26):1657–1721. DOI: 10.1080/00222933.2018.1481235.

Vieira LM, Spencer Jones ME, Winston JE, Migotto AE, Marques AC. 2014. Evidence for polyphyly of the genus *Scrupocellaria* (Bryozoa: Candidae) based on a phylogenetic analysis of morphological characters. PLoS ONE 9(4): e95296. DOI: 10.1371/journal.pone.0095296.

Waters AW. 1879a. On the Bryozoa (Polyzoa) of the Bay of Naples. Annals and Magazine of Natural History (*Ser. 5*) 3:114–126, DOI: 10.1080/00222937908682488.

Waters AW. 1879b. On the Bryozoa (Polyzoa) of the Bay of Naples (continued). Annals and Magazine of Natural History (*Ser. 5*) 3:192–202, DOI: 10.1080/00222937908694085.

Waters AW. 1898. Observations on the Membraniporidae. Journal of the Linnean Society (Zoology) London 26:654–693. DOI: 10.1111/j.1096-3642.1898.tb01741.x.

Waters AW. 1899. Bryozoa from Madeira. Journal of the Royal Microscopical Society 19(1):6–16. DOI: 10.1111/j.1365-2818.1899.tb00139.x.

Wood SV. 1844. Descriptive catalogue of the zoophytes from the Crag. Annals and Magazine of Natural History 13:10–21. DOI: 10.1080/03745484409442561.

Zabala M. 1986. Fauna dels Briozous dels Països Catalans. Institut d'Estudis Catalans, Arxius de la Secció de Ciéncies, Barcelona 84:1–836.

Zabala M, Maluquer P. 1988. Illustrated keys for the classification of Mediterranean Bryozoa. Treballs Del Museu de Zoologia 4:1–294.

Zabala M, Maluquer P, Harmelin JG. 1993. Epibiotic bryozoans on deep-water scleractinian corals from the Catalonia slope (western Mediterranean, Spain, France). Scientia Marina 57(1):65–78.