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MYRIAPORA SCIUTOI N. SP., A NEW FOSSIL ATLANTO-MEDITERRANEAN BRYOZOAN SPECIES, AND COMMENTS ON ALLIED TAXA

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Abstract. We describe a new fossil species of *Myriapora, M. sciutoi* n. sp., which is similar in general appearance to the Recent, Atlantic, deep-sea species *M. bugei* d'Hondt, 1975. The new species has been found in sediments of the late Tortonian-Messinian of NW Morocco, and the Gelasian of NE Sicily and south Calabria, Italy. The main diagnostic characters of the new species are: erect, rigid growth, with lateral branches developing at right angles; arrangement of the zooids in whorls; dimorphic orifice, which has a very marked sinus in autozooids; prominent ooecia usually present in all the zooids from the same whorl. The previous diagnosis of the genus has been amended in order to include the presence of species with zooids arranged in whorls, in addition to those arranged quincuncially. A generic reassignment to *Myriapora* or to the allied genus *Leieschara* for all the known species to date is also proposed. The geographical and stratigraphical distribution of *M. sciutoi* n. sp. suggests a recolonization of the Mediterranean, after the Messinian Salinity Crisis, from founder populations that have survived in the Atlantic.

Introduction

The recent publication of SEM images of the type specimen of *Myriapora bugei* d'Hondt, 1975 by Berning (2013) allowed a reliable comparison between this species and similar material from southern Italy, partly reported as *Spiroporina* sp. in a previous paper (Barrier et al. 1987), and partly unpublished, collected on different occasions during more than 15 years of research. Based on this comparison we here describe a new species, which lived in the Atlanto-Mediterranean area from the Late Miocene to the Gelasian. Comments on some congeneric species are made, and the diagnosis of the genus is amended after Vávra (2011) to assess the diagnostic characters that distinguish species of *Myriapora* from species of the allied genus *Leieschara*, both included into the family Myriaporidae. A reassignment of species to these two genera is suggested, mainly following Schäfer et al. (2009).

Materials and methods

This study is based on fossil material from southern Italy and Morocco (Fig. 1). Specimens from Italy were found in sediments at Capo Milazzo Peninsula, in the north-eastern corner of Sicily, and in southern Calabria. At Capo Milazzo, carbonate silts and silty sands, usually reported as "yellow calcareous marls", discontinuously crop out. These sediments were deposited in small morphological depressions eroded into pre-Pliocene terrains, locally represented by Palaeozoic metamorphic rocks and by late Tortonian to Messinian sediments, predominantly reefal carbonates (Fois 1989, 1990). Silts and silty sands largely consist of planktonic foraminifera and, locally, by abundant bioclasts formed by the remains of benthic organisms, mostly isidid internodes, echinoderms, bryozoans, brachiopods and serpulids. All studied macro- and microfaunas point to deposition in bathyal environments (Gaetani & Sacca 1984; Gaetani 1986; Violanti 1988; Rosso 2002a, 2002b, 2005a, 2013; Sciuto 2005, 2009, 2012, 2014; Rosso & Braga 2012) during the Pliocene-Pleistocene (Violanti 1988). The studied specimens were found exclusively in the Cala S. Antonino and Punta Mazza sections, recording the upper part of the MPl5 and the MPl6 Zones, largely corresponding to the Gelasian (e.g. Violanti 2012). The sedimentation of layers 8 and 9 in the Pavigliana section (Reggio Calabria), which also yielded specimens of the new species, was essentially coeval. They were interpreted by Barrier et al. (1987) as deposited during the Late Pliocene in the *Globorotalia inflata* foraminifer biozone of Colalongo & Sartoni (1979). This biozone is considered as corresponding to the upper part of the Gelasian (see Violanti 2012), which is now included in the early Pleistocene (Gibbard et al. 2010). The palaeoenvironment inferred for these bioclastic coarse sands, mostly characterised by bivalves and brachiopods, was located at the shelf-break in a highly hydrodynamic setting progressively shal-

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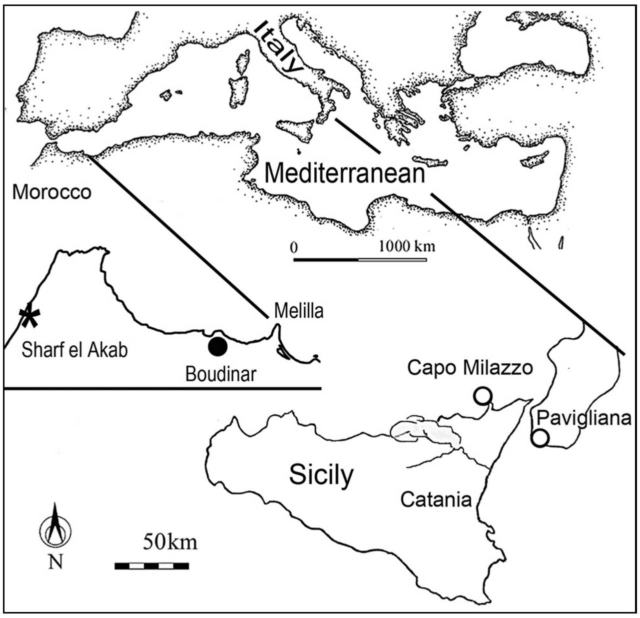

Fig. 1 - Location of outcrops from which specimens of *Myriapora sciutoi* n. sp. have been recorded in the Mediterranean area. Asterisk: Sharf el Akab, Tortonian; solid circle: Boudinar, Messinian; open circles: Capo Milazzo and Pavigliana sections, Gelasian.

lowing from the outer shelf, at 100-120 m, to the upper slope, at 150-180 m (Barrier et al. 1987).

Samples were washed through a 63 µm mesh sieve and dried. Specimens were picked from fractions larger than 500 µm.

Additional material was kindly supplied by Khalil El Hajjaji (Université Sidi Mohammed Ben Abdellah of Tetuan, Morocco). These specimens come from sandy layers in Late Miocene successions, and specifically from: 1) layers deposited during the Messinian, cropping out in the Boudinar area, west of the Melilla peninsula, along the Mediterranean coasts of Morocco, and described by El Hajjaji (1992); 2) sediments deposited in an Atlantic context during the late Tortonian (El Hajjaji pers. comm., 1994), and belonging to the Charf el Akab series (Sefian et al. 1999). In both cases sedimentation took place in different shelf settings (El Hajjaji 1992; Sefian et al. 1998).

Further comparative material belongs to the BIOICE collections, and comes from the northeastern part of the Atlantic Ocean, off Iceland, and was made available through the kindness of Gudmungur Gudmundsson.

All specimens were identified under a stereomicroscope. Selected uncoated specimens were analysed using a low-vacuum scanning electron microscope (TESCAN VEGA 2 LMU) at the Microscopy Laboratory of the University of Catania, with images generated using back-scattered electrons. Zooidal measurements were made from SEM images using the image processing program ImageJ. Measurements are given as the mean in microns plus/minus standard deviation, observed range, number of specimens used, and total number of measurements made (Tab. 1). Measurements use the following abbreviations: do, distance between midpoints of orifices of adjacent autozooids as an approximation of zooid size, following Berning (2007: 224); Zd, zooid depth, as the distance between the frontal surface and the termination of the zooid towards the centre of the branch in cross-section; OL, orifice length (including sinus); OW, orifice width; OL*, orifice length in ovicellate zooids; OW*, orifice width in ovicellate zooids; OvL, ooecial length; OvW, ooecial width.

Specimens are stored in the Palaeontological section of the Museo di Scienze della Terra (PMC, University of Catania).

	N (zooids, fragments)	Mean	SD	Min	Max
do	32, 10	1050	±9	912	1224
Zd	14, 2	548	±47	454	601
OL	10, 5	224	±12	198	237
OW	10, 5	166	±15	145	185
OL*	6, 6	280	±1	279	281
OW*	6, 6	256	±4	254	259
OvL	6, 6	592	±36	549	638
OvW	6, 6	778	±25	746	816

Tab. 1 - Measurements (in µm) of *Myriapora sciutoi* n. sp.

Systematic palaeontology

Suborder **Neocheilostomina** d'Hondt, 1985
Superfamily Schizoporelloidea Jullien, 1883
Family Myriaporidae Gray, 1841
Genus *Myriapora* de Blainville, 1830
Type species: *Millepora truncata* Pallas, 1766

Myriapora sciutoi n. sp.

Figs 2-4

1987 *Spiroporina* sp. Barrier et al., p. 119.

1992 *Myriapora bugei* d'Hondt, El Hajjaji, p. 250, pl. 15, figs 14-15.

Origin of the name: after Francesco Sciuto, palaeontologist at the University of Catania, who described the ostracod faunas of the same localities from which the present species originates.

Holotype: PMC.B 19.8.10.2003 a: a fertile specimen from Sample 1 (1998) from the S. Antonino section, Capo Milazzo, figured in Fig. 3.

Paratypes: PMC. B19.8.10.2003 b: the remaining 11, mostly infertile, fragments from the same sample.

Type horizon: "Yellow calcareous marls" deposited in bathyal environments during the Gelasian.

Type locality: Capo Milazzo, NE Sicily.

Other examined material: Cala S. Antonino West: picking: 93 specimens; Cala S. Antonino Centre: samples: 4 (1998), 4 specimens; 1 (1999), 7 specimens; 2 (1999), 4 specimens; 17 (2000), 8 specimens; 5 (2002), 4 specimens; 7 (2002), 1 specimen; Punta Mazza: sample 6 (2003), 1 specimen. Pavigliana: layer 8: 33 specimens; layer 9: 4 specimens. Gelasian. All material is deposited under the collective Catalogue Number PMC Rosso Milazzo Collection I.G. B-39a. Morocco: Charf el Akab (late Tortonian), 4 specimens; Boudinar (Messinian), 2 specimen. Collective Catalogue Number PMC Rosso Collection M.M. B-39b.

Material of other species: BIOICE 2610. Cruise HM 94, Stat. 2. 10.07.1994, sampled through an RP Sledge from Lat: 67°00'25"N; Long: 17°25'01"W; depth 248 m, to Lat: 67°00'52"N; Long: 17°23'78"W; depth 238 m, off N Iceland: *Leieschara coarctata* and *L. subgracile*. BIOICE 2612. Cruise HM 94, Stat. 3. 11.07.1994, sampled through a Sledge from Lat: 67°07'60"N; Long: 17°04'60"W; depth 350 m, to Lat: 67°08'27"N; Long: 17°33'95"W; depth 372 m, off N Iceland: *Leieschara coarctata*.

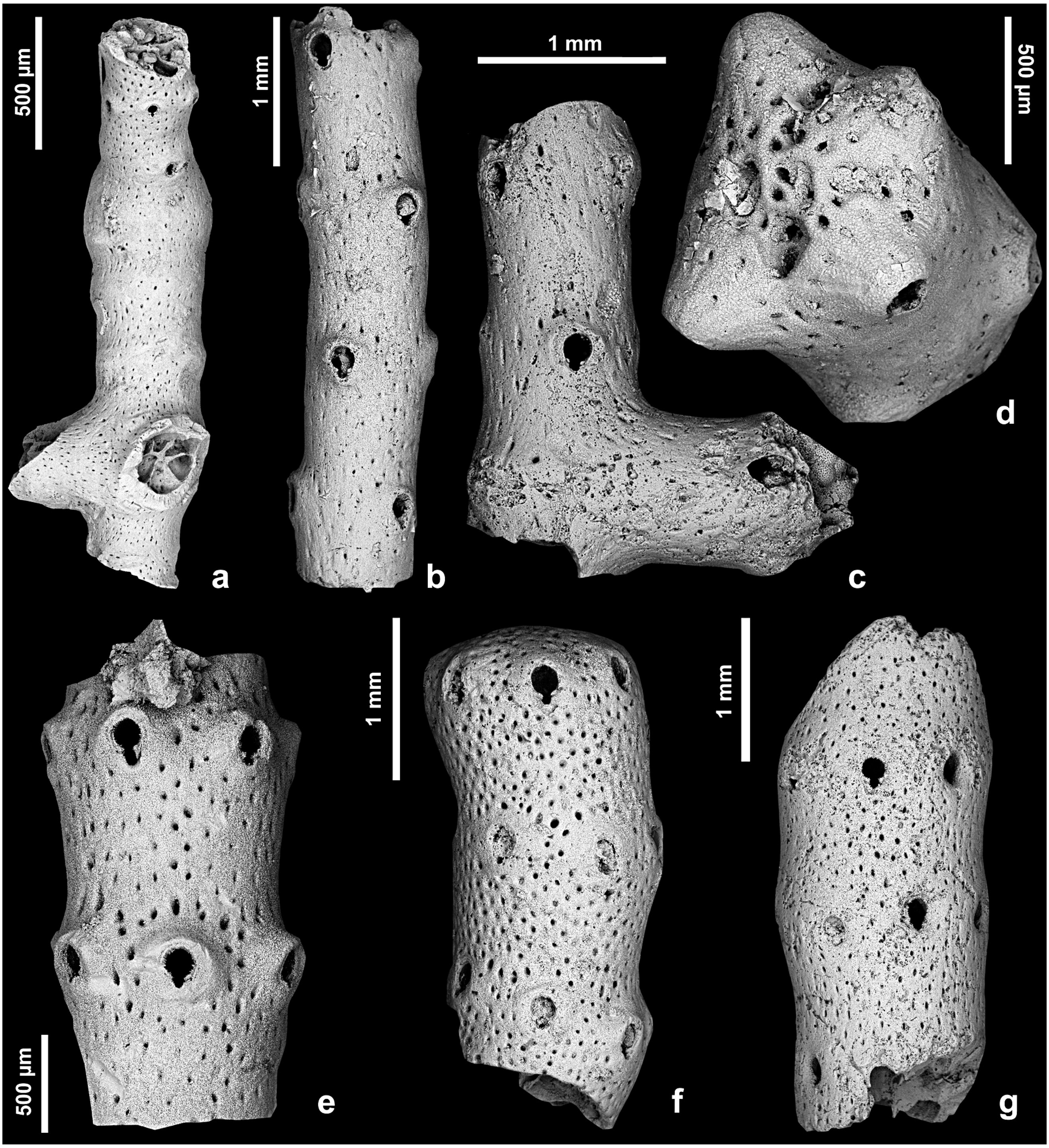

Fig. 2 - *Myriapora sciutoi* n. sp. general appearance. All specimens come from Cala S. Antonino, Milazzo, Gelasian, except for specimen f which is from Boudinar (Morocco), Messinian. a) Large stem with two lateral branches diverging at the same level. b) Long, straight and slender branch. c) Lateral branch arising at 90° from a parental branch. d) Tip of a juvenile slender branch consisting of only four zooids per whorl. e) Branch fragment showing whorls of zooids with distally raised orificial portions causing an undulating outline. Note the widely spaced, slit-like pseudopores. f) Old branch fragment showing densely-packed pseudopores. g) Branch fragment showing a variable appearance of the frontal surface and pore morphology, possibly resulting from small-scale differential corrosion.

Diagnosis: *Myriapora* with erect colonies whose slender branches arise by lateral offsets. Four to eight zooids arranged in whorls, indistinct and distally raised, very large. Frontal shield with slit-like pseudopores. Orifices dimorphic. Ooecium large and prominent.

Description. Colony erect rigid, with fragments a few centimetres long. Branching pattern characteristically at a right angle (Fig. 2a, c). The new branches form secondarily, either isolated, or as two-three lateral stems developing at the same height around the parent branch (Fig. 2a). Branch budding possibly after partial resorption through zooidal pseudopores which enlarge to ensure communication between zooids. Occasionally, new

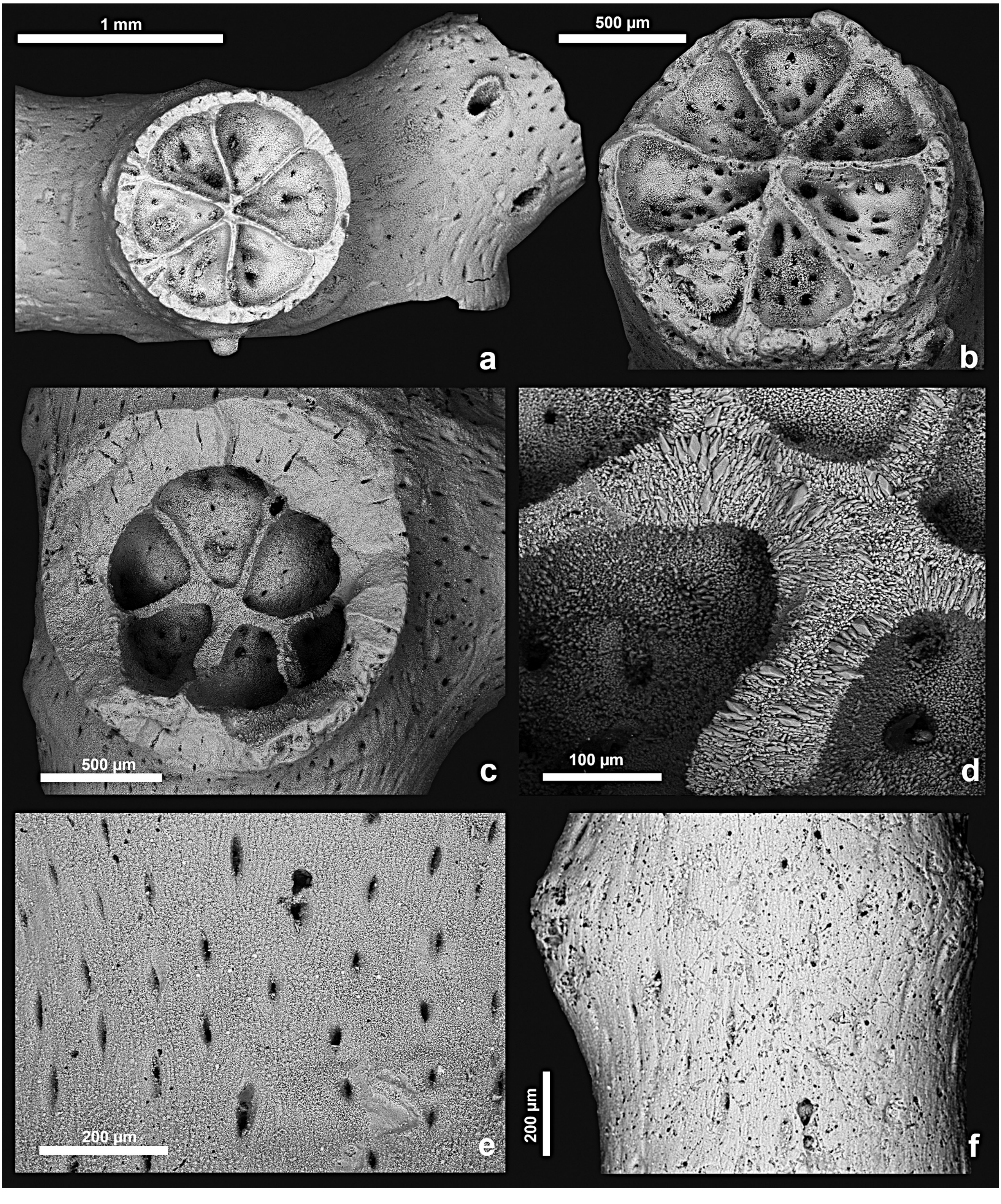

Fig. 3 - *Myriapora sciutoi* n. sp., branch cross sections and surface appearance. a) Cross section of a newly formed lateral branch consisting of six regular, radially arranged zooids. A few connecting pores are visible, one for each zooid is characteristically larger. Cala S. Antonino, Milazzo, Gelasian. b) Cross section of a thick branch including seven zooids arranged roughly radially, originating from a median lamina in the central region. Note the numerous pores in the zooidal walls. Cala S. Antonino, Milazzo, Gelasian. c-d) Pavigliana, Gelasian. c) Cross section of an old branch with six zooids radiating from a median lamina, and a thick secondary calcification strengthening the zooidal frontal shields. d) Detail of zooidal walls in c) to show the arrangement of prismatic crystals. e) Close-up of the branch surface longitudinally pierced by slit-like pseudopores and sculptured by faint furrows and ridges. Pavigliana, Gelasian. f) Close-up of the surface of an old branch. Pseudopores are partly hidden by secondary calcification. Cala S. Antonino, Milazzo, Gelasian.

branches arise from zooidal orifices. Branches subcircular in cross section, slender, consisting of four to eight, but more commonly six longitudinal rows of zooids arranged in whorls (Figs 2; 3a-b, 4c-e). Subsequent whorls slightly rotated, so that the zooids are alternating. Zooids deep, radiating from the centre of the branch (Figs 2d; 3a-d). Zooid boundaries invisible, except for the distal margin, which is raised during early ontogeny (causing the branch undulating outline) and devoid of pores (Fig. 2e). Distance between adjacent orifices large. Frontal shield porous (Figs 2-3). Pseudopores slit-like (Fig. 3e), longitudinally elongated, 28-60 μm long, evenly distributed, faintly aligned distally to some orifices (Fig. 2e), their density ranging from 15 to 25 in a 500x500 μm square. Marginal areolae indistinguishable, possibly corresponding to the longest pseudopores. Surface also sculptured by barely visible, extremely faint, longitudinal ribs and furrows, which persist in late ontogeny (Fig. 3f), often becoming more pronounced. Primary orifice dimorphic: in autozooids, upside-down ovoidal, longer than wide (mean OL/OW= 1.35), with a deep and wide U-shaped sinus occupying nearly one-quarter of the total length, lined by deeply sloping shoulders and separated from the anter by two strong (20x50 μm) rounded condyles extending beyond shoulders (Fig. 4a-b); orifice in ovicellate zooids semielliptical (mean OL/OW= 1.10) with a straight to slightly concave proximal border, occupying 80% of total width, lined by indistinct shoulders and marked by two strong condyles, very proximally placed (Fig. 4c-f). Oral spines absent. Connections between zooids in subsequent whorls through a set of 2-11 septular pores in their proximal walls (Fig. 3a-b, d). Ooecia rare but present on all zooids of certain whorls, very large, globular, mostly incorporated into the frontal shields of the two distal zooids, protruding above the branch surface and producing annular swellings (Fig. 4c-e). Ooecium boundaries invisible, surface porous. Pseudopores apparently larger, less elongated and more numerous than those of the frontal surface. Ooecium aperture at an acute angle to frontal plane (Fig. 4e); its distal border not observed. Ancestrula not observed in the present material.

Secondary calcification responsible for the thickening of the frontal surface and eventually for the occlusion of zooidal orifices and pseudopores (Figs 2a, 3f), as well as for the smoothing of the branch outline.

Variability. Variability mostly concerns branch thickness (Tab. 2) and the number of zooids per whorl, as well as the density of pseudopores on the frontal surface. Specimens from Capo Milazzo are the most slender, with whorls usually including five to six zooids, rarely four. In contrast, branches from Pavigliana consist of up to eight zooids and have a thickness comparable to those from Morocco (Tab. 2).

Site	Age	Mean	SD	Min	Max	N
Morocco	late Tortonian-Messinian	1.43	±0.13	1.20	1.58	6
Milazzo, Sicilia, Italy	Gelasian	0.90	±0.10	0.72	1.16	52
Pavigliana, Calabria, Italy	Gelasian-early Pleistocene	1.28	±0.14	1.03	1.51	14

Tab. 2 - Intracolony variability in branch diameter (in mm) in *Myriapora sciutoi* n. sp.

Remarks. The present species superficially resembles *Myriapora bugei* d'Hondt, 1975 in its general appearance, including growth morphology, branching pattern (compare Fig. 2a with fig. 27 of d'Hondt 1975, and fig. 4a of Berning 2013), the arrangement of zooids in subsequent whorls, and the dimorphism of the orifices. However, several characters distinguish *M. sciutoi* n. sp. from *M. bugei*. Firstly, the number of zooids per whorl, and consequently the branch thickness, is greater in the former species than in the latter. Secondly, the orifices of autozooids and maternal zooids have different shapes, sizes and L/W ratios. The primary orifice in autozooids of *M. sciutoi* n. sp. has a higher L/W ratio (1.35 vs 1.14, the latter calculated from data in Berning 2013), a narrower sinus with more deeply inclined shoulders, and more prominent condyles than *M. bugei*. The orifice in maternal zooids has a decidedly straight proximal border in *M. bugei* and is proportionally shorter than in *M. sciutoi* n. sp. The different orifice morphology of the Moroccan specimens assigned to *M. bugei* by El Hajjaji (1992) was already noticed by Berning (2013). Differences in the number of zooids per whorl and in the shape of the orificial sinus, although included within the species variability of *M. bugei* by Berning (2013), were actually suggested by this author as characters pointing to the possible presence of separate species in present-day populations sampled on seamounts from widely distant geographical areas of the Atlantic Ocean.

Finally, the main difference between *M. sciutoi* n. sp. and *M. bugei* is provided by the ooecium, which is large, prominent and well recognisable in the former species, but indistinct in *M. bugei*. Possibly for this reason, ooecia were overlooked by d'Hondt (1975), and not included in his description of the species, although they can be seen in his fig. 26, as indicated by the dimorphic orifice of the lowermost zooid. Maternal zooids in *M. bugei* are only indicated by a very slight swollen ring corresponding with the whorl of ovicellate zooids, and by pseudopores that are radially arranged on ooecium frontal surface, as stated by Berning (2013). Actually, ooecia can be more easily discovered by looking for orifices with a straight, non-sinuate, proximal border.

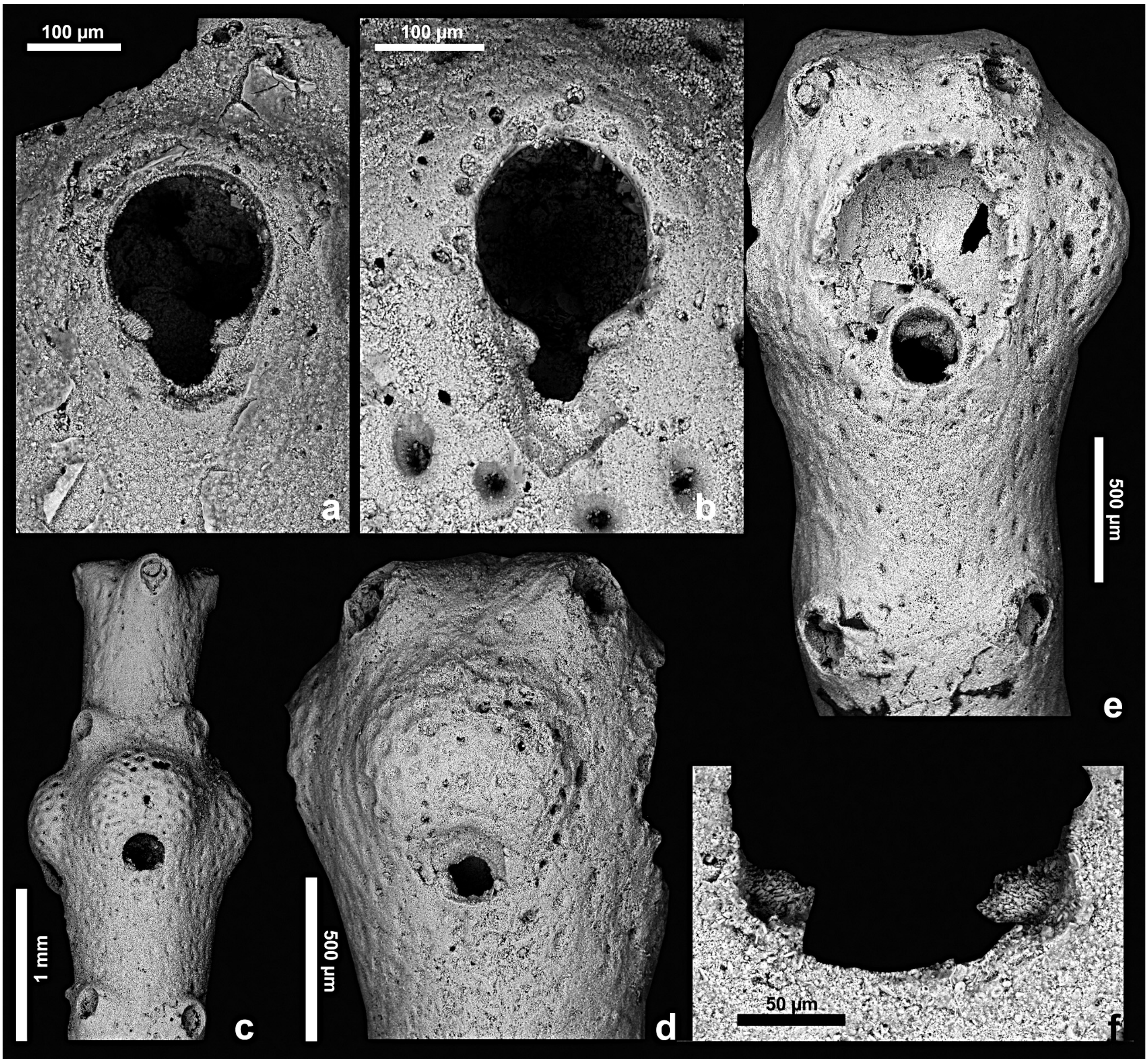

Fig. 4 - *Myriapora sciutoi* n. sp., orifice and ooecium. a) Primary orifice. Cala S. Antonino, Milazzo, Gelasian. b) Primary orifice. Boudinar (Morocco), Messinian. c) General view of a branch to show the prominence of ooecia and the swelling formed by the whorl of ovicellate zooids. d-f) Holotype PMC. B 19. 8.10.2003 a. Cala S. Antonino, Milazzo, Gelasian. d) Frontal view of a complete ooecium. e) Branch tip with a broken ooecium. The dimorphic orifice and the partial inclusion of the ooecium within distal zooids are visible. f) Close-up of the orifice of the ovicellate zooid in e.

M. sciutoi n. sp. and *M. bugei* can be easily distinguished from all other species in the genus because they exhibit a verticillate distribution of zooids along branches, in spite of the typical 'in echelon' arrangement. Their erect rigid (vinculariiform) colonies possess peculiar morphologies caused by an irregular branching pattern, resulting from the offset of one-three new branches at the same level along the parental one and orthogonal to it. These lateral branches apparently develop through frontal budding at special loci in some zooids in the same whorl (Fig. 2a), that give rise to the basal zooids of the new branch(es). As in *M. bugei* (d'Hondt 1975: fig. 27; Berning 2013: fig. 4A), branching in *M. sciutoi* occurs in subsequent, or in closely spaced, whorls along a main branch. More often, branching areas are relatively distantly spaced as indicated by numerous up to 5.5 mm long straight fragments, without any evidence of lateral branching. A single fragment from Boudinar includes a basal expanded portion for attachment to the substratum but such structures are not present in any of the numerous specimens collected from southern Italy and particularly from Capo Milazzo. From those layers, several other erect rigid species are known (Rosso 2002b; Rosso & Braga 2012), that largely include a remarkable percentage of fragments with evidences of attachment portions (AR, personal observations). Although the colonies have certainly started off growing on a stable substratum, the paucity of colony bases and the unusual branching pattern suggest that both *M. bugei* and *M. sciutoi* might exploit fragmentation as a reproduction strategy, as observed for other arborescent species by Håkansson & Thomsen (2001) and Cheetham (2002). The special branching pattern allows to continue to grow on the bottom soft sediments when the original substrata are occasionally turned down, even due to the colony load, or branches broken off. This last adaptation is shared with some other species from the present-day Mediterranean, both cheilostome and cyclostome (Harmelin 1976; Rosso 1996).

Species of the genus *Myriapora*, although being mostly erect rigid, actually exhibit an array of growth morphologies including a fungiform species, *M. fungiformis* Vávra, 1983, as well as an 'encrusting' species, *M. kuhni* Vávra, 2011, with zooids quincuncially arranged in a narrow spiralling string. Nevertheless, all species presently assigned to the genus (www. bryozoa.net by P. Bock, accessed 08.01.2015) share important zooidal features including the presence of a frontal shield entirely perforated by pseudopores, a sinuate orifice with strong condyles, a dimorphic orifice in ovicellate zooids, and the absence of oral spines. All of these characters have been incorporated in the recent revised diagnosis of *Myriapora* by Vávra (2011). This author also considered the absence of avicularia as a diagnostic character for this genus and, indeed, avicularia are absent from *M. truncata* (Pallas, 1766), the type species of the genus (see Gautier 1962; Berning 2007). In contrast, avicularia are present in the species *M. subgracilis* (d'Orbigny, 1852) (Fig. 5a-b) and the subspecies *M. subgracilis variabilis* (Androsova 1958) (Androsova 1958: fig. 73). Both species are currently assigned to *Myriapora* or its synonyms (e.g. Ryland & Hayward 1991; Berning 2013; Grischenko 2014; www.bryozoa.net by P. Bock, accessed 08.01.2015), although sometimes accommodated within *Leieschara* M. Sars, 1863 (Androsova 1958; Kluge 1975). This latter genus includes its type species, *L. coarctata* M. Sars, 1863, and *L. orientalis* (Kluge, 1929) (www.bryozoa.net by P. Bock, accessed 08.01.2015). *Leieschara* is very similar to *Myriapora* but differs in having the orifice with a straight proximal border and a narrow sinus, and most importantly in having 1 to 3 avicularia per zooid, generally associated with the orifice, as is the case in *L. coarctata* (Fig. 5c-e). Further differences between the two genera, mostly concerning the zooidal shield ultrastructure, were stressed by Schäfer et al. (2009). In agreement with Schäfer et al. (2009), and taking into account features of *Myriapora* and *Leieschara*, the accommodation of *M. subgracilis* within the genus *Leieschara* is here suggested. We also agree with the generic attribution of *M. subgracilis variabilis* to *Leieschara* as originally proposed by Androsova (1958). Consequently, we support the opinion of Schäfer et al. (2009) that the species *L. coarctata, L. orientalis, L. subgracilis* and *L. subgracilis variabilis* belong within *Leieschara*, and the species *M. truncata, M. bugei, M. fungiformis,* within *Myriapora,* with the addition of the recently described species *M. kuhni* and *M. sciutoi* n. sp. This separation appears also to be consistent with the geographic segregation of the two genera. *Leieschara* is restricted to very high (polar and subpolar) latitudes, and apparently lacks a fossil record (although dead accumulations of *L. coarctata* and *L. subgracilis* have been reported from the modern Kodiak shelf by Cuffey & Turner 1987). *Myriapora* is widespread at lower latitudes in the Atlanto-Mediterranean region, and has a fossil record going back to the Oligocene.

Based on the considerations reported above, the diagnosis of the genus by Vávra (2011) is further amended to include the possibility that within the genus *Myriapora*, zooids may be arranged in whorls, in addition to being arranged strictly quincuncially.

Distribution. The first appearance of *Myriapora sciutoi* n. sp. is possibly in the Late Miocene (late Tortonian-early Messinian) of Morocco. From there (Fig. 1) the species was reported as *M. bugei* by El Hajjaji (1992) from the Tortonian of Charf el Akab, on the Atlantic side of Morocco, and from the Messinian of Boudinar, on the Mediterranean side of Morocco. Only a few fragments were found in sediments from the localities where the species was probably rare. More abundant material is available from a restricted sector of southern Italy. In this area, *M. sciutoi* n. sp. was probably more common because it has been found in several samples from Capo Milazzo Peninsula and the Reggio Calabria zone, all collected in sediments deposited during the Gelasian. In contrast, specimens of *M. sciutoi* n. sp. have so far never been reported in other Late Miocene sediments from southern Italy (see Seguenza 1879-80; Neviani 1900) or elsewhere, or from the younger Pleistocene sediments of the same area (e.g. Di Geronimo et al. 1997; Rosso 2005b), or the present-day Mediterranean (see Rosso 2003 and Rosso et al. 2010, among others).

The stratigraphic distribution of *M. sciutoi* n. sp. includes pre- and post- Messinian Salinity Crisis times, with its Messinian records from sediments deposited in a western Mediterranean marginal basin. Species with such a distribution have often been considered as palaeoendemics, persisting during the desiccation events in possible satellite basins (Moissette & Pouyet 1987; Di Geronimo 1990), whose presence has been strongly questioned (see Berning 2006) although it could be not completely discarded, at least for some westernmost Mediterranean areas subjected to periodic Atlantic inflow (cf. Rouchy & Caruso 2006). In the present in-

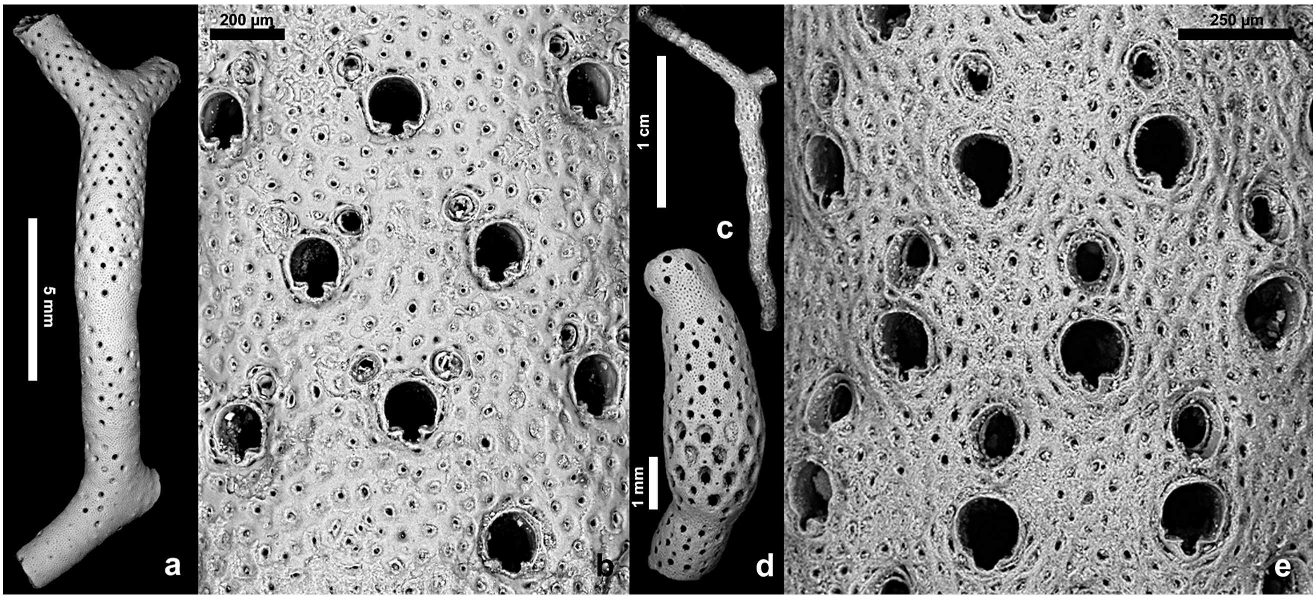

Fig. 5 - *Leieschara* species from the present-day North Atlantic. a-b) *Leieschara subgracilis* (d'Orbigny, 1852), BIOICE 2610, off northeastern Iceland, Recent. a) A branch showing bands of secondary calcification occluding zooidal orifices and avicularia. b) Group of zooids, several exhibiting one or two avicularia distolateral to the orifice. c-e) *Leieschara coarctata* M. Sars, 1863, BIOICE Cruise, off northeastern Iceland, Recent. c) A repeatedly bifurcating branch showing subsequent annulations typical of the species. Sample BIOICE 2612. d) Fertile branch fragment with a thickened portion corresponding to ovicellate zooids. Sample BIOICE 2610. e) Close-up of d showing a group of indistinct zooids, each with an avicularium distal to the orifice.

stance, the Tortonian record of *M. sciutoi* n. sp. in the Moroccan Atlantic region clearly points to its wide distribution during the Late Miocene in the Mediterranean and the nearby Atlantic, and supports the hypothesis of a recolonisation of the Mediterranean after its flooding in the Early Pliocene, by populations which have persisted in the Atlantic (Sefian et al. 1999; Taylor 2000; Berning et al. 2005; Berning 2006).

On the basis of present knowledge, *M. sciutoi* n. sp. could be considered as a Tortonian-Gelasian species that possibly disappeared from the Mediterranean at the end of the Gelasian, following the dramatic climatic/hydrological changes that affected the basin at that time, and that produced well documented faunistic changes within benthic molluscs (see Monegatti & Raffi 2010, among others). Until now it has not been recorded from the Atlantic region after the Tortonian, although its persistence in that area can be supposed at least until the Early Pliocene. It is reasonable to hypothesise that the very closely related species *M. bugei*, which is exclusively reported from the present-day Atlantic, and *M. sciutoi*, which is documented from the Atlantic-Mediterranean area until the Gelasian are strictly linked. Further information about the post-Miocene fossil record of this group of *Myriapora* species is needed to put forward reliable hypotheses about their appearance and evolution, as well as to ascertain whether *M. bugei* corresponds to a species complex, as suggested by the morphological differences observed in different populations from the Atlantic Ocean by Berning (2013).

The Miocene records of *M. sciutoi* n. sp. are from sediments that were deposited in mid-outer shelf settings (El Hajjaji 1992; Sefian et al. 1999), whereas Gelasian populations from the central Mediterranean were able to colonise deeper environments from the shelf break to the upper slope, possibly down to 400-600 m depth (Barrier et al. 1987; Gaetani & Saccà 1984). This depth range largely overlaps with that of *M. bugei*, reported in the Azores from 190 to 350 m depth (d'Hondt 1975), and occurring down to 1235 m (Berning 2013). It is likely that this group of species evolved, eventually, the ability to exploit progressively deeper environments of the Atlantic-Mediterranean area.

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