

## Notes on two species of the genus *Turbicellepora* Ryland, 1963 (Bryozoa, Cheilostomida) of the Atlanto-Mediterranean region : *T. avicularis* (Hincks, 1860) and *T. magnicostata* (Barroso, 1919).

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**Abstract :** Morphological variability of *Turbicellepora avicularis* and *T. magnicostata* is considered ; it is possible to conclude that *T. magnicostata* rarely shows conspicuous ribs on the frontal wall, which is opposite to the original description of the species. So, a redescription of *T. magnicostata* is based on the knowledge of its morphological variability. The relation (length orifice/width orifice) is considered a good parameter for distinguishing *T. avicularis* and *T. magnicostata* ; other useful characters are the anatomy of the vicarious avicularia and ovicells. Photographs of the ancestor of *T. magnicostata* are provided.

**Résumé :** L'auteur considère la variabilité morphologique de *Turbicellepora avicularis* et *T. magnicostata*. Il conclut que *T. magnicostata* présente rarement les sillons frontaux cités dans la diagnose originale de l'espèce. Aussi, *T. magnicostata* est-elle redécrite en mettant l'accent sur sa variabilité morphologique. La relation (longueur orifice/largeur orifice) est considérée un bon critère pour distinguer *T. avicularis* et *T. magnicostata* ; d'autres caractères utiles sont l'anatomie des aviculaires interzoéciaux et des ovicelles. Des photographies de l'ancêtre de *T. magnicostata* sont présentées.

### INTRODUCTION

The cheilostome bryozoan genus *Turbicellepora* was introduced by Ryland (1963) to replace the widely used *Schismopora* Auctt. and its description was completed by Pouyet (1973). *Turbicellepora* comprises a large number of superficially very similar living species. This superficial similarity involves a difficulty for distinguishing some species of this genus. In addition, some species have a morphological variability. *T. avicularis* is a highly variable species and is perhaps the most difficult to define (Hayward, 1978). On the other hand, *T. magnicostata* was described by Barroso (1919), who uses the presence of conspicuous ribs on the frontal wall as an important character ; however, this feature is highly variable, and most examples collected of this species lack frontal ribs. The situation has been complicated by the usage of *Cellepora armata* Hincks, regarded by Hayward (1978) as a spurious species. In general, Hayward (op. cit.) supposes that the records of *C. armata* in the Atlantic must be assigned to *T. avicularis* ; in the Mediterranean, more than one species has been recorded as *C. armata*. This question is very important, because there is a large number of reports of *C. armata* until the early 70 s. These records should be reassigned only in the cases where the original specimen is available for study, or where the report is accompanied by adequate description or figures.

This paper attempts to trace the range and variation of *T. avicularis* and *T. magnicostata* and to establish the best characters for distinguishing the two species.

## MATERIALS AND METHODS

The collections of the National Museum of Natural Sciences (Madrid) and of the Cantabrian Museum of the Sea (Santander) have provided a part of specimens for this study. Additional material was sampled by the author on the Atlantic and Mediterranean coasts of the Iberian Peninsula by various sampling methods (diving at some shallow stations, dredging and trawling). So, specimens from western Mediterranean, Alboran Sea, Gibraltar Strait, Gulf of Cadiz and Cantabrian Sea have been studied.

Freshly collected samples were fixed in 70 % alcohol for later use in morphological studies. Some specimens were coated with gold for examination under the Scanning Electron Microscope.

Measurements of the zooidal dimensions were made under the stereomicroscope at high magnification. The length and width of the orifice were the principal morphometric parameters measured. On the Basque coast, other parameters were measured : length and width of the semielliptical vicarious avicularia, length and width of the triangular vicarious avicularia and length of the suboral avicularia.

## SYSTEMATIC ACCOUNTS

*Turbicellepora avicularis* (Hincks, 1860) (Fig. 1)

*Cellepora avicularis* : Hincks, 1860, p. 278.

*Cellepora avicularis* Hincks : Hincks, 1880, p. 406, pl. 54 (figs. 4-6).

"*Schismopora*" *avicularis* (Hincks) : Gautier, 1962, p. 258.

*Turbicellepora avicularis* (Hincks) : Hayward, 1978, p. 566, figs. 1, 2 (A and B), 3, 4 (I-K), 5 (A-E), 8 and 9.

*Turbicellepora avicularis* (Hincks) : Hayward & Ryland, 1979, p. 284, fig. 124 (A-E).

*Turbicellepora avicularis* (Hincks) : Zabala, 1986, p. 575, fig. 204.

## HABITAT

*Turbicellepora avicularis* encrusts stones, algae, hydroids, bryozoans, shells, etc. It has been collected from the lower shore to at least 130 m (Hayward, 1978), and most typically, between 20 - 60 m (Gautier, 1962).

## MATERIAL EXAMINED

Redondela (Gulf of Cadiz) : 23-VII-1989 : 22 m. Gibraltar Strait : 21-VII-1989 : 110 m. Sand-bank "Las Bóvedas" (Alboran Sea) : 13-VII-1989 : 30 m. Motril (Alboran Sea) : 11-VII-1989 : 62 m. Vélez Málaga (Alboran Sea) : 10-VII-1989 : 68 m. Naples : 1915 [National Museum of Natural Sciences, number 25.03/104].

## DESCRIPTION

Colony encrusting, growing from small patches to form nodular incrustations or encircling erect substrata to form cylindrical growths. Autozooids convex, with a smooth frontal

wall and marginal areolae, sometimes small and few in number. The orifice is longer than wider, with a semicircular anter and a deep, narrow and V-shaped proximal sinus. The suboral avicularium is enclosed by the peristome, and it is situated proximally and laterally to the orifice ; its cystid is inclined with regard to the frontal plane of the autozoid. Vicarious avicularia belong to these two different types : the first one, elongate, spatulate, often present in abundance, from 0.370 to 0.610 mm long, with a well developed palate and a strong crossbar with a very thick columella ; the second one, with a triangular mandible (from 0.130 to 0.210 mm long) and a cystid that may be columnar or squat ; its columella and crossbar are massively developed too. Ovicells are prominent, spherical and smooth surface, with the ectooecium showing a variable number of round pores (up to 11). The lophophore shows from 13 to 16 tentacles (Hayward, 1978). Embryos are deep yellow in colour.

#### MORPHOMETRIC STUDY

The following table shows the measurements obtained by several authors of the length and width of the orifice.

##### Length of the orifice

	range (mm)	mean (mm)	n
Naples (Alvarez, in press)	0.119-0.179	0.153	27
Mediterranean (Gautier, 1962)	0.130-0.140	-	-
Gulf of Cadiz (Alvarez, original)	0.145-0.193	0.169	30
Mediterr. & Atlantic (Hayward, 1978)	0.131-0.161	0.148	692

##### Width of the orifice

	range (mm)	mean (mm)	n
Naples (Alvarez, in press)	0.112-0.160	0.131	29
Mediterranean (Gautier, 1962)	0.120-0.130	-	-
Gulf of Cadiz (Alvarez, original)	0.129-0.176	0.152	30
Mediterr. & Atlantic (Hayward, 1978)	0.120-0.147	0.133	692

##### Global Measurements

	range (mm)	mean (mm)	n
Length of the orifices	0.119-0.193	0.149	749
Width of the orifices	0.112-0.176	0.133	751

#### DISTRIBUTION

*Turbicellepora avicularis* has been reported in the Northeastern Atlantic, from Norway to the Gulf of Cadiz. It has been also recorded in the Western Mediterranean.

*Turbicellepora magnicostata* (Barroso, 1919) (Figs 2 and 3)

*Schismopora magnicostata* : Barroso, 1919, p. 346, figs. 23-32.

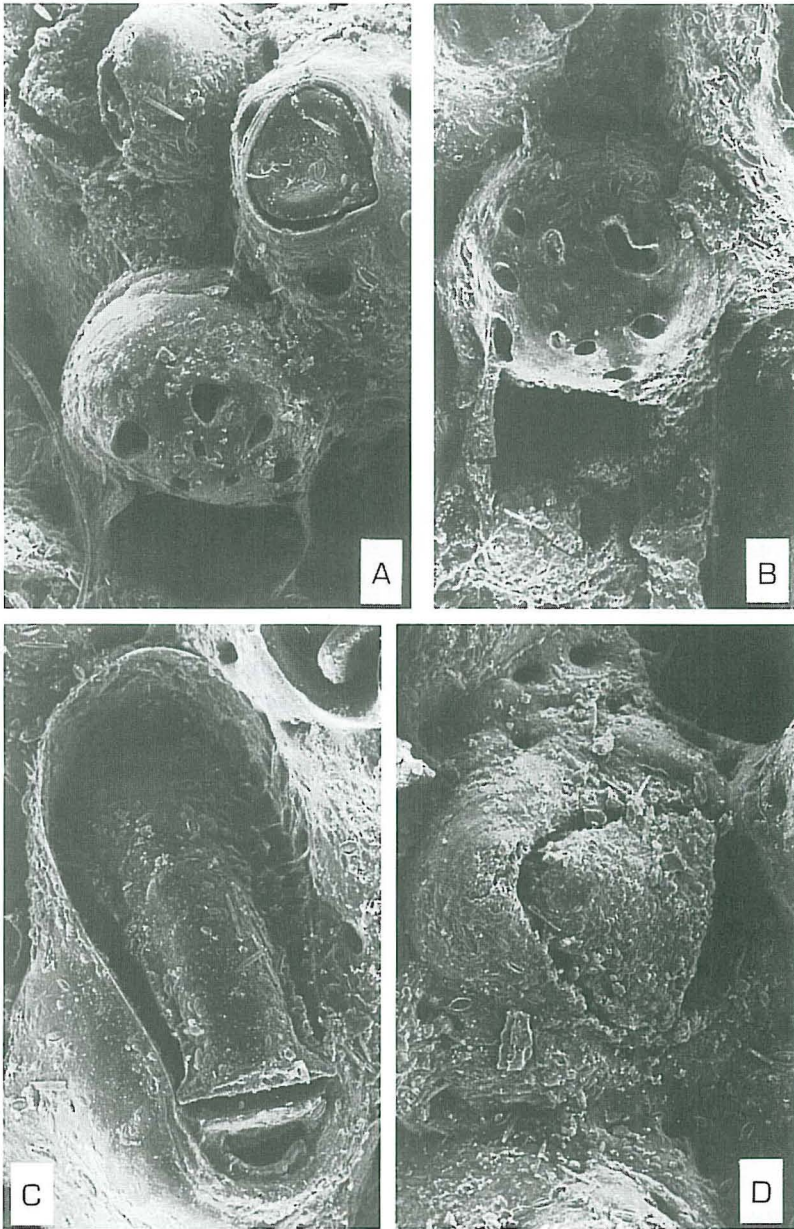


Fig. 1 : *Turbicellepora avicularis* (Hincks)

A : An orifice and an ovicell. The lateral oral pores are completed. It is also possible to see a suboral avicularium [x 200].

B : Detail of an ovicell [x 200].

C : Spatulate vicarious avicularium [x 200].

D : Triangular vicarious avicularium [x 200].

*Schismopora areolata* : Canu & Bassler, 1925, p. 57, pls. 5 (Figs. 7-11) and 7 (Fig. 21).

*Schismopora liouvillei* : Canu & Bassler, 1925, p. 58, pl. 6 (Figs. 5 and 6).

*Schismopora magnicostata* Barroso : Canu & Bassler, 1928, p. 57.

*Schismopora armata* Hincks : Canu & Bassler, 1930, p. 76, pl. 11 (Figs. 1-12).

*Schismopora magnicostata* Barroso : Canu & Bassler, 1930, p. 78, pl. 11 (Figs. 17-21).

"*Shismopora*" *armata* (Hincks) : Gautier, 1962, p. 256.

"*Schismopora*" *magnicostata* Barroso : Gautier, 1962, p. 262.

*Turbicellepora armata* (Hincks) : Buge & Debourle, 1977, p. 349, pl. 11 (Fig. 3).

*Turbicellepora magnicostata* (Barroso) : Hayward, 1978, p. 579, Figs. 2 (C and D), 4 (B), 5 (P-S) and 16 (A-C).

*Turbicellepora magnicostata* (Barroso) : Hayward & Ryland, 1979, p. 286, Fig. 125.

*Turbicellepora magnicostata* (Barroso) : Zabala, 1986, p. 579, Fig. 206, pl. 23, (D-F).

*Turbicellepora magnicostata* (Barroso) : Alvarez, 1987, p. 65, pl. 12 (Figs. F, H, I and J).

## HABITAT

This species grows on a big variety of substrata, both organic and inorganic. Thus, it has been cited on stones, algae, seagrass, sponges, shells, etc. Its bathymetric range is large, being found even at depths of 140 m (Canu & Bassler, 1930 : as *Schismopora armata*), though it is usually found from the shore to 50 m.

## MATERIAL EXAMINED

Bay of Bilbao (Cantabrian Sea) : October, 1983 and August, 1984 : 0-8.5 m. Santander (Cantabrian Sea) : 1912 [Cantabrian Museum of the Sea, number 3/M/88]. Tarifa (Gilbraltar Strait) : 21-VII-1989 : 15 m. Cape of Palos (Western Mediterranean) : 1983 [National Museum of Natural Sciences, number 25.03/107]. Benidorm (Western Mediterranean) : August, 1988 : 2-8 m. Naples : 1915 [National Museum of Natural Sciences, number 25.03/106].

## DESCRIPTION

Colony encrusting, forming broad patches on stones or nodular incrustations on algae ; deep orange colour. Autozooids broad and convex ; its frontal surface smooth, with large and conspicuous areolae and, sometimes, raised ribs between the areolae converging to form a prominent suboral umbo. The orifice is wider than long, with a semicircular anter and showing in its proximal portion a sinus at least as wide as deep, or even wider than deep. An avicularium, laterally and proximally to the orifice, is on the autozooids, being included in the space delimited by the peristome. The avicularian cystid presents a variable anatomy, having sometimes a columnar form (up to 0.240 mm high) or a conical one ; its length varies between 0.075 and 0.135 mm ; its anterior outline is triangular and its mandible is steeply inclined to the frontal plane of the autozoid. Vicarious avicularia may be abundant in some colonies. These avicularia can belong to these two different types : the first one elongated, semielliptical, with big dimensions (0.235 - 0.440 mm long) ; its rostrum has a poorly developed palate, a slender crossbar and a scarcely discernible columella ; the second one, with a blunt triangular mandible and a smaller size (0.145 - 0.290 mm long). The ovicell is prominent, spherical, with the ectooecium incompletely developed,

with 4 - 5 round spaces (0.015 x 0.025 mm, approximately), several of which may coalesce to give irregular lacunae (0.045 x 0.115 mm, approximately), that reveal the endooecium. The lophophore presents 16 tentacles (specimens from the Basque coast). Embryos of an intense orange colour. Ancestrula with a membranous frontal surface surrounded by eight spines.

MORPHOMETRIC STUDY

The following table shows the measurements obtained about specimens from the Bay of Bilbao (Cantabrian Sea : N of the Iberian Peninsula) and its neighbouring coasts (both eastern and western). The examples were collected in the intertidal and in the infralittoral (down to 8.5 m) on algae, boulders and shells.

	range (mm)	mean (mm)	n
Length of the orifices	0.128-0.177	0.154	90
Width of the orifices	0.129-0.193	0.153	90
Length semielliptical vicarious avicularia	0.273-0.435	0.373	73
Width semielliptical vicarious avicularia	0.129-0.225	0.193	69
Length triangular vicarious avicularia	0.145-0.290	0.221	36
Width triangular vicarious avicularia	0.072-0.175	0.122	36
Length suboral avicularia	0.096-0.130	0.112	10
Width suboral avicularia	0.040-0.073	0.054	10

For the purpose of comparing these measurements to the ones obtained by other authors in other Atlanto-Mediterranean regions, the table below shows the length and width dimensions of the orifice.

	range (mm)	mean (mm)	n
Length of the orifice			
Bay of Bilbao (Alvarez, original)	0.128-0.177	0.154	90
Benidorm [Mediterr.] (Alvarez, 1990)	0.125-0.157	0.135	45
Mediterranean (Alvarez, in press)	0.127-0.159	0.137	19
Mediterr. & Atlantic (Hayward, 1978)	0.130-0.174	0.150	161
Mediterranean (Gautier, 1962)	0.130-0.150	-	-
Width of the orifice			
Bay of Bilbao (Alvarez, original)	0.129-0.193	0.153	90
Benidorm [Mediterr.] (Alvarez, 1990)	0.126-0.162	0.142	45
Mediterranean (Alvarez, in press)	0.124-0.160	0.145	35
Mediterr. & Atlantic (Hayward, 1978)	0.139-0.166	0.155	161
Mediterranean (Gautier, 1962)	0.140-0.160	-	-

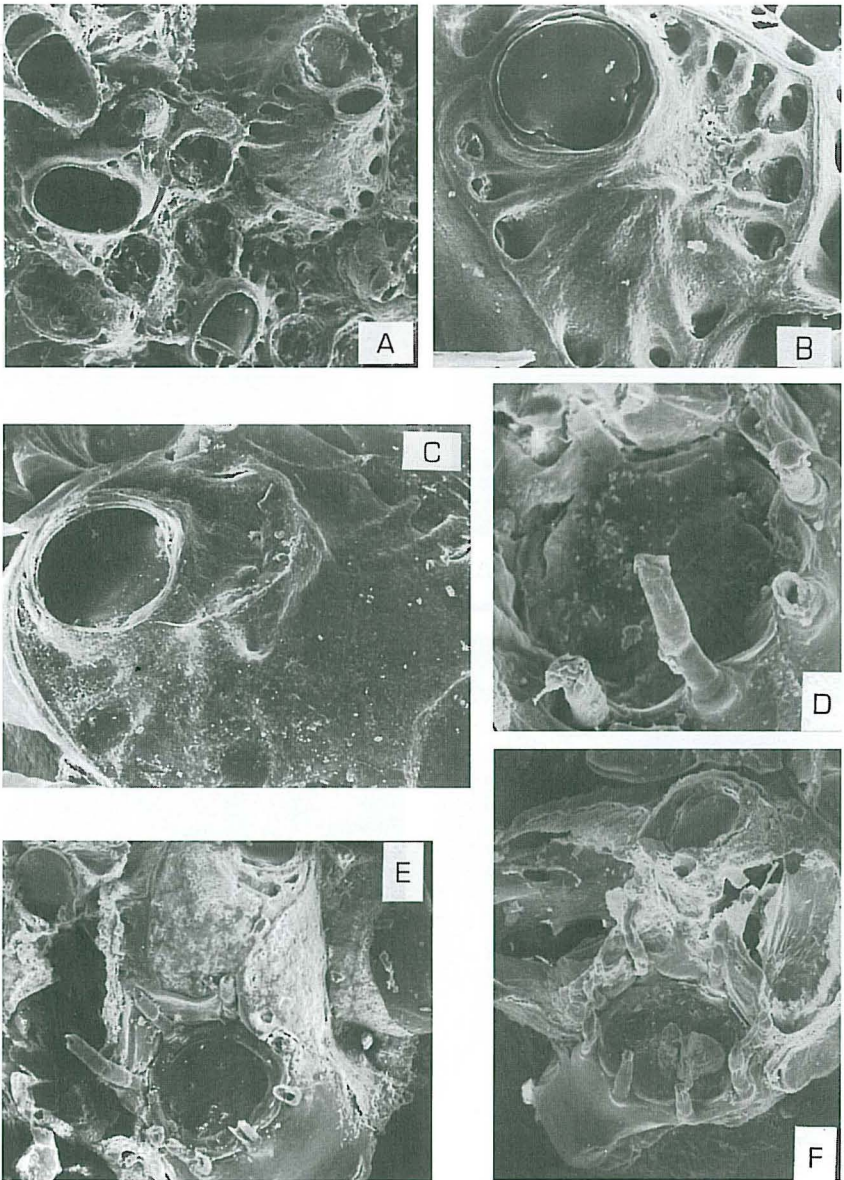


Fig. 2 : *Turbicellepora magnicostata* (Barroso).

A : General view of the colony surface [x 200].

B : An autozooid with well developed areolae. Notice the morphology of the orifice [x 200].

C : Frontally budded autozooid incompletely developed [x 200].

D : Ancestrula. Detail of the membranous surface and the spines [x 360].

E : Ancestrula. Notice the membranous frontal surface surrounded by eight short spines [x 180].

F : Ancestrula and periancestrular autozooids [x 180].

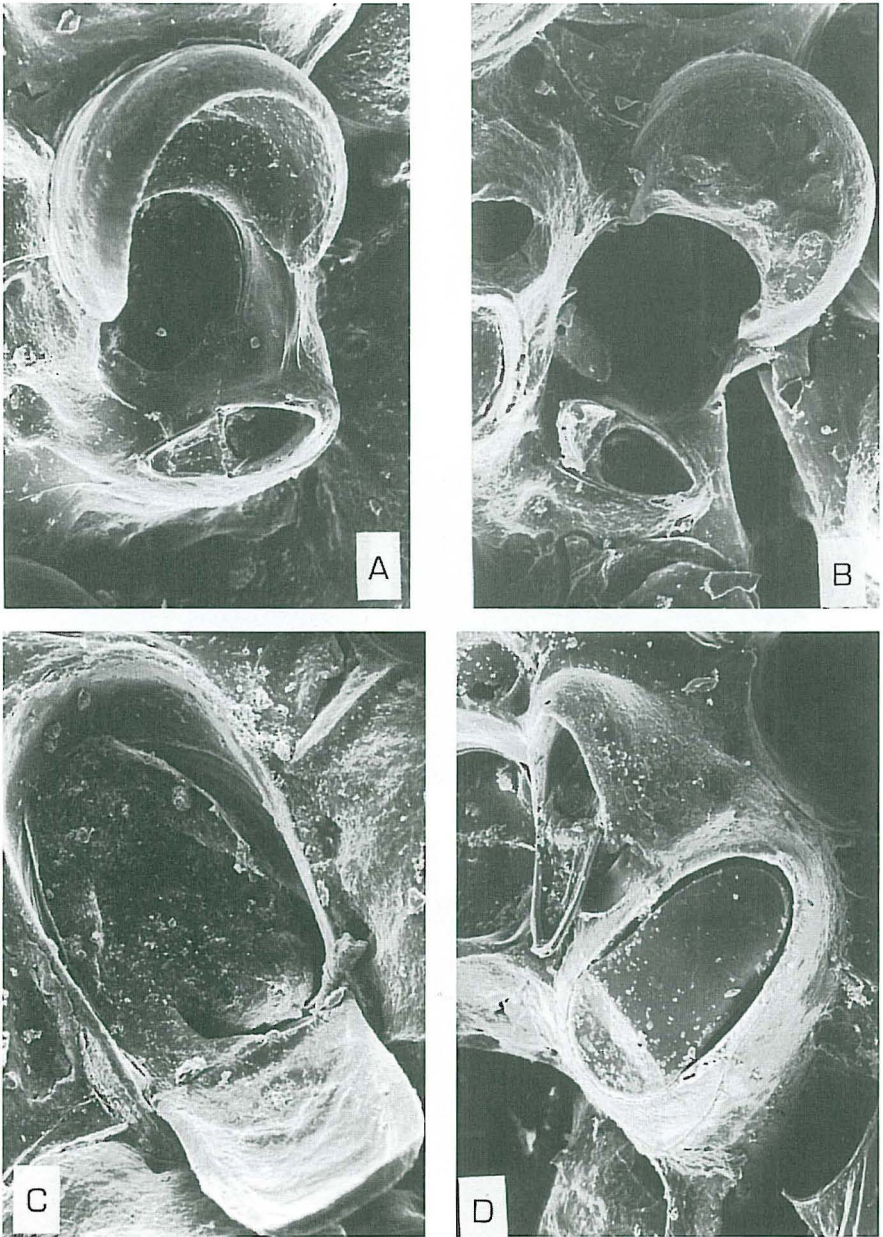


Fig. 3 : *Turbicellepora magnicostata* (Barroso).

A : An incompletely developed ovicell. The suboral avicularium is open [x 200].

B : A well developed ovicell. Notice the lacunae in the ectooecium [x 200].

C : Semielliptical vicarious avicularium [x 200].

D : Triangular vicarious avicularium and suboral avicularium [x 200].

## Global Measurements

	range (mm)	mean (mm)	n
Length of the orifices	0.120-0.177	0.148	315
Width of the orifices	0.124-0.193	0.151 <sub>1</sub>	331

## DISTRIBUTION

This species has been reported in the Northeastern Atlantic, from the British Isles to the Gibraltar Strait. Its presence has been also signalled in the Mediterranean, from Alboran to the Aegean Sea.

## CONCLUSION

Both *Turbicellepora avicularis* and *T. magnicostata* show a certain morphological variability. In *T. avicularis* the proportions of the sinus are not constant : the width and the depth of this sinus are variable. In *T. magnicostata* the orifice shows a morphological variability (d'Hondt, 1988) and the frontal ribs may be present or absent, and, if they exist, their development is not uniform, showing even an intracolony variability ; certainly, the specimens from the Cantabrian littoral lack ribs on the frontal wall or have them scarcely developed. In the Mediterranean littoral, the ribs are more frequent and developed, but it is also possible to find colonies with the surface of the autozooids without ribs. In this situation, we must conclude that the morphological characters that allow a more reliable discrimination of the two species are : the anatomy of the vicarious avicularia, the anatomy of the ovicells and the proportions of the orifice.

In *T. avicularis*, the vicarious avicularia are elongate, spatulate, with a well developed palate and a strong crossbar with a very thick columella (Fig. 1 C), or with a triangular mandible and a cystid that may be columnar or squat (Fig. 1 D). In *T. magnicostata*, the vicarious avicularia are elongate, semielliptical, with a poorly developed palate, a slender crossbar and a scarcely discernible columella (Fig. 3 C), or with a blunt triangular mandible (Fig. 3 D).

In *T. avicularis*, the ovicells are prominent, spherical and smooth surface, with the ectooecium showing a variable number of round pores (up to 11) [Fig. 1 A and B]. In *T. magnicostata*, the ovicells are prominent, spherical, with the ectooecium incompletely developed, with four or five round pores, several of which may coalesce to give irregular lacunae (Fig. 3 B).

After calculating the relation (length orifice/width orifice) it is noticed that this relation is different for the two species. Taking the measurements showed in the morphometric studies, it is possible to see that the relation (length orifice/width orifice) is  $\leq 1$  in *T. magnicostata* and always  $> 1$  in *T. avicularis*.

Relation (Length orifice / Width orifice)

	<i>T. avicularis</i>	<i>T. magnicostata</i>
- Atlantic and Mediterranean (Hayward, 1978)	1.11	0.96
- Mediterranean (Alvarez, in press)	1.16	0.94
- Gulf of Cadiz (Alvarez, original)	1.11	-
- Mediterranean (Gautier, 1962)	1.08	0.98
- Bay of Bilbao (Alvarez, original)	-	1.00
- Mediterranean (Alvarez, 1990)	-	0.94

This morphometric study can be made separately in the Atlantic and in the Mediterranean. In the case of *T. avicularis*.

(Mean values, in mm)

	Length orifice	Width orifice	Rel. (L. or/W.or.)
Atlantic	0.146 (N : 480)	0.131 (N : 480)	1.11
Mediterranean	0.149 (N : 47)	0.134 (N : 49)	1.11

In the case of *T. magnicostata* :

(Mean values, in mm)

	Length orifice	Width orifice	Rel. (L. or/W.or.)
Atlantic	0.157 (N : 130)	0.156 (N : 130)	1.00
Mediterranean	0.142 (N : 185)	0.148 (N : 201)	0.95

We can observe that the relation (length orifice/width orifice) is the same in the Mediterranean and in the Atlantic in *T. avicularis*. Nevertheless, in *T. magnicostata* there is a substantial difference in the proportions of the orifice, with the relation (length orifice/width orifice) lower in the Mediterranean, and this species presents an orifice whose dimensions are bigger in the Atlantic than in the Mediterranean.

The assignment to *Turbicellepora avicularis* by Hayward (1978) of all the specimens of *Cellepora armata* considered in his study (Hayward, op. cit. page 569) is corroborated. Thirteen specimens have been studied by this author ; the mean length of the orifice is 0.1508 mm, and the mean width is 0.1397 mm ; so, the relation (length orifice/width orifice) is 1.07 ; this value agrees with the characteristic ratio of *T. avicularis*.

In this study are presented some photographs of the ancestrula of *Turbicellepora magnicostata*. The ancestrula of this species has not been illustrated before. Waters (1925) figured an ancestrula from Liguria which he attributed to *T. avicularis* ; this ancestrula has a frontal

surface surrounded by eight spines. Now, we present some photographs (Fig. 2 D - F) of the ancestrula of *T. magnicostata* with a membranous frontal surface surrounded by eight spines. It is possible that the species whose ancestrula figures Waters (1925) correspond to *T. magnicostata*; in fact, the *Cellepora avicularis* cited by Waters (1879) has been considered a synonym of *T. magnicostata* by Hayward (1978). Furthermore, this author described the ancestrula of *T. avicularis* "with numerous (about 10) short spines" (Hayward, 1978, p. 568).

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