Redescription of the type species of the genus *Polymastia* Bowerbank, 1864 (Porifera, Demospongiae, Hadromerida)

Christine MORROW
Environmental Science Unit, Trinity College,
Dublin 2 (Ireland)

Nicole BOURY-ESNAULT
Centre d'Océanologie de Marseille
(CNRS-Université de la Méditerranée, UMR 6540 DIMAR),
Station marine d'Endoume, F-13007 Marseille (France)
esnault@com.univ-mrs.fr

Morrow C. & Boury-Esnault N. 2000. — Redescription of the type species of the genus *Polymastia* Bowerbank, 1864 (Porifera, Demospongiae, Hadromerida). *Zoosystema* 22 (2) : 327-335.

ABSTRACT
The type species of the genus *Polymastia* Bowerbank, 1864 is *Spongia mamillaris* Müller, 1806. For almost two centuries the type specimen was ignored, but it was recently rediscovered in the Zoological Museum in Copenhagen (Denmark). This type specimen is here redescribed. It corresponds to specimens from the Swedish west coast collected recently close to the type locality and it does not correspond to the common *Polymastia* species from the NE Atlantic coast (North Sea, Channel Sea, British coasts) erroneously called *"mamillaris"* since Johnston (1842) and Bowerbank (1864). This common *Polymastia* corresponds to *Polymastia* (*Spongia*) *penicillus* (Montagu, 1818), according to a reexamination of a specimen from Montagu (BMNH 30.7.3.26 deposited in BMNH in the Dr Grant Cabinet). The main differences between *P. mamillaris* and *P. penicillus* are the number of layers of the cortex, the type of free spicules present in the choanosome which are intermediary tylostyles in *P. penicillus* versus ectosomal tylostyles in *P. mamillaris*, the shape of the spicules cylindrical in *P. penicillus* versus fusiform in *P. mamillaris* and the thickness of the spicules which vary from 4 to 12 µm in *P. penicillus* versus 8 to 24 µm in *P. mamillaris.*

KEY WORDS
Porifera,
Polymastia,
Demosponges,
Hadromerida,
type specimen.

RÉSUMÉ

Redescription de l'espèce-type du genre Polymastia *Bowerbank, 1864 (Porifera, Demospongiae, Hadromerida).*

L'espèce-type du genre *Polymastia* Bowerbank, 1864 est *Spongia mamillaris* Müller, 1806. Depuis pratiquement deux siècles le spécimen-type a été ignoré et vient d'être seulement récemment redécouvert au Zoological Museum à Copenhague (Danemark). Nous redécrivons ici ce spécimen-type. Il correspond aux spécimens récoltés dans les années récentes sur la côte ouest de la Suède et ne correspond absolument pas à l'espèce de *Polymastia* commune en Atlantique N-E (particulièrement sur les côtes de la mer du Nord, de la Manche et de la mer d'Irlande) appelée à tort « *mamillaris* » depuis Johnston (1842) et Bowerbank (1864). Cette *Polymastia* commune correspond à *Polymastia (Spongia) penicillus* (Montagu, 1818) d'après le réexamen d'un spécimen de Montagu (déposé au BMNH 30.7.3.26 dans le Cabinet du Dr Grant). Les différences principales entre *P. mamillaris* et *P. penicillus* sont le nombre de couches qui constituent le cortex, le type de spicules libres présent dans le choanosome qui sont des tylostyles intermédiaires chez *P. penicillus* et des tylostyles ectosomiques chez *P. mamillaris*, la forme des spicules cylindriques chez *P. penicillus* et fusiformes chez *P. mamillaris* et l'épaisseur des spicules qui varient entre 4 à 12 µm chez *P. penicillus* contre 8 à 24 µm chez *P. mamillaris*.

MOTS CLÉS
Porifera, *Polymastia*, Démosponges, Hadromerida, spécimen-type.

INTRODUCTION

The genus *Polymastia* was erected by Bowerbank in 1864. He designated *Halichondria mamillaris* "Johnston, 1842" as the type species and considered it "the best type of *Polymastia"*. In fact the species *"mamillaris"* was not described by Johnston but by Müller (1806) under the name *Spongia mamillaris*. Johnston (1842) transferred *"mamillaris"* from the genus *Spongia* to the genus *Halichondria* and also synonymized *Spongia mamillaris* Müller, 1806 with *Spongia penicillus* Montagu, 1818. Bowerbank followed this view and seems to have ignored the description of Müller as there is no mention of this author in any text of Bowerbank (1864, 1866, 1872-1876) concerning *Polymastia mamillaris*. Vosmaer (1882) followed by Levinsen (1886) and Fristedt (1887) considered both species as distinct mainly because of the presence of very long spicules around the margin of specimens of *"penicillus"*. In fact, as stressed by Topsent (1900) they had confused this species with *Trichostemma hemisphaericum* Sars, 1872 while the description of *"penicillus"* by Montagu is clearly not a *Trichostemma*.

All subsequent spongologists have only taken into account the view of Bowerbank. Many authors ignored the description of Müller and gave Johnston, 1842 as authorship for "*mamillaris*". According to Vosmaer (1935), in fact "nobody has been able to see Müller's original specimen".

The type specimen of *Polymastia mamillaris* has recently been found in the Zoological Museum in Copenhagen (Denmark). That of *P. penicillus* (Montagu, 1818) is in Dr Grant Cabinet at the Natural History Museum, London (BMNH 30.7.3.26). "I have compared the specimens sent to me by Mr Hyndman, from Larne Lough, with the type of Montagu's *Spongia penicillus*, in the possession of Dr Grant…" (Bowerbank 1866: 73).

In this paper we redescribe the type specimen of *Polymastia mamillaris* (Müller, 1806) and the common *Polymastia* species from the NE Atlantic coast erroneously called *"mamillaris"* since Johnston and Bowerbank.

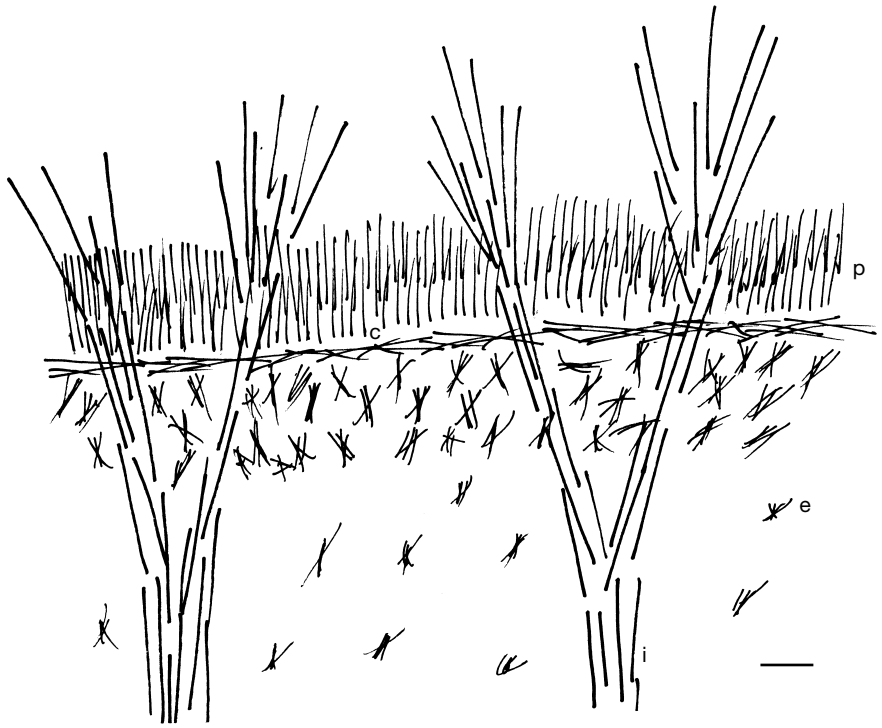

FIG. 1. — *Polymastia mamillaris* (Müller, 1806); drawing of a transversal section of the main body. Abbreviations: **p**, palisade of ectosomal tylostyles; **c**, middle collagenous layer; **l**, tangential layer of intermediary tylostyles; **i**, free intermediary spicules; **e**, groups of ectosomal spicules. Scale bar: 170 µm.

SYSTEMATICS

Polymastia Bowerbank, 1864

Polymastia Bowerbank, 1864: 177; type species *Halichondria (Spongia) mamillaris* by original designation

Pencillaria Gray, 1867: 527; type species *Spongia mamillaris* by original designation

Rinalda Schmidt, 1870: 51; type species *Rinalda uberrima* by original designation

DIAGNOSIS

Polymastiidae, thickly encrusting, spherical or cushion-shaped, always with papillae. Skeleton composed of radial tracts of principal spicules between which free spicules are scattered. Cortex composed of at least two layers, the superficial layer is a palisade of small tylostyles, the lower layer is made of intermediary spicules, tangential, semi-tangential or perpendicular to the surface. Exotyles echinating the surface may be present. The principal spicules can be tylostyles, subtylostyles, styles, or strongyloxeas, intermediary spicules are most often tylostyles, and ectosomal spicules are always tylostyles.

Polymastia mamillaris (Müller, 1806)
(Figs 1; 2D-F)

Spongia mamillaris Müller, 1806: 44. – transferred by Bowerbank 1864: 177.

HOLOTYPE. — **Bohuslän.** North Atlantic (Swedish west coast), 58°15'N, 11°50'E, 2.I.1993, Zoological Museum in Copenhagen (Denmark), labelled Riksmuseel Stockholm.

OTHER SPECIMENS. — From the Zoologisk Museum Copenhagen collected on the Swedish west coast:
Björms Rev. 120-200 m, 11.VII.1975.
Ulvillarna. 150-225 m, 21.III.1977.
East of Ramsô. 99-108 m, 16.V.1974.
Säcken. 76 m, 13.05.1974; 80-90 m, 16.X.1974.

TYPE LOCALITY. — North Atlantic coast: Sweden coast 58°15', 11°50'E.

DESCRIPTION

External characters

The type specimen is a fragment of a cushion-shaped, attached sponge approximately 35 × 18 × 7 mm thick. The upper surface is hispid. The surface of the sponge traps silt and the colour is only discernible on the papillae. The color is cream in alcohol. The specimen has 26 inhalant papillae and one exhalant. The mean length of the inhalant papillae is 8 × 2 mm in diameter. The exhalant papilla is 11 mm long and approximately 4 mm in diameter.

Skeleton (Fig. 1)

The ectosomal skeleton is about 400 µm thick and composed of three layers: the upper layer is a dense palisade (≈ 300 µm thick) of fusiform tylostyles, the middle layer is collagenous (≈ 20 µm thick) and the lower layer is a tangential layer (≈ 80 µm thick) made of intermediary spicules.

Choanosomal tracts of principal spicules are 53-106 μm thick. These tracts are divided into two to three smaller ones below the ectosome. They cross the ectosome and echinate the surface by approximately 875 µm. Groups from two to five ectosomal spicules are scattered between the choanosomal tracts. They are particularly abundant below the tangential layer of intermediary spicules in a layer approximately 500 µm thick.

The skeleton of the inhalant papillae consists of ascending multispicular megasclere tracts that run the length of the papillae. These are supported by a network of intermediary tylostyles arranged perpendicularly to the megascleres tracts. Towards the periphery there is a layer of tangentially arranged intermediary tylostyles and external to this a palisade composed of ectosomal tylostyles.

Spicules (Fig. 2D-F)

Ectosomal tylostyles are fusiform, straight or slightly bent with a well-marked head: 143-196/5.3-16 µm (mean 169/10.6 µm, N > 50).

Intermediary styles or subtylostyles, straight 243-561/8-15.9 µm (mean 445/13.2 µm, N > 50).

Principal spicules are straight, fusiform strongyloxeas, 742-1378/8-32 μm (mean 1052-24.5 μm, N > 50).

REMARKS

We have the opportunity, thanks to our colleague Ole Tendal, to reexamine specimens of *Polymastia* from the Swedish west coast collected between 76 and 225 m deep. These specimens correspond to the type of Müller: ectosomal skeleton composed of three layers, groups from two to five ectosomal spicules scattered between the choanosomal tracts and particularly abundant below the tangential layer of the ectosome, shape of the ectosomal tylostyles (101-182/5.2-11.7, mean 148/8.4 µm, N > 50) and of the principal choanosomal spicules (strongyloxeas 461-1320/10.6-26.5, mean 853/20 µm, N > 50).

On the other hand, the type specimen of *Polymastia mamillaris* does not correspond with what is commonly called *P. mamillaris* in the North East Atlantic (Channel, North Sea, Irish Sea). The North East Atlantic common *Polymastia* has a two-layered cortex, free intermediary tylostyles in the choanosome and the shape of spicules is not fusiform (detailed description in Boury-Esnault 1974, 1987).

Polymastia penicillus (Montagu, 1818)
(Figs 2A-C; 3)

Spongia penicillus Montagu, 1818: 93
not *Polymastia penicillus* Vosmaer 1882: 26. – Levinsen 1886: 346. – Fristedt 1887: 434 (in fact *Trichostemma hemisphaericum*).

HOLOTYPE. — BMNH 30.7.3.26 from a specimen of Montagu in the Dr Grant Cabinet.

OTHER SPECIMENS. — From the South coast of the Channel Sea (Aber Benoit, intertidal zone NBE coll.) and Irish coast (CM coll.).

TYPE LOCALITY. — Precise type locality unknown. The specimen was obtained by dredging on the coast of Devon (Great Britain).

DESCRIPTION

External characters

The type specimen is whole dry and is a small piece with few papillae. This does not allow to

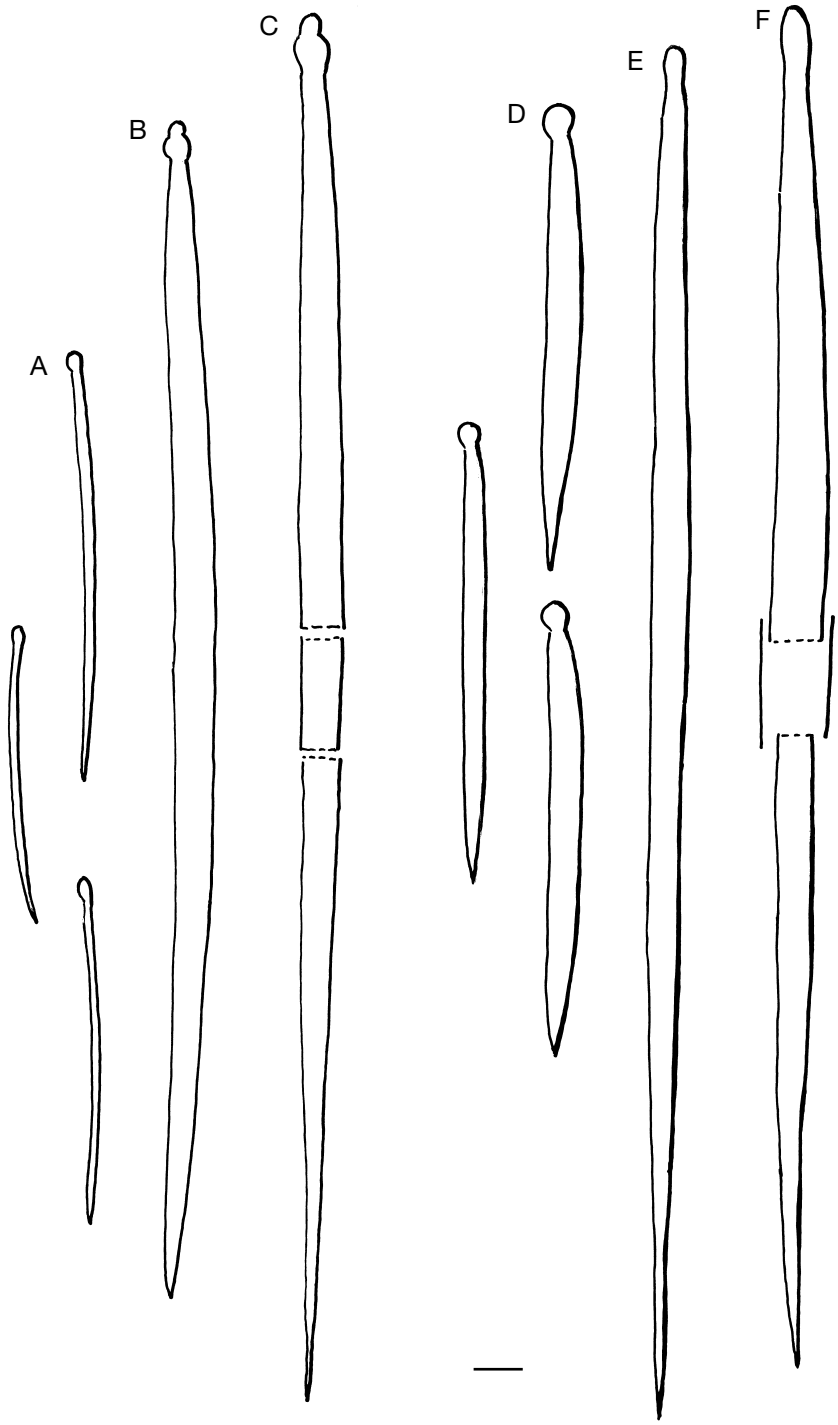

FIG. 2. — **A**-**C**, *Polymastia penicillus* Montagu, 1818; **A**, ectosomal tylostyles; **B**, intermediary tylostyles; **C**, principal tylostyles; **D**-**F**, *Polymastia mamillaris* (Müller, 1806); **D**, ectosomal tylostyles; **E**, intermediary tylostyles; **F,** principal tylostyles. Scale bar: 17 µm.

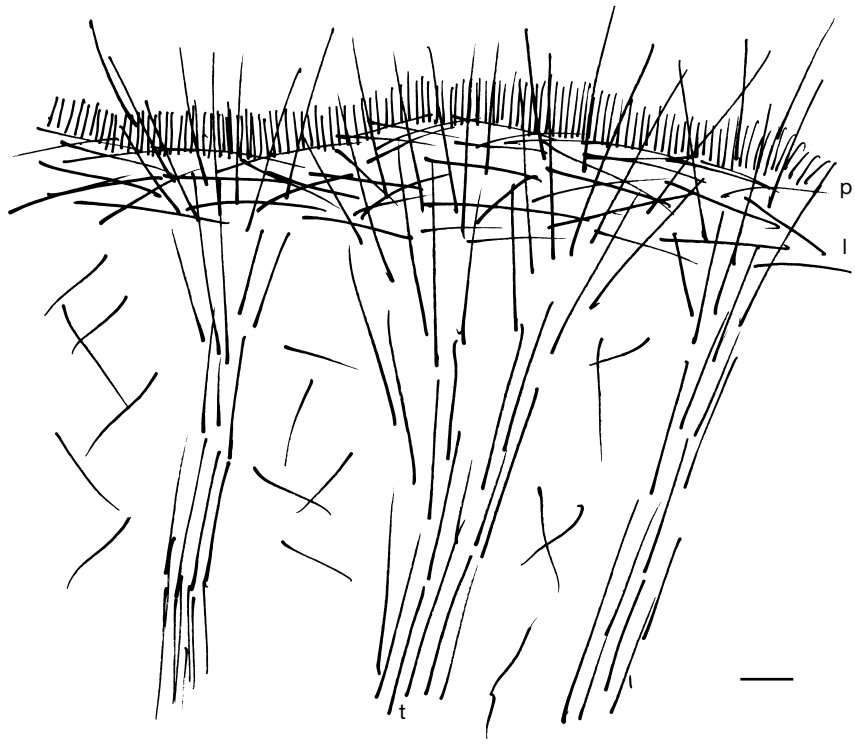

FIG. 3. — *Polymastia penicillus* Montagu, 1818; drawing of a transversal section of the main body. Abbreviations: **p**, palisade of ectosomal tylostyles; **l**, tangential layer of intermediary tylostyles; **t**, longitudinal tracts of principal tylostyles. Scale bar: 170 µm.

give a description of the external characters. Montagu (1818) described this specimen as yellowish and gave a drawing of the external shape (Montagu 1818: pl. 13, fig. 7).

Skeleton (Fig. 3).
The ectosomal skeleton is about 500 µm thick and composed of two layers. The external one is a palisade (≈ 170 µm thick) of ectosomal tylostyles perpendicular to the surface and which lays directly on the internal tangential layer (≈ 340 µm thick) of intermediary tylostyles.
The choanosomal skeleton consists of multispicular tracts of principal tylostyles perpendicular to the surface which they pass through. Free intermediary tylostyles are scattered between these tracts.
The principal skeleton of the papillae is composed of longitudinal tracts of principal tylostyles. They are the extension of the tracts from the choanosome. From the outside to the inside, the skeleton of the papillae is composed of a palisade of ectosomal tylostyles, a tangential layer of intermediary tylostyles which are in continuity with that of the main body, and the longitudinal tracts.

Spicules (Fig. 2A-C)
Ectosomal tylostyles straight or slightly bent with a well-marked head: 154-201/1.5-4 µm (mean 175/2.5 µm, N > 50).
Intermediary tylostyles straight or slightly bent with a head more or less marked: 300-715/8-11 µm (mean 507/10 µm, N > 50).
Principal tylostyles straight or slightly bent with a head more or less marked: 874-1543/8-12 µm (mean 1080/10 µm, N > 50).

REMARKS
The studied specimen of *P. penicillus* is the specimen BMNH (30.7.3.26) from Montagu collection in the Dr Grant Cabinet. We formally

TABLE 1. — Discriminating characters for the species of *Polymastia* from the Atlantic area, reported by Boury-Esnault (1987) and Boury-Esnault *et al*. (1994). Abbreviations: **b**, bent; **e**, ectosomal spicule; **f**, fusiform; **I**, intermediary spicule; **P**, perpendicular; **p**, polytylote; **S**, strongyloxea; **s**, straight; **St**, style; **T**, tylostyle; **t**, tangential.

	Cortex				Choanosome	Papilla	Spicules						
	Thickness in µm	N° of layers	Foreign bodies	Orientation internal layer	Free spicule type	Number / specimen	In cellular lamina	Echinating exhalant canal	N° of types	Type of principal	Type of intermediary	Type of ectosomal	exotyle
P. mamillaris	400	3	-	t	e	>10	?	?	3	S	St	Tf	-
P. penicillus	500	2	-	t	I	>10	-	-	3	T	T	T	-
P. agglutinans	700	2	+	t	I	<10	+	e	3	St	St	T	-
P. conigera	300	2	-	t	I	<10	+	I	3	Tp	Tp	T	-
P. inflata	600	2	-	t	I+e	<10	+	-	3	Sf	Tf	T	-
P. infrapilosa	900-1250	2	-	t	e	>10	+	I	3	S-Tf	Tf	T	-
P. grimaldi	650	3	-	t	e	>100	+	-	4	S-Tf	S-Tf	T	+
P. robusta	700	2	-	t	I	>10	+	-	2	T	= T	T	-
P. spinula	250	2	-	t	I	>10	?	-	3	Sfb	Tfb	Tb	-
P. uberrima	2200	2	-	t	I	>10	+	I	3	Sfs	Ts	Tb	-
P. corticata	2000	2	-	P	I	>100	+	-	3	Stf	Stf	T	-
P. polytylota	350	2	-	t	I+e	1	+	-	3	Tpfs	Tfs	Tb	-
P. littoralis	3000	2	-	t	e	>10	+	-	3	Stf	Tfb	T	-
P. tenax	1000-3000	2	-	P	I+e	>10	+	e	3	Tf	Tf	T	-
P. janeirensis	300-1000	2	+	t	e	>100	-	-	3	St	St	T	-
P. ectofibrosa	300	2	-	t	e	<10	-	e	3	T	T	T	-
P. radiosa	650	2	-	t	e	1	-	-	3	T	T	T	-
P. tissieri	550	2	-	t	e	1-2	-	-	4	Tp	T	T	+

designed this specimen as the type specimen of *Polymastia penicillus*. The common *Polymastia* species from the NE Atlantic coast corresponds exactly with this species (Boury-Esnault 1974, 1987; personal collections of the authors from Irish coast and Channel Sea) and with the specimens (BMNH 1910.1.1.8 and BMNH 1930.7.3.3) from the Bowerbank collection and identified by Bowerbank as *P. mamillaris*.

DISCUSSION

Polymastia mamillaris and *P. penicillus* considered as synonymous since Johnston (1842) are in fact two valid species. The main differences between *P. mamillaris* and *P. penicillus* are the number of layers of the cortex, the type of free spicules present in the choanosome which are intermediary in *P. penicillus* versus ectosomal in *P. mamillaris*, the shape and size of the spicules particularly the thickness of the three types of spicules which vary from 2 to 12 µm in *P. penicillus* versus 11 to 24 µm in *P. mamillaris.*

The redescription of the characters of *Spongia mamillaris* Müller, 1806 does not modify the definition of the genus *Polymastia* as it is presently understood and accepted (Boury-Esnault 1987; Boury-Esnault *et al.* 1994; Kelly-Borges & Bergquist 1997). Consequently the type species of *Polymastia* is *Spongia mamillaris* Müller, 1806, misidentified as *Halichondria mamillaris* "Johnston, 1842" in the original designation by Bowerbank, 1864.

In order to compare the different species of *Polymastia* found in the Atlantic Ocean, we have completed a comparative table made by Boury-Esnault (1987) with further data found in Boury-Esnault *et al*. (1994) (Table 1). No other *Polymastia* known from the Atlantic area corresponds with the true *Polymastia mamillaris* Müller (1806). On the other hand, the type of *P. penicillus* corresponds perfectly with the *Polymastia* species from the NE Atlantic coast erroneously called *"mamillaris"* since Johnston and Bowerbank. This common species is accordingly to be called *P. penicillus* (Montagu, 1818).

In future work, a great attention has to be paid to the geographic distribution of both species. *Polymastia mamillaris* is presently known from the Swedish west coast, the type locality being 58°15'N, 11°50'E. *Polymastia mamillaris* has a more northern distribution than *P. penicillus*. The apparently large geographical distribution of *P. mamillaris* over the whole North Atlantic as well as South Atlantic (Burton 1926) is in fact due to an overconservative taxonomy as it has been demonstrated for many over complex of sponge species (Boury-Esnault *et al*. 1999; Klautau *et al.* 1999). Once more it is necessary to point out the necessity to return to the type specimen, to carefully verify the skeletal characters and to observe the morphological similarities even for a well-known species.

Acknowledgements

We particularly thank Clare Valentine for the help given with the search of the type specimens, Ole Tendal for providing specimens from the Swedish coast and for translation from Danish of the description of Levinsen (1886), Christian Marshal for technical assistance, and Bernard Picton and Jean Vacelet for discussion and help in the improvement of the manuscript.

REFERENCES

Boury-Esnault N. 1974. — Structure et ultrastructure des papilles d'éponges du genre *Polymatia* Bowerbank. *Archives de Zoologie expérimentale et générale* 115: 141-165.

Boury-Esnault N. 1987. — The *Polymastia* species (Demosponges, Hadromerida) of the Atlantic area: 29-66, *in* Vacelet J. & Boury-Esnault N. (eds), *Taxonomy of Porifera from the NE Atlantic and Mediterranean Sea*. Springer-Verlag, Berlin; Heidelberg.

Boury-Esnault N., Pansini M. & Uriz M. J. 1994. — Spongiaires bathyaux de la mer d'Alboran et du golfe ibéro-marocain. *Mémoires du Muséum national d'Histoire naturelle* 160 : 1-174.

Boury-Esnault N., Klautau M., Bézac C., Wulff J. & Solé-Cava A. M. 1999. — Comparative study of putative conspecific sponge populations from both sides of the Isthmus of Panama. *Journal of Marine Biological Association of the United Kingdom* 79: 39-59.

Bowerbank J. S. 1864. — *A Monograph of the British Spongiadae.* Volume 1. Robert Hardwicke, London, 289 p.

Bowerbank J. S. 1866. — *A Monograph of the British Spongiadae.* Volume 2. Robert Hardwicke, London, 388 p.

Bowerbank J. S. 1872-1876. — Contribution to a general history of the Spongiadae. *Proceedings of the Zoological Society of London* 4: 115-129, 196-202, 626-635; 5: 1-25, 319-333; 7: 281-296; 8: 769-775.

Burton M 1926. — Descriptions of South African sponges collected in the South African Marine Survey I. Myxospongida and Astrotetraxonida. *Fisheries and Marine Biological Survey, Report 4 for the Year 1925, Union of South Africa.*

Fristedt K. 1887. — Sponges from the Atlantic and Arctic oceans and the Behring sea. *Vega-Expeditionens Vetensk. Iakttagelser (Nordenskiöld)* 4: 401-471.

Gray J. E. 1867. — Notes on the arrangement of sponges, with the description of some new genera. *Proceedings of the Zoological Society of London*: 492-558.

Johnston G. 1842. — *A History of British Sponges and Lithophytes.* W. H. Lizard, Edinburgh, 264 p.

Kelly-Borges M. & Bergquist P. 1997. — Revision of Southwest Pacific Polymastiidae (Porifera: Demospongiae: Hadromerida) with descriptions of new species of *Polymastia* Bowerbank, *Tylexocladus* Topsent, and *Acanthopolymastia gen. nov.* from New Zealand and the Norfolk Ridge, New Caledonia. *New Zealand Journal of Marine and Freshwater Research* 31: 367-402

Klautau M., Russo C., Lazoski C., Boury-Esnault N., Thorpe J. P. & Solé-Cava A. M. 1999. — Does cosmopolitanism in morphologically simple species result from overconservative systematics? A case study using the marine sponge *Chondrilla nucula. Evolution* 53: 1414-1422.

Levinsen G. M. R. 1886. — Kara-Havets Swampe (Porifera). *Dijmphna-Togtets zoologisk-botaniske Udbytte* 1: 341-372.

Montagu G. 1818. — An essay on sponges, with descriptions of all the species that have been discovered on the Coast of Great Britain. *Memoirs of the Wernerian Natural History Society* 2: 67-121.

Müller O. F. 1806. — *Zoologia danica.* Havniae, Copenhagen: 1-44.

Schmidt O. 1870. — *Grundzüge einer Spongien Fauna des Atlantischen Gebietes.* Wilhelm Engelmann, Leipzig, 85 p.

Topsent E. 1900. — Étude monographique des Spongiaires de France. III: Monaxonida (Hadromerina). *Archives de Zoologie expérimentale et générale* 8 : 1-331.

Vosmaer G. C. J. 1882. — Report on the sponges dredged up in the Arctic Sea by the "Willem Barents" in the years 1878 & 1879. *Niederländisches Archiv für Zoologie,* supplément 1: 1-58.

Vosmaer R. 1935. — *The Sponges of the Bay of Naples: Porifera Incalcaria with analyses of genera and studies in the variations of species.* Volume 2. Martinus Nijhoff, The Hague: 457-828.

Submitted on 10 August 1999;
accepted on 23 November 1999.