

# BEAUFORTIA

INSTITUTE OF TAXONOMIC ZOOLOGY (ZOOLOGICAL MUSEUM)  
UNIVERSITY OF AMSTERDAM

Vol. 43 no. 11

December 31, 1993

## SUBERITIDAE (DEMOSPONGIAE, HADROMERIDA) FROM THE NORTH AEGEAN SEA

ELENI VOULTSIADOU-KOUKOURA\* & ROB W. M. VAN SOEST\*\*

\*Department of Zoology, University of Thessaloniki, 54006 Thessaloniki, Greece

\*\*Institute of Taxonomic Zoology (Zoological Museum), University of Amsterdam,  
P.O.Box 94766, 1090 GT Amsterdam, The Netherlands

Keywords: Sponges, Hadromerida, Suberitidae, North Aegean Sea

### ABSTRACT

Sampling in the North Aegean Sea yielded nine species of the family Suberitidae, four of which, *Pseudosuberites sulphureus*, *P. hyalinus*, *Suberites ficus* and *S. syringella*, are new for the fauna of the Eastern Mediterranean, and three more, *S. carnosus*, *S. domuncula*, and *S. massa*, are new records for the fauna of the Aegean Sea. For each of the nine species comments on the systematics, as well as geographical and ecological information is given. A redescription is given of the little known species *Suberites massa* Nardo. A review of the distribution of all Mediterranean Suberitidae is also presented, in which it is concluded that a further three species not represented in our material have been reported from the Eastern Mediterranean, viz. *Laxosuberites ectyoninus*, *Prosuberites longispina*, and *P. epiphytum*. Six suberitids reported from other parts of the Mediterranean so far have not been found in the Eastern Mediterranean.

### INTRODUCTION

Knowledge of Eastern Mediterranean sponges is poor compared to that of other parts of the Mediterranean (cf. Van Soest, 1994: Fig. 2). Recent collecting activities in the North Aegean Sea have been organized especially for the purpose of increasing this knowledge, and thus of enabling more firmly based conclusions on alleged Eastern Mediterranean endemism and generally low diversity. In an ongoing series of papers (e.g. Voultsiadou-Koukoura, et al. 1991; Voultsiadou-Koukoura & Van Soest 1991a,b; Voultsiadou-Koukoura & Koukouras, 1993), the results of the sponge collecting have been and are being reported; several species new to science and apparently endemic to the Eastern Mediterranean have been described.

The present paper deals with the Hadromerid family Suberitidae. Thusfar, only five species of this family were reported from Greek waters: *Rhizaxinella pyrifer* (Della Chiaje), *Terpios fugax*

Duch. & Mich., *Laxosuberites ectyoninus* Topsent, *Prosuberites longispina* Topsent and *P. epiphytum* (Lamarck). From other Eastern Mediterranean localities also *Suberites domuncula* (Olivier) (Sea of Marmara and Black Sea), *S. carnosus* (Johnston) (Suez Canal) and *S. massa* Nardo (Sea of Marmara) were recorded.

The purpose of this paper is to give new systematic, ecological and zoogeographical information on the Suberitidae of the Aegean Sea and more generally of the Eastern Mediterranean, as well as an account of the distribution of the species belonging to this family in the Mediterranean.

## MATERIAL AND METHODS

A total of 105 specimens were examined, collected from various localities in the North Aegean Sea. Sampling was made by SCUBA diving, fishing nets, dredges and grabs, in depths from 3 to about 150 m. The examined material is deposited in the Museum of the Department of Zoology, University of Thessaloniki and partly in the Zoological Museum of Amsterdam.

## SYSTEMATIC REMARKS AND DESCRIPTIONS

### Family Suberitidae Schmidt, 1870

Remarks on the definition of the family, including a brief survey of its history, and its distinctness from the closely related family Polymastiidae Gray, 1867, which shares with the Suberitidae the absence of aster- or streptaster microscleres:

Schmidt (1870): "..... without special cortical structures.... spicules in confusion or in reticulate tracts.... spicules in the periphery directed outwards..." (translated from German) (Schmidt includes *Radiella* and part of the *Polymastia* species, which are now grouped in the family Polymastiidae).

Topsent (1900): "Clavulida normally without microscleres; no differentiated cortex; no radiating skeleton. Megasccleres almost constantly tylostyles." (translated from French) (Topsent de-

fining a separate family Polymastiidae as having a differentiated cortex and a radiating skeleton).

Lévi (1973): "Hadromerida ... without digitate papillae. The skeleton, often confused in the interior, is generally radiating at the periphery." (translated from French) (Lévi defined a separate family Polymastiidae as having "...generally two or three categories of tylostyles; ...with digitate erect papillae...").

Bergquist (1978): "...radial arrangement of the skeleton is evident only at the surface. The spicules have confused orientation in the deeper regions of the sponges, but in a few cases may assume a loose axial orientation." (Bergquist defined a separate family Polymastiidae as having "...tylostyles... always divisible into two or three clear size categories. Microscleres are rare, but acanthose micro-oxeas can be present. The ...body with erect oscular and pore-bearing papillae is characteristic for the family").

Hartman (1982) follows Bergquist's definition closely, but assigns spined centrotylote diactinal "microscleres" to the suberitids instead of to the polymastiids.

By comparing the various definitions of the family Suberitidae, there are few definite characters by which it can be identified without referring to the Polymastiidae: Suberitidae do not have papillae (but some Polymastiidae such as certain *Aaptos* species, also lack them, while other non-polymastiid Hadromerids, like *Cliona*, sometimes have papillae), there should be no cortical specialization (but it is as yet unclear to which extent that exists in genera other than *Polymastia*) and no clear megascclere size categories are allowed (but *Suberites* species frequently have a clearly smaller tylostyle size in the peripheral bouquets). The only character all authors agree upon is the confused nature of the choanosomal skeleton; however the skeletons of e.g. *Rhizaxinella* spp., and also that of *Suberites massa* described below, are well organized in an axial skeleton of aligned larger tylostyles and an extra-axial skeleton of radiating bundles of smaller tylostyles. We agree with Boury-Esnault (1987) that the Suberitidae-Polymastiidae are in need of a critical revision.

The following nine suberitid species, belonging to four genera were found in the collected material:

Genus *Pseudosuberites* Topsent, 1893

Suberitidae with tangential *Halichondria*-like detachable ectosomal skeleton, covering large subdermal spaces; choanomal skeleton also a *Halichondria*-like confused mass of tylostyles (rephrased after Topsent, 1900).

***Pseudosuberites sulphureus*** (Bowerbank, 1866)

*Suberanthus flavus*; Von Lendenfeld, 1896: 144, pl. V, VII, XII (not: *Halichondria flava* Lieberkühn, 1859).

Two specimens were collected on the coast of the Sithonia Peninsula (Singitikos Bay), at a depth of 4 m, attached to a colony of the coral *Cladocora caespitosa*. The morphology and skeletal structure conform to Topsent's (1900) description; tylostyles measured 300-500 x 4-12  $\mu\text{m}$ .

The species was not previously found in the Eastern Mediterranean, but it has been widely reported elsewhere, both in the Mediterranean (e.g. Topsent, 1925; Pulitzer-Finali, 1983) and on the Eastern Atlantic coasts (e.g. Topsent, 1900). *P. sulphureus* may be confused with *P. mollis* Topsent (1925, 1934); the spicules of this Western Mediterranean species, however, are appreciably smaller and thinner (up to 365 by 8  $\mu\text{m}$ ).

***Pseudosuberites hyalinus*** (Ridley & Dendy, 1887)

Six specimens were collected in Thermaikos and Pagasitikos Bays and off the coasts of Lesbos Island, at depths of 60 - 150 m, on rocks and coralligenous substrates. The morphology and skeletal structure conform to Topsent's (1900) descriptions; the fusiform tylostyles measured 300-850 x 4-20  $\mu\text{m}$ .

This is the first record of the species from the Eastern Mediterranean. Originally it was described from the coast of Patagonia in the South Atlantic (Ridley & Dendy, 1887); Topsent's (1898, 1900) decision (followed by all other au-

thors) that the Mediterranean and North Atlantic specimens of the present species are conspecific with the South Atlantic ones remains to be demonstrated. Several specimens described from the Mediterranean have considerably smaller spicules than the maximum given by Ridley & Dendy (1100 by 25  $\mu\text{m}$ ) and Topsent (1900) (1200 by 26  $\mu\text{m}$ ), viz. Vacelet (1969): 660 by 22  $\mu\text{m}$ , Pulitzer-Finali (1983): 810 by 17  $\mu\text{m}$ . On the other hand, specimens described by Uriz (1988) from deep water off Namibia, show considerably bigger spicules (up to 2030  $\mu\text{m}$ ).

Genus *Terpios* Duchassaing & Michelotti, 1864

"Thinly encrusting Suberitidae with gelatinous choanosome containing small tylostyles in disorderly arrangement" (Topsent, 1900)(translated from French).

Remark: There has been a tendency among authors - probably unwarranted - to confine the use of *Terpios* to thinly encrusting suberitids with poly-lobate tylostyle heads (cf. De Laubenfels, 1936:152), in order to avoid confusion with *Prosuberites* (encrusting Suberitidae with tylostyles erect on the substrate with points outward), and *Laxosuberites* (encrusting or massive Suberitidae with the tylostyles arranged in radiating tracts ending in surface bouquets) (both as defined by Topsent, 1900). However, *Terpios*, *Prosuberites* and *Laxosuberites* characters seem to occur in various combinations in different species. For example the Indo-West Pacific species "*Suberites*" *cruciatulus* Dendy has the quadrilobate tylostyle-heads of *Terpios* combined with a *Laxosuberites* architecture. A revision of encrusting suberitids might reveal that the differences between these "genera" are artificial.

***Terpios fugax*** Duchassaing & Michelotti, 1864

*Hymeniacion gelatinosa* Bowerbank, 1866: 222; 1874: 95, pl. XXXVIII figs 7-8; 1882: 88.

*Hymedesmia tenuicula* Bowerbank, 1882: 62, pl.I fig. 5.

Two specimens were collected in Thermaikos Bay, at depths of 25-30 m, forming encrustations

on stones and polychaete tubes. The morphology and architecture conformed to Topsent's (1900) description; spicules measured 250-400 x 4-6  $\mu\text{m}$ .

This species has been reported previously from the Aegean Sea (Saronikos Bay) by Peres & Picard (1958); elsewhere in the Mediterranean it was reported frequently (e.g. Von Lendenfeld, 1896; Topsent, 1900, 1925; Pulitzer-Finali, 1978). Originally, it was described from the Virgin Islands (Caribbean), where it is a common species. Whether Von Lendenfeld's (1896) and Topsent's (1898, 1900) decision that the Caribbean specimens are conspecific with Mediterranean and Eastern Atlantic specimens is correct, remains to be demonstrated. Casual comparison of Caribbean specimens in the ZMA collection with the present material revealed that the latter have considerably thicker tylostyles (250-400 by 4-6  $\mu\text{m}$  against 100-305 by 1-3.5  $\mu\text{m}$ ), which show also less strongly lobate/flattened heads than the Caribbean specimens.

Genus *Suberites* Nardo, 1833

"Massive, compact, velvety surface; no detachable ectosome; confused skeleton; surface spicules smaller and vertically arranged. Often gemmules, on the substrate." (Topsent, 1900) (translated from French).

Remark: In accordance with most recent authors we consider specimens with centrotylote micro-rhabds (assigned to a separate genus *Ficulina* Gray, 1867 in the older literature) congeneric. The confused skeleton referred to in the definition of *Suberites* often takes the form of an anastomosing series of aligned spicules ("reticulation") or, in branching forms, an axial concentration of aligned spicules or tracts. Peripherally, the spicules are arranged in bouquets, a feature shared with *Laxosuberites*.

***Suberites ficus*** (Linnaeus, 1767)

*Ficulina ficus*; Von Lendenfeld, 1896: 94, pls. III, VI, VII, XI.

Over 30 specimens of this species were collected

in Thermaikos, Singitikos and Pagasitikos Bays, and off the coasts of Chios Island, at depths of 30-150 m, on muddy substrates. In almost all cases the sponge was attached to empty gastropod shells, formerly inhabited by hermit crabs. Spicules include tylostyles measuring 160-400 x 2-8  $\mu\text{m}$  and centrotylote micro-rhabds measuring 20-120 x 1-4  $\mu\text{m}$ .

The species was not hitherto known from the Eastern Mediterranean. Mediterranean records are from the Adriatic (Von Lendenfeld, 1896), the coasts of France (Topsent, 1934) and Spain (Uriz, 1978). Outside the Mediterranean, it is a common species off the coasts of Western Europe (e.g. Van Soest, 1977) and West Africa (e.g. Uriz, 1988; Van Soest, 1993).

***Suberites domuncula*** (Olivi, 1792)

25 specimens were found in Thermaikos and Kavala Bays, and off the island of Lesbos, at depths of 3-110 m, on muddy and coralligenous bottoms. As is customary in this species, they were always attached to and completely surrounding gastropod shells, in this case of *Phyllonotus trunculus* and *Aporrhais pespelecani*. Spicule sizes: tylostyles 100-350 x 4-8  $\mu\text{m}$  and oxeas 250-350 x 4-8  $\mu\text{m}$ .

The species is reported for the first time from the Aegean Sea, although it was already known from the nearby Sea of Marmara and the Black Sea (Arndt, 1947). It is very common in the Western Mediterranean (e.g. Topsent, 1925; Sarà, 1960; Rützler, 1967; Uriz, 1978) and off the coasts of West Africa (Van Soest, 1993).

***Suberites carnosus*** (Johnston, 1842)

Ten specimens were found in Thermaikos Bay and off Lesbos Island, at depths from 2 to 150 m, nine of which had the typical clavate form and one the incrusting form. All the typical specimens were found attached on hard substrates, such as stones or gastropod shells and the encrusting form on the carapace and the walking legs of the crab *Inachus communissimus*. Tylostyle sizes were found to be 300-800 x 8-20  $\mu\text{m}$ .

A wide variety of growth forms were assigned



Fig.1. *Suberites massa* Nardo, long-branched fragments from the Aegean Sea (natural size).

to this species (cf. Topsent, 1900), from clavate with apical oscule, through thickly and thinly ramose, to massively encrusting-lobose. These growth forms are not readily recognizable in the original area from which the species was described (i.e. the British Isles), where only the clavate (sometimes doubly clavate) growth form is found (see Hiscock et al., 1984; Ackers et al., 1988). The clavate form (fo. *typica* sensu Topsent) is found throughout the Mediterranean and also occurs in the Aegean Sea. Thinly ramose growth forms (fo. *ramosa* sensu Topsent) have been recently reassigned to a separate species, *Suberites syringella* (Schmidt) (see below), while lobate forms (fo. *flava* sensu Topsent) are assignable to *Suberites massa* Nardo. Thinly encrusting growth forms (fo. *incrustans* sensu Topsent) are difficult to distinguish from *Prosuberites epiphytum*, and may be the initial stages of one of the mentioned species.

This is the first record of this species from the Aegean Sea. Previously, it was found in the Suez

Canal by Burton (1926), and generally is regarded as very common all over the Mediterranean (e.g. Boury-Esnault, 1973; Uriz, 1978). Records from the Atlantic and the Indo-Pacific Oceans (e.g. Topsent, 1900; Bergquist, 1968) indicate this as an alleged cosmopolitan species.

***Suberites massa* Nardo, 1847**

Figs. 1-3.

*Suberites massa* Nardo, 1847; Schmidt, 1862: 67, pl.VII fig. 2 (cf. also Desqueyroux & Stone, 1992: pl. 14 fig.80); Von Lendenfeld, 1896: 126, pl.4 figs. 39-41.

*Halichondria lobata* Lieberkühn, 1859: 353.

*Halichondria flava* Lieberkühn, 1859: 353.

*Suberites lobatus* Schmidt, 1862: 68 (cf. also Desqueyroux & Stone, 1992: pl. 13 figs.76-79)

*Suberites flavus*; Schmidt, 1862: 68 (cf. also Desqueyroux & Stone, 1992: pl. 12 figs. 71-72)

Not: *Suberanthus flavus* sensu Von Lendenfeld, 1896:

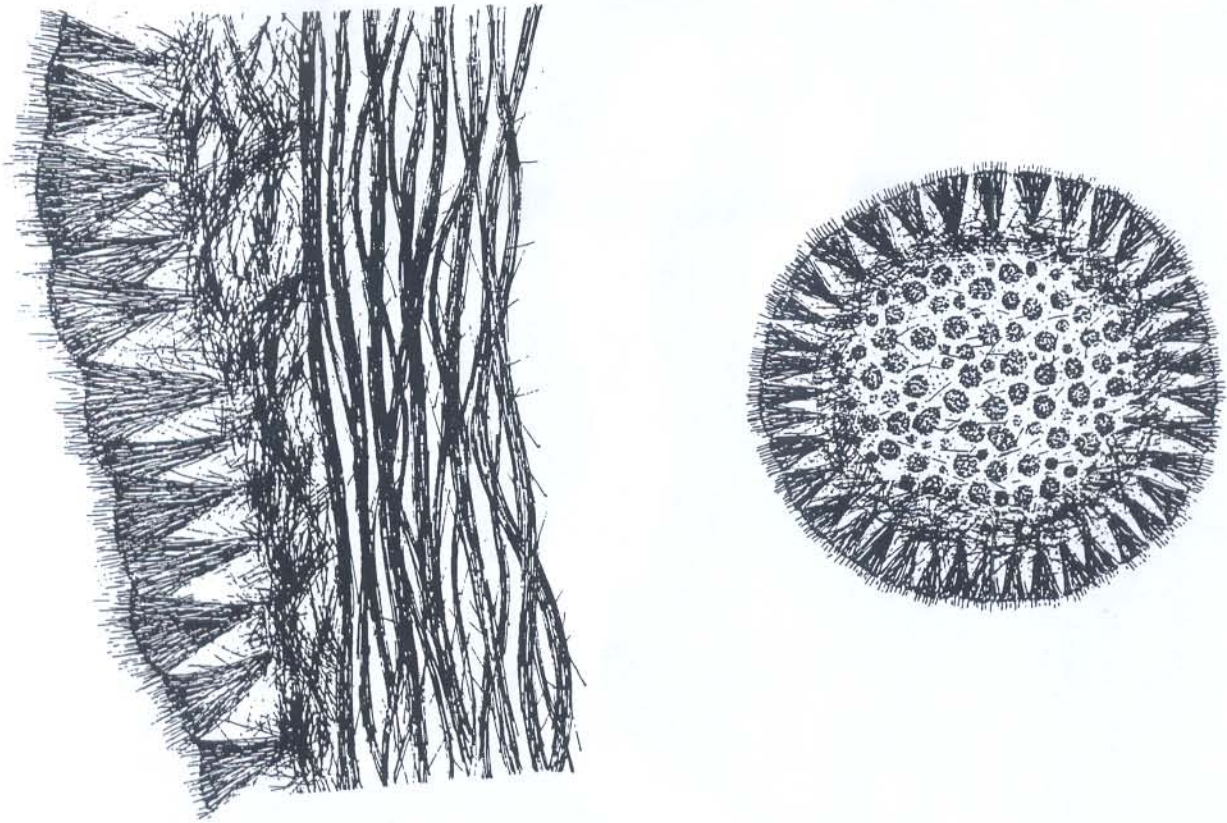


Fig. 2. *Suberites massa* Nardo, skeletal structure: left, longitudinal section showing surface spicule brushes on the left and axial spicule bundles on the right, right, cross section through a branch showing surface brushes and axial bundles.

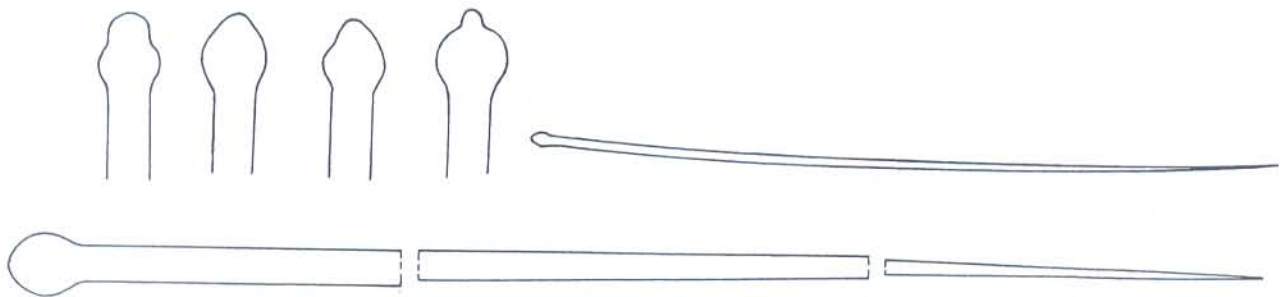


Fig. 3. Spicules of *Suberites massa* Nardo.

144 (= *Pseudosuberites sulphureus*)

*Suberites hystrix* Schmidt, 1868: 15.

*Suberites carnosus flavus*; Topsent, 1900: 231.

Four specimens belonging to this species were found. Three are fragmentary branches found in Thermaikos Bay (Cape Epanomi) at a depth of about 30 m, one is a mass of broken branches (Fig. 1) presumably belonging to a single specimen collected also in Thermaikos Gulf by dredging at a depth of about 60 m. Although not originating from the Aegean Sea mention must be made of one very well preserved branching erect specimen from Rovinj (Adriatic Sea) stored in the collections of the ZMA (reg.no. 10471; no information available on its habitat).

All specimens had the same general structure: branching with elongate, almost erect branches, generally flattened but in some places cylindrical. Their thickness varied from 4 to 12 mm. The color is beige to brownish in alcohol. Consistency is firm and moderately elastic, easily torn. Surface is smooth, finely rugose in some places with a minutely velvety feeling due to the spicules protruding from the sponge surface.

In all specimens there is a clearly recognizable *axial skeleton surrounded by a well distinguishable peripheral layer* (Fig. 2). The axial part may be cylindrical or flattened in cross section covering from 30 to 80% of the total width of the branch. It is made up of multispicular tracts 50-100  $\mu\text{m}$  in diameter, the vast majority of which are straight, arranged parallel to one another, crossed by some wavy ones. They consist of large tylostyles measuring 730-1000 x 14-20  $\mu\text{m}$ ; these are straight or slightly curved with a rounded or subterminal head (Fig. 3). The peripheral skeleton consists of small tylostyles oblique or vertical to the axial tracts, which are not strictly organized. They either lie in short tracts or are arranged in a confused manner with a general direction towards the sponge surface. Near the surface, the spicules are organized in fan-shaped brushes (Fig. 2) vertical or slightly oblique to it. They have a ray length of about 500  $\mu\text{m}$  and they form an angle of about 30°. The small tylostyles forming the brushes penetrate the sponge surface

giving rise to a dense hispidation. Extra-axial tylostyles measure 180-350  $\mu\text{m}$  not differing in shape from the large ones (Fig. 3).

This is the first record of the species from the Aegean Sea. It was previously reported from the Atlantic European coasts (Arndt, 1935; Borojevic et al., 1968), the Adriatic (Von Lendenfeld, 1896) and also from the Sea of Marmara (Arndt, 1947). According to Von Lendenfeld (1896) and other authors *S. lobatus* (Lieberkühn, 1859) and *S. antarcticus* Carter, 1882 are synonyms of *S. massa*. *S. antarcticus* var. *mediterranea* Ferrer-Hernandez, 1922 is probably also a junior synonym of this species.

Most records of this species, other than those of Von Lendenfeld (1896), concern specimens with a massive base from which issue branches of varying length, often merely short thick outcrops; the occurrence of long-branched forms such as found by us is apparently much rarer.

### ***Suberites syringella* (Schmidt, 1868)**

*Raspailia syringella* Schmidt, 1868: 10, pl.2 fig. 9

*Suberites carnosus* var. *ramosus* Topsent, 1900: 235, pl.7 figs. 1-2; Uriz, 1978: 74, fig. 44.

*Suberites carnosus* var. *syringella*; Topsent, 1938: 13

*Suberites syringella*; Pulitzer-Finali, 1978: 24, fig. 2; 1983: 483.

Four specimens were found off Chios Island, at a depth of about 150 m, on fragments of hard substrate. The species is characterized by a repent ramose growth form, with thin branches, not exceeding 3-4 mm in diameter. Axial and extra-axial skeletons are not separately recognizable, with choanosomal spicule bundles bending off to end at the surface in a confused mass of spicules; bouquets are ill-developed. Typical tylostyle sizes: in the choanosome: 450 by 5  $\mu\text{m}$ , in the periphery: 210 by 3  $\mu\text{m}$ . Size range: 150-500 x 3-6  $\mu\text{m}$ .

The species has not been reported from the Eastern Mediterranean before. It is known from the coasts of Algeria (Schmidt, 1868), Banyuls (Topsent, 1900), Sicily (Topsent, 1928), Monaco (Topsent, 1934), Naples (Pulitzer-Finali, 1978), Corsica (Vacelet, 1960; Pulitzer-Finali, 1983),

Table 1

Mediterranean Suberitidae and their distribution in the Western Mediterranean (WM), Adriatic (AD), Eastern Mediterranean (EM), Aegean Sea (AS), Black Sea (BS), Atlantic (ATL) and Indo-Pacific (IPC).

MEDITERRANEAN SUBERITIDAE	WM	AD	EM	AS	BS	ATL	IPC
<i>Laxosuberites ectyoninus</i> Topsent	*		*	*			
<i>Laxosuberites rugosus</i> (Schmidt)	*	*					
<i>Prosuberites brevispinus</i> Laubenfels	*				*		
<i>Prosuberites epiphytum</i> (Lamarck)	*	*	*	*	*	*	
<i>Prosuberites longispina</i> Topsent	*	*	*	*		*	
<i>Prosuberites modestus</i> Pulitzer-Finali	*						
<i>Prosuberites rugosus</i> Topsent	*						
<i>Pseudosuberites hyalinus</i> (Ridley & Dendy)	*		*	*		*	
<i>Pseudosuberites mollis</i> Topsent	*					*	
<i>Pseudosuberites sulphureus</i> (Bowerbank)	*	*	*	*			
<i>Rhizaxinella elongata</i> (Ridley & Dendy)	*	*				*	
<i>Rhizaxinella gracilis</i> (Von Lendenfeld)	*	*					
<i>Rhizaxinella pyrifer</i> (Delle Chiaje)	*	*	*	*		*	
<i>Suberites ficus</i> (Linnaeus)	*	*	*	*		*	*
<i>Suberites domuncula</i> (Oliv)	*	*	*	*	*	*	*
<i>Suberites carnosus</i> (Johnston)	*	*	*	*	*	*	*
<i>Suberites massa</i> Nardo	*	*	*	*		*	
<i>Suberites syringella</i> (Schmidt)	*		*	*	*	*	
<i>Terpios fugax</i> Duch. & Mich.	*	*	*	*		*	

and possibly from West Africa (Van Soest, 1993: pl. IC).

To summarize, the well-established *Suberites* species known up till now from the Mediterranean are the following: *S. ficus* (L.), *S. domuncula* (Oliv), *S. carnosus* (Johnston), *S. syringella* (Schmidt) and *S. massa* (Nardo). A further two species are mentioned in the checklist of Pulitzer-Finali (1983): *Suberites bursa* (Schmidt, 1862) and *S. hystrix* (Schmidt, 1868). The first is probably not a *Suberites* (cf. Vosmaer, 1935: 421) but remains ill-known because it has never been redescribed (cf. also Desqueyroux & Stone, 1992: pl. 11 figs. 64-65), the latter is a junior synonym of *Suberites massa* (cf. Topsent, 1938: junior synonym of *S. carnosus*, lobate form).

#### Genus *Rhizaxinella* Keller, 1880

"Suberitidae with a simple or branched thin peduncle, normally attached to the substrate by a

group of 'roots'; body globular, ovoid or cylindrical, velvety or finely hispid, compact, with a more or less radiating skeleton, and with an apical oscule" (Topsent, 1900) (translated from French).

#### ***Rhizaxinella pyrifer*** (Delle Chiaje, 1829)

20 specimens were found in Thermaikos and Strymonikos Bays, off the north coasts of Evia Island and off Lesbos Island, at depths of 70-150 m, on stones and rocks. Two of the specimens found in Thermaikos Bay were attached to the scleractinian *Caryophyllia smithi* Stokes & Broderip. All specimens conformed to Topsent's (1900) description; spicules are tylostyles measuring 300-1200 x 7-20 µm, flexuous tylostyles 800-2500 x 3-8 µm and raphids 80-120 µm.

The species was previously reported from the Aegean Sea (Saronikos Bay) by Vamvakas (1970). It is common in the Western Mediterranean (e.g. Sarà, 1960).



## ZOOGEOGRAPHICAL REMARKS

Of the nine suberitids found in the Aegean Sea during this survey, four species, viz. *Pseudosuberites sulphureus*, *P. hyalinus*, *Suberites ficus* and *S. syringella* are new records for the fauna of the Eastern Mediterranean. Three more species are new records for the fauna of the Aegean Sea: *Suberites domuncula* and *S. massa* previously reported only from the Sea of Marmara (Arndt, 1947) and *S. carnosus* from the Suez Canal (Burton, 1926).

Apart from the nine species found during this study, three further suberitid species have been previously recorded from the Aegean Sea: *Laxosuberites ectyoninus* Topsent and *Prosuberites longispina* Topsent in an ecological study carried out in Saronikos Bay by Vamvakas in 1970 (the sponge material was identified by J. Vacelet), and *Prosuberites epiphytum* (Lamarck) by Saritas (1973) off the Turkish coasts. Thus, up to the present, twelve suberitid species are known from the Aegean Sea. The same number of species is known from the Eastern Mediterranean.

The number of Suberitidae species known up to the present from the whole Mediterranean, including the Black Sea and the Sea of Marmara, is 19 (excluding two dubious *Suberites* species, see above). These species are listed in Table I with their distribution also given in the Western Mediterranean basin (including the French, Spanish, Western Italian and Algerian coasts), the Adriatic Sea, the Aegean Sea, the Eastern Mediterranean (including the Sea of Marmara), the Black Sea, the Atlantic and the Pacific Oceans. The most important of the references taken into account are the following: Von Lendenfeld, 1896; Topsent, 1900, 1934; Ferrer-Hernandez, 1916; Babic, 1922; Arndt, 1935, 1947; De Laubenfels, 1951; Hartman, 1958; Vacelet, 1960, 1969; Rützler, 1965; Bergquist, 1968; Borojevic et al., 1968; Bacescu et al., 1971; Vamvakas, 1970; Saritas, 1973; Pulitzer-Finali, 1978; Uriz 1978, 1988.

As can be seen from the table, five of these species, *Prosuberites epiphytum*, *Pseudosuberites hyalinus*, *Suberites ficus*, *S. domuncula* and *S. carnosus* allegedly are cosmopolitan. Furthermore, the species *Prosuberites longispina*, *Pseudosuberites mollis*, *Rhizax-*

*inella elongata*, *R. pyrifer*, *Suberites massa*, *Suberites syringella*, and *Terpios fugax* have an Atlanto-Mediterranean distribution. In addition, of *Pseudosuberites mollis* which has been recorded from Aqaba by Burton (1952), Por (1978) mentions that it is an Anti-Lessepsian migrant, although its presence in the Eastern Mediterranean has not been reported yet. *Prosuberites brevispinus* described by De Laubenfels (1951) from the Black Sea has not been found elsewhere in the Mediterranean, and it is possibly an endemic of this area. The remaining six species, *Laxosuberites ectyoninus*, *L. rugosus*, *Prosuberites modestus*, *P. rugosus*, *Pseudosuberites sulphureus*, and *Rhizaxinella gracilis* can be characterized as Mediterranean endemics.

Up to the present, the status of the suberitid fauna in the above areas of the Mediterranean is the following: 17 species are known from the Western Basin, 12 from the Adriatic, 12 from the Aegean, 12 from the Eastern Mediterranean, and 4 from the Black Sea. The lower number of species found in the Adriatic and the Aegean Sea in comparison to that found in the Western basin could be attributed on one hand to the limited research effort carried out in the former areas and secondly to the enrichment of the Western basin with Atlantic species. The very low number of species in the Black Sea is presumably due to the reduced salinity of its waters. The above observations are in accordance with those made on the distribution of the keratose sponges in the Mediterranean (Voultsiadou-Koukoura & Koukouras, 1993), as well as on the distribution of other animal groups such as decapod crustaceans (Koukouras et al. 1992).

## REFERENCES

- ACKERS, R.G., D. MOSS, B.E. PICTON & S.M. STONE, 1985. Sponges of the British Isles. Marine Conservation Society, Ross-on-Wye, U.K.: 1-199.
- ARNDT, W., 1935. Porifera. In: G. Grimpe, ed. Die Tierwelt der Nord- und Ostsee, 27(3a): 1-140.
- ARNDT, W., 1947. Verzeichnis der bisher von der Schwarzen Meer-Küste Bulgariens und Rumäniens angegebenen Schwämme. Publ. mar. biol. Stat. Varna Bulg., 13: 1-28.
- BABIC, K., 1922. Monactinellida und Tetractinellida des

- Adriatischen Meeres. Zool. Jb. Abt. Syst., **46**: 217-302.
- BACESCU, M., G.I. MÜLLER, & M.T. GOMOIU, 1971. Ecologie Marina. Vol.IV. Ditura Academiei Republicii Socialiste Romania:1- 460.
- BERGQUIST, P.R., 1968. The marine fauna of New Zealand: Porifera, Demospongiae, Part 1 (Tetractinomorpha and Lithistida). New Zealand oceanogr. Inst. Mem. **37**: 1-105.
- BERGQUIST, P. R., 1978. Sponges. Hutchinson & Co., London :1-218.
- BOROJEVIC, R., L. CABIOCH & C. LÉVI, 1968. Spongiaires. Inventaire de la faune marine de Roscoff. Ed. Stat. Biol. Roscoff: 1- 41.
- BOURY-ESNAULT, N., 1973. Résultats scientifiques des campagnes de la "Calypso" au large des côtes atlantiques de l' Amerique du Sud (1961-62). 29. Spongiaires. Ann. Inst. océan. Monaco, **49** (suppl.): 263-295.
- BOURY-ESNAULT, N., 1987. The *Polymastia* species (Demosponges, Hadromerida) of the Atlantic area. In: J. Vacelet & N. Boury-Esnault, eds. Taxonomy of Porifera from the N.E. Atlantic and Mediterranean Sea. NATO ASI ser. vol. **G13**: 29-66.
- BOWERBANK, J.S., 1866. A monograph of the British Spongiadae. II. Ray Soc. London: 1-388.
- BOWERBANK, J.S., 1874. A monograph of the British Spongiadae. III. Ray Soc. London: 1-367.
- BOWERBANK, J.S., 1882. A monograph of the British Spongiadae. IV. Ray Soc. London: 1- 245.
- BURTON, M., 1926. Report on the sponges. Cambridge Expedition to the Suez Canal. Trans. zool. Soc. London, **27** (1): 71-83.
- BURTON, M., 1952. The "Manihine" expedition to the Gulf of Aqaba, 1948-49. III. Sponges. Bull. Brit. Mus. nat. Hist. Zool., **1**: 163-174.
- DESQUEYROUX-FAUNDEZ, R. & S.M. STONE, 1992. O.Schmidt Sponge Catalogue. An illustrated guide to the Graz Museum collection, with notes on additional material. Muséum d'Histoire Naturelle Geneva: 1-190, 49 pls.
- FERRER-HERNANDEZ, F., 1916. Fauna del Mediterraneo occidental. Esponjas Espanolas. Trab. Mus. nac. Cienc. nat. Zool., **27**:1-52.
- HARTMAN, W.D., 1958. Natural history of the marine sponges of Southern New England. Bull. Peabody Mus. nat. Hist., **12**: 1-155.
- HARTMAN, W.D., 1982. Porifera. In: S.P. Parker, ed. Synopsis and classification of living organisms. MacGraw-Hill, New York: 640-666.
- HISCOCK, K., S.M. STONE & D.J. GEORGE, 1983. The marine fauna of Lundy. Porifera (Sponges). A preliminary study. Rep. Lundy Fld. Soc., **34**: 16-35.
- KOUKOURAS, A., C. DOUNAS, M. TÜRKAY & E. VOULTSIADOU-KOUKOURA, 1992. Decapod Crustacean fauna of the Aegean Sea: New information, Check List, Affinities. Senckenbergiana marit., **22** (3/6): 217-244.
- LAUBENFELS, M.W. de, 1936. A discussion of the sponge fauna of the Dry Tortugas in particular and the West Indies in general, with material for a revision of the families and orders of the Porifera.( Publ. Carnegie Inst.Washington, 467 ). Papers Tortugas Lab., **30**: 1-225.
- LAUBENFELS, M.W. de, 1951. A collection of sponges from the Black Sea. Arch. Hydrobiol., **45**: 213-216.
- LENDENFELD, R. von, 1896. Die Clavulina der Adria. E.Karras, Halle: 1- 251.
- LÉVI, C., 1973. Systématique de la classe de Demospongiaria (Demosponges). In: P.Grassé, ed. Traité de Zoologie (Masson et Cie), **3** (1): 577-631.
- PERES, J.M. & J. PICARD, 1958. Recherches sur les peuplements benthiques de la Méditerranée nord-oriental. Ann. Inst. océanogr. Monaco, **34**: 213-291.
- POR, F.D., 1978. Lessepsian Migration. The influx of Red Sea Biota into the Mediterranean by way of the Suez Canal. Springer Verlag, Berlin: 1- 228.
- PULITZER-FINALI, G., 1978. Report on a collection of sponges from the Bay of Naples. III Hadromerida, Axinellida, Poecilosclerida, Halichondrida, Haplosclerida. Boll. Mus. Ist. Univ. Genova, **45**: 7-89.
- PULITZER-FINALI, G., 1983. A collection of Mediterranean Demospongiae (Porifera) with, in appendix, a list of the Demospongiae hitherto recorded from the Mediterranean Sea. Ann. Mus. civ. Storia nat. Genova, **84**: 445-621.
- RIDLEY, S.O. & A. DENDY, 1887. Report on the Monaxonida collected by HMS "Challenger" during the years 1873-76. Rep. sci. Res. Explor. Voy. Challenger. Zool., **20** (59): 1-257.
- RÜTZLER, K., 1965. Systematik und Ökologie der Poriferen aus Litoralschattengebieten der Nordadria. Z. Morph. Ökol. Tiere, **55**: 1-82.
- RÜTZLER, K., 1967. Liste und Verteilung der Poriferen aus der Umgebung von Rovinj. Thal. Jugoslavica, **3**: 1-6.
- SARÀ, M., 1960. Poriferi del litorale del' isola d' Ischia e loro ripartizione per ambienti. Publ. Staz. zool. Napoli, **31** (3): 421-472.
- SARITAS, M. 1973. Report on the sponges (Porifera) occurring on *Posidonia oceanica* (L.) at the coast of Altinluk, Edremit Bay (Aegean Sea). Sci. Rep. Fac. Sci. Ege Univ., **168**: 3-21.
- SCHMIDT, O., 1862.Die Spongien des Adriatischen

- Meeres. Engelmann, Leipzig: i-viii, 1-88.
- SCHMIDT, O., 1868. Die Spongien der Küste von Algier. Mit Nachträgen zu den Spongien des Adriatischen Meeres (Drittes Suppl.). Engelmann, Leipzig: i-iv, 1-44.
- SCHMIDT, O., 1870. Grundzüge einer Spongien-fauna des Atlantischen Gebietes. Engelmann, Leipzig: i-vi, 1-88.
- SOEST, R.W.M. van, 1977. Marine and freshwater sponges (Porifera) of the Netherlands. Zool. Meded. Leiden, **50** (16): 261-273.
- SOEST, R.W.M. van, 1993. Distribution of sponges on the Mauritanian continental shelf. In: W.J. Wolff, J. van der Land, P.H. Nienhuis & P.A.W.J. de Wilde, eds. Ecological studies in the coastal waters of Mauritania. Hydrobiologia, **258**: 95-106.
- SOEST, R.W.M. van, 1994. Demosponge distribution patterns. In: R.W.M. van Soest, Th.M.G. van Kempen & J.C. Braekman, eds. Sponges in time and space. Proc. 4th Int. Porifera Congr. Balkema, Rotterdam: 1-480.
- TOPSENT, E., 1898. Sur les Hadromerina de l' Adriatique. Bull. soc. Sci. Med. Ouest Rennes, **7**: 117-130.
- TOPSENT, E., 1900. Étude monographique des Spongiaires de France. III. Monaxonida (Hadromerida). Archs. Zool. exp. gén., (3) **8**: 1-331.
- TOPSENT, E., 1925. Étude des spongiaires de Golfe de Naples. Archs. Zool. exp. gén., **63**: 623-725.
- TOPSENT, E., 1928. Spongiaires de l' Atlantique et de la Méditerranée provenant des croisières du Prince ALBERT 1er de Monaco. Rés. Camp. sci. Prince Albert Monaco, **74**: 1-376.
- TOPSENT, E., 1934. Éponges observées dans les parages de Monaco. Part. I. Bull. Inst. océanogr. Monaco, **650**: 1-42.
- TOPSENT, E., 1938. Contribution nouvelle à la connaissance des éponges de côtes d' Algérie. Les espèces nouvelles d' O. Schmidt, 1868. Bull. Inst. océanogr. Monaco, **758**: 1-32.
- URIZ, M.J., 1978. Contribución a la fauna de esponjas (Demospongia) de Catalunya. An. Sec. Cien. Col. Univ. Gerona, **7**: 1-220.
- URIZ, M.J., 1988. Deep-water sponges from the continental shelf and slope off Namibia (Southwest Africa): Classes Hexactinellida and Demospongiae. Monogr. Zool. Mar., **3**: 9-157.
- VACELET, J., 1960. Éponges de la Méditerranée Nord occidentale recoltées par le "Président Théodore Tisser" 1958. Rev. Trav. Inst. Pêch. marit., **24** (2): 257-272.
- VACELET, J., 1969. Éponges de la roche du large et de l' étage bathyal de Méditerranée. Mém. Mus. natn. Hist. nat. Paris, **59** (2): 145-219.
- VAMVAKAS, C., 1970. Peuplements benthiques des substrats meubles du sud de la Mer Egée. Téthys, **2** (1): 89-129.
- VOSMAER, G., 1935. The sponges of the bay of Naples. Porifera Incalcareia. M.Nijhoff, The Hague: 1-875 (in 3 vols.).
- VOULTSIADOU-KOUKOURA, E., R.W.M. van SOEST & A. KOUKOURAS, 1991. *Coscinoderma spardense* sp. n. from the Aegean Sea with comments on *Coscinoderma confragosum* (Porifera, Dictyoceratida). Zool. Scripta, **20** (3): 195-199.
- VOULTSIADOU-KOUKOURA, E. & R.W.M. van SOEST, 1991a. *Phorbos posidoni* n.sp. (Porifera: Poecilosclerida) from the Aegean Sea, with a discussion of the family Anchinoidae. J. nat. Hist., **25**: 827-836.
- VOULTSIADOU-KOUKOURA, E. & R.W.M. van SOEST, 1991b. *Hemiasterella aristoteliana* n.sp. (Porifera, Hadromerida) from the Aegean Sea with a discussion of the family Hemiasterellidae. Bijdr. Dierk., **61**(1): 43-49.
- VOULTSIADOU-KOUKOURA, E. & A. KOUKOURAS, 1993. Contribution to the knowledge of Keratose sponges (Dictyoceratida, Dendroceratida, Verongida: Demospongiae, Porifera) of the Aegean Sea. Mitt. zool. Mus. Berlin., **69**(1): 57-72.

---

Received: August 3, 1993