

OCTOCORAL FAUNA OF THE AEGEAN SEA WITH A CHECK LIST OF THE MEDITERRANEAN SPECIES: NEW INFORMATION, FAUNAL COMPARISONS

BY

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Abstract

Sampling in the North Aegean Sea yielded 24 species of the class Octocoralia, 9 of which are new records for the Eastern Mediterranean, while 5 more species are new for the Aegean Sea. For each of the 24 species, information is given on their distribution and their habitat. A check list of the 43 known Mediterranean octocorals is also presented and the faunas of various parts of the Mediterranean are compared on the basis of the literature.

Résumé

Octocoraux de la mer Égée

Vingt-quatre espèces appartenant à la classe Octocoralia ont été récoltées dans le nord de la mer Égée. Neuf espèces sont mentionnées pour la première fois pour la faune de la Méditerranée orientale, et cinq autres sont nouvelles pour la faune de la mer Égée. Des informations concernant la répartition et l'habitat des 24 espèces sont données. La liste des 43 espèces d'octocoraux méditerranéens déjà connues est également présentée. Une comparaison avec la faune des différentes régions de la Méditerranée est réalisée.

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INTRODUCTION

Although Aristotle was the first to mention the presence of anthozoans in the Aegean Sea, relevant information from this area (and from the Eastern Mediterranean in general) remained poor when compared with the Western Mediterranean. In modern times, first fragmentary information on anthozoans of the Aegean Sea was provided by BORY DE SAINT VINCENT (1834) and STEINDACHNER (1891) who recorded (without details) *Isidella elongata* (as *Isis elongata* and *Isidella elongata* respectively) and by FORBES (1844) who recorded *Corallium rubrum*.

Later studies raised the number of known octocoral species in the Aegean to 11; this was given by PÉRÈS & PICARD (1958) reporting 5 species, GELDIAY & KOCATAS

(1972) reporting 1 species from the gulf of Izmir, CARPINE & GRASSHOFF (1975) reporting 3 species from various areas, CHINTIROGLOU *et al.* (1989) commenting on the presence of *Corallium rubrum*, and VAFIDIS & KOUKOURAS (1991) describing a new species, *Crassophyllum thessalonicae*.

This paper reports *i*) new information on the octocoral fauna of the Aegean Sea, *ii*) the first check list of the octocorals of the Mediterranean Sea and *iii*) a comparison of the octocoral fauna of the Aegean Sea with that of other Mediterranean areas and with that of the Mediterranean in general.

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MATERIAL AND METHODS

680 specimens, collected from 52 stations in the North Aegean Sea (*fig. 1*), were examined. These stations are part of a broad sampling program, started in 1970, to study the benthic macrofauna of the North Aegean Sea. Information on the characteristics of the sampling stations is given in the presentation of the species found.

Samples were obtained using fishing nets (bold line with capital letter), by free or scuba diving and various types of dredges and grabs (full dots with a number), at depths to approximately 1000 m.

The specimens were anaesthetized by keeping them for about 8 hours in a sea water solution of 0.5% MgSO₄, before fixation in 10% formaline and later transferred to 70% ethanol. The specimens have been deposited in the Museum of the Department of Zoology, University of Thessaloniki. Sclerites were prepared by dissolving the soft tissues in cold, concentrated sodium hypochlorite.

In order to estimate the affinities among the octocoral faunas of certain Mediterranean areas, we use the number of species in common.

RESULTS AND DISCUSSION

MATERIAL EXAMINED

The following 24 species were found in North Aegean Sea during the present study.

Order STOLONIFERA

Family CORNULARIIDAE

Cornularia cornucopiae (Pallas, 1766)

Cornularia cornucopiae, Weinberg, 1978, p. 141, pl. 1. – Manuel, 1981, p. 34, fig. 7.

50 colonies (stations: 66, 120, 131, 133, 135, 146a) were collected from depths of 0-16 m, on rocks, stones, the phaeophycean *Cystoseira*, the scleractinian *Cladocora caespitosa* (Linnaeus) and the decapod *Pisa nodipes* (Leach).

Distribution: First record from the E. Mediterranean. W. Mediterranean, Adriatic (PAX & MÜLLER,

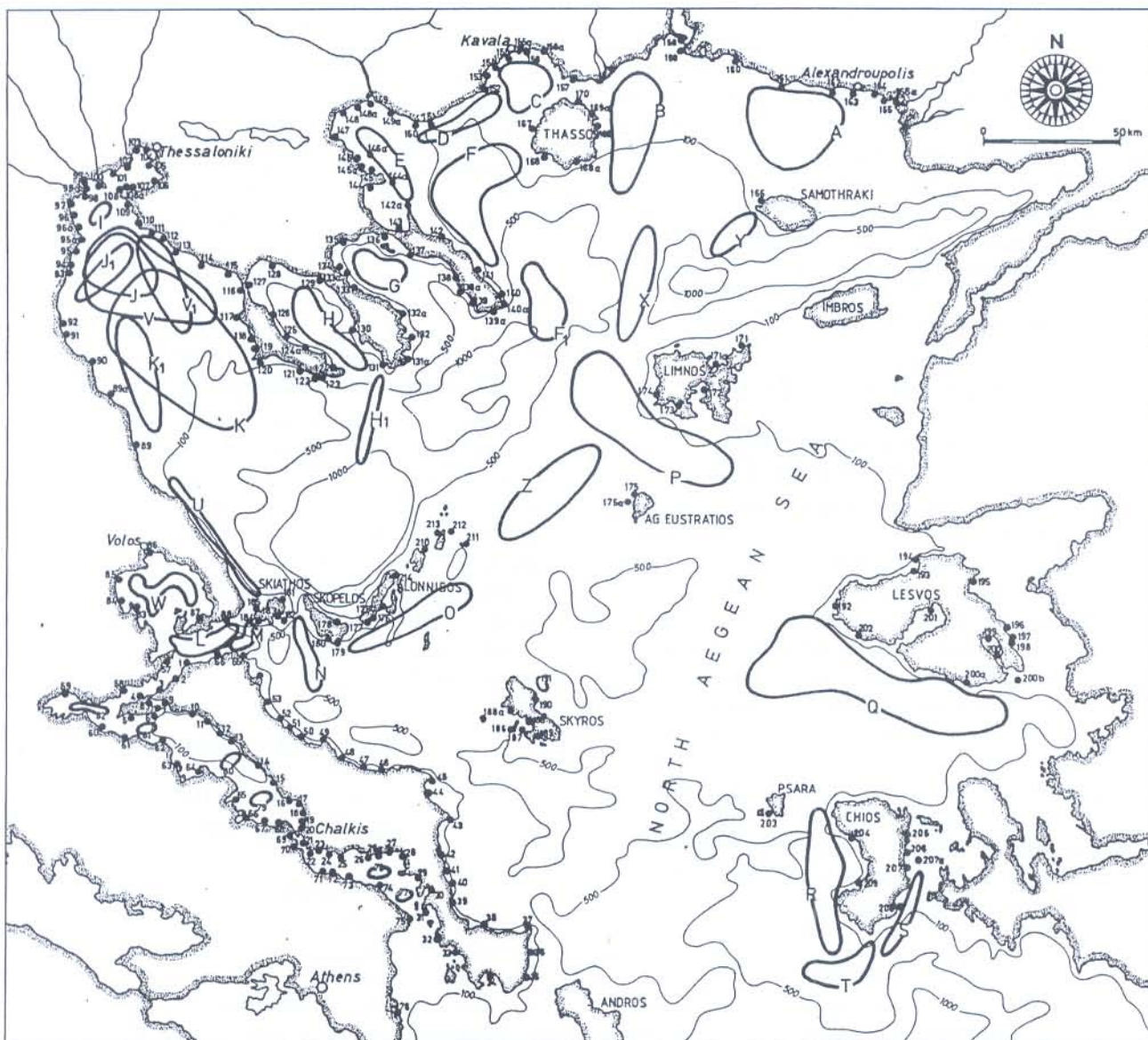


FIG. 1. – Map of the Aegean Sea, indicating the sampling stations (for explanations see § Material and Methods).

FIG. 1. – Carte de la mer Égée, avec la localisation des stations d'échantillonnage (voir les explications dans le § Material and Methods).

1962; WEINBERG, 1978; GILI, 1987, etc.), S. coast of England, Atlantic coast of France (MANUEL, 1981), Azores (TIXIER-DURIVAUULT & D'HONDT, 1975).

Family CLAVULARIIDAE

Clavularia crassa (Milne-Edwards, 1848)

Clavularia steveninoae, d'Hondt & Tixier-Durivault, 1975, p. 585, figs. 1-4.

Clavularia ochracea, Weinberg, 1978, p. 147, pl. 7-11.

Clavularia crassa, Weinberg, 1978, p. 144, pl. 2-6; 1986, p. 244.

36 colonies (stations: 66, 120, 135, 144a, 146a, 175a) were found at depths of 0-5 m, on stones, the phaeophycean *Cystoseira*, the scleractinian *C. caespitosa* and the ascidian *Microcosmus sabatieri* Roule.

Distribution: First record from the Aegean Sea. Sea of Marmara (DEMIR, 1952-54), W. Mediterranean, Adriatic (BERENQUIER, 1954; D'HONDT & TIXIER-DURIVAUULT, 1975; GILI, 1987, etc.).

***Sarcodictyon roseum* (Philippi, 1842)**

Rolandia rosea, Weinberg, 1978, p. 167, pl. 16-18.

Sarcodictyon roseum, Manuel, 1981, p. 36, fig. 8.

64 colonies (stations: 3, 67, 69, 131a, 166, 176a, 177, V) were found at depths of 0-100 m, on rocks, stones, the octocorals *Eunicella singularis* and *Corallium rubrum*, the scleractinian *C. caespitosa*, the gastropod *Tonna galea* Linnaeus, the bivalve *Pinna nobilis* Linnaeus and the ascidian *M. sabatieri*.

Distribution: S. Aegean Sea (PÉRÈS & PICARD, 1958), W. Mediterranean, Adriatic (WEINBERG, 1978; GILI, 1987, etc.), common all over British coasts (MANUEL, 1981), Atlantic coast of France (TIXIER-DURIVAUULT & D'HONDT, 1975), Azores (THOMSON, 1927).

Order ALCYONACEA

Family ALCYONIIDAE

***Alcyonium palmatum* Pallas, 1766**

Alcyonium palmatum, Verseveldt, 1964, p. 160, figs. 3-7, pl. XII – Weinberg, 1977, p. 133, pl. 1-2.

189 colonies (stations: 78, 109, 110, 139a, 177, 200b, A, C, F, I, J, J₁, K, K₁, P, R, V₁, Y) were collected from depths of 25-91 m, on muddy or sandy bottoms, with their sterile stalk often buried in the sediment. In most cases, the colonies live fixed on a hard substrate (stones, shells, etc.). On specimens from stations 110, C, K, the gastropod *Marionia blainvillea* (Risso) was found.

Distribution: Aegean Sea (PÉRÈS & PICARD, 1958), Sea of Marmara (DEMIR, 1952-54), W. Mediterranean, Adriatic (PAX & MÜLLER, 1962; VERSEVELDT, 1964; GILI, 1987, etc.), Atlantic coast of France (LAFARGUE, 1969), W. coast of Portugal (NOBRE, 1931), Azores (THOMSON, 1927).

***Alcyonium acaule* Marion, 1878**

Alcyonium acaule, Verseveldt, 1964, p. 155, figs. 1-2. – Weinberg, 1977, p. 136, pl. 3-7, Tab. I.

4 colonies from station 144a, on rocks, between 25 and 30 m. On two specimens, the gastropod *Polia scacchiana* (Scacchi) was found, and on one specimen the ascidian *Halocynthia papillosa* Linnaeus was noted.

Distribution: Aegean Sea (PÉRÈS & PICARD, 1958), W. Mediterranean, Adriatic (PAX & MÜLLER, 1962; VERSEVELDT, 1964; GILI, 1987, etc.).

***Alcyonium coralloides* (Pallas, 1766)**

Parerythropodium coralloides, Weinberg, 1975, p. 53, figs. 1-9. – Weinberg, 1977, p. 144, pl. 8-9, Tab. II.

Alcyonium coralloides, Groot & Weinberg, 1982, p. 293, figs. 1-11, Tab. 1-4.

40 encrusting colonies (stations: 60, 138a, 139, 139a, 144a, 168, 169, 175a, 177, 200b, 207a, K) were found at depths of 12-100 m, on rock, stones, gorgonian axes (*Eunicella singularis*, *E. cavolini*, *E. verrucosa*, *Paramuricea clavata*, *P. macrospina*) and bivalve shells (*Pteria hirundo* (Linnaeus)).

Distribution: First record from the Aegean Sea. Sea of Marmara (TIXIER-DURIVAUULT, 1961), W. Mediterranean, Adriatic (PAX & MÜLLER, 1962; GROOT & WEINBERG, 1982, etc.), S.W. coast of England, S. Ireland (VAN SOEST & WEINBERG, 1980), Atlantic coast of France (TIXIER-DURIVAUULT & LAFARGUE, 1966).

Family MAASELLIDAE

***Paralcyonium spinulosum* (Delle Chiaje, 1822)**

Paralcyonium spinulosum, Parenzan, 1977, p. 77, fig. 2. – Weinberg, 1977, p. 156, figs. 13-18.

6 colonies (stations: 67, 69, 139a, K) were found on rocks. The specimen from station 69 was attached to the ascidian *M. sabatieri*. All specimens were found at depths between 20 and 73 m.

Distribution: First record from the E. Mediterranean. W. Mediterranean (PARENZAN, 1977, etc.), Atlantic coast of France (LAFARGUE, 1969), Azores (THOMSON, 1927).

Order GORGONACEA

Family CORALLIIDAE

***Corallium rubrum* (Linnaeus, 1758)**

Corallium rubrum, Carpine & Grasshoff, 1975, p. 112, fig. 62. – Weinberg, 1976, p. 98, pl. 1, 17-20

22 colonies (stations: 138a, 139a, 177, 194) were collected at depths of 50-91 m, in caves or under overhangs. On specimens from stations 138a, 139 and 177 the octocoral *S. roseum* and the molluscs *Ostrea edulis* Linnaeus, *Calliostoma zizyphinum* (Linnaeus), *Pseudosimnia carnea* (Poiret), *Heliacus alleryi* (Seguenza), *Coralliophila brevis* (Blainville) and *Mitra zonata* Marryat were found.

Distribution: Aegean Sea (CHINTIROGLOU *et al.*, 1989, etc.), Kastelorizo (ZIBROWIUS, 1979), W. Mediterranean, Adriatic (PAX & MÜLLER, 1962; CARPINE & GRASSHOFF, 1975; GILI, 1987, etc.), Ibero-Moroccan

Gulf (ROSSI, 1950), Senegal, Cape Verde Islands (ZIBROWIUS *et al.*, 1984).

Family PARAMURICEIDAE

Paramuricea clavata (Risso, 1826)

Paramuricea clavata, Carpine & Grasshoff, 1975, p. 14, figs. 1-5. – Weinberg, 1976, p. 94, pl. 13-16.

20 colonies (stations: 60, 139, 139a, 175a, 176a, 177, 200, 200b) from depths of 20-91 m, on hard substrates (rocks, coralligenous bottoms). The octocoral *A. coralloides*, the scleractinian *Paracyathus pulchellus* (Philippi) (on a dead part of a colony), the bivalve *Neopycnodonte cochlear* (Poli) and the gastropods *C. zizyphinum*, *Simnia purpurea* Risso and *Coralliophila squamosa* (Bivona), were found on the branches of this species.

Distribution: First record from the Aegean Sea. Sea of Marmara (ÖZTÜRK & BOURGUET, 1990), W. Mediterranean, Adriatic (CARPINE & GRASSHOFF, 1975; GILI, 1987, etc.).

Paramuricea macrospina (Koch, 1882)

Paramuricea macrospina, Carpine, 1963, p. 19, figs. 10, 12-14. – Carpine & Grasshoff, 1975, p. 22, figs. 6-10.

17 colonies (stations: 139a, 175a, 200, 200b) were collected from rocks, between 20 and 90 m. On the specimen of station 139a, the octocoral *A. coralloides* was found, while on another from station 175a, the scleractinian *P. pulchellus* (on a dead part of a colony) and the bivalve *P. hirundo*.

Distribution: Aegean Sea (CARPINE & GRASSHOFF, 1975), Sea of Marmara (DEMIR, 1952-54), W. Mediterranean, Adriatic (CARPINE & GRASSHOFF, 1975; GILI, 1987, etc.).

Spinimuricea klavereni (Carpine & Grasshoff, 1975)

Echinomuricea klavereni, Carpine & Grasshoff, 1975, p. 31, figs. 11-14.

Spinimuricea klavereni, Grasshoff, 1992, p. 87.

39 colonies (stations: V, V₁) were found at depths of 25-40 m, on sand-silty bottoms, stones, shells and detritic matter.

Distribution: Aegean Sea (CARPINE & GRASSHOFF, 1975), Sea of Marmara (DEMIR, 1952-54), W. Mediterranean (CARPINE & GRASSHOFF, 1975; GRASSHOFF, 1977b, etc.).

Swiftia dubia (Thomson, 1929)

Swiftia pallida, Madsen, 1970, p. 1, pl. 1-2.

Swiftia dubia, Grasshoff, 1989, p. 209, fig. 3.

7 colonies from station 139a. The colonies were found on a piece of rock, depth ca. 200 m. On one specimen, the sea anemone *Amphianthus dohrnii* (Von Koch) was found, on another the bivalve *P. hirundo*.

Distribution: Aegean Sea (CARPINE & GRASSHOFF, 1975), W. Mediterranean (CARPINE & GRASSHOFF, 1975; GRASSHOFF, 1989, etc.), Atlantic coast of Europe, Azores, Madeira (GRASSHOFF, 1977b, 1989; MANUEL, 1981, etc.).

Villogorgia bebrycoides (Koch, 1887)

Villogorgia bebrycoides, Carpine & Grasshoff, 1975, p. 52, figs. 25-27. – Grasshoff, 1977b, p. 58, figs. 55-57.

3 colonies from station X attached on stones and biogenic detritus, between 70 and 90 m.

Distribution: First record from the E. Mediterranean. W. Mediterranean (CARPINE & GRASSHOFF, 1975, etc.), coast of Portugal (GRASSHOFF, 1985), Azores, Madeira (STUDER, 1901; GRASSHOFF, 1977b).

Family PLEXAURIDAE

Eunicella singularis (Esper, 1791)

Eunicella stricta, Rossi, 1959, p. 207, figs. 1-2.

Eunicella singularis, Weinberg, 1976, p. 68, pl. 1, 2-6.

30 colonies (stations: 138a, 142a, 144a, 168, 169, 175a, A, D, F, P, V) were found on various types of hard substrates, from 10 to 170 m. The octocorals *S. roseum*, *A. coralloides*, the gastropods *Neosomnia spelta* (Linnaeus), *Danilia otaviana* (Cantraine), *Fusinus pulchellus* (Philippi) and the ascidian *H. papillosa*, were found on the branches of these specimens.

Distribution: First record from the E. Mediterranean, W. Mediterranean, Adriatic (CARPINE & GRASSHOFF, 1975; GILI, 1987, etc.).

Eunicella cavolini (Koch, 1887)

Eunicella cavolini, Rossi, 1959, p. 212, figs. 3-4. – Weinberg, 1976, p. 75, pl. 1, 6-8.

25 colonies (stations: 40, 131a, 138a, 139a, 169, 175, 175a, 176a, 191, V) were found in depths of 30-100 m, on hard substrates (stones, coralligenous bottoms, shells). On the specimen of station 138a, the octocoral *A. coralloides* and the bivalve *P. hirundo* were found, while on the specimen from station 176a, the polychaete *Lepidonotus clava* (Montagu) and the gastropods *Gibbula fanulum* (Gmelin) and *Pseudosimnia carnea* were present.

Distribution: S. Aegean Sea (PÉRÈS & PICARD, 1958), Sea of Marmara (DEMIR, 1952-54; ÖZTÜRK & BOURGUET, 1990), W. Mediterranean, Adriatic (CARPINE & GRASSHOFF, 1975; GILI, 1987, etc.).

Eunicella verrucosa (Pallas, 1766)

Eunicella verrucosa, Rossi, 1959, p. 216, figs. 5-8. – Manuel, 1981, p. 50, fig. 13.

12 colonies (stations: 60, 138a, 139a, 168, 175a, 200b) were found on stones and coralligenous bottoms, at depths of 20-72 m. On the specimen of station 138a, the octocoral *A. coralloides* was found, on the specimen from station 175a the gastropod *Simnia nicaensis* Risso.

Distribution: First record from the E. Mediterranean. W. Mediterranean (CARPINE & GRASSHOFF, 1975; GILI, 1987, etc.), from British coasts to Angola, Madeira, Canary Islands, Cape Verde Islands (CARPINE & GRASSHOFF, 1975; GRASSHOFF, 1977a, 1992; MANUEL, 1981, etc.).

Family PRIMNOIDAE

Callogorgia verticillata (Pallas, 1766)

Callogorgia verticillata, Carpine, 1963, p. 30, fig. 20.

Callogorgia verticillata, Carpine & Grasshoff, 1975, p. 102, figs. 56-58.

5 colonies (stations: 139a, 194, 210) were found on stones, at depths from 60 to 200 m. On the specimen of station 139a the bivalve *P. hirundo* was found.

Distribution: First record from the E. Mediterranean. W. Mediterranean (CARPINE & GRASSHOFF, 1975; GILI, 1987, etc.), Biscay Gulf, W. coasts of Portugal and Morocco, Josephine Bank, Meteor Bank, Madeira (NOBRE, 1931; GRASSHOFF, 1985), Azores (STUDER, 1901), Cape Verde Islands (THOMSON, 1927).

Family ISIDIDAE

Isidella elongata (Esper, 1788)

Isidella elongata, Carpine, 1963, p. 32, fig. 21. – Carpine & Grasshoff, 1975, p. 107, figs. 59-61.

One colony from station F, attached on a small calcareous stone, depth ca. 150 m.

Distribution: BORY DE SAINT VINCENT (1834) and STEINDACHNER (1891), reported this species from the Aegean (as *Isis elongata* and *Isidiella elongata* respectively) without details. Its presence in the Eastern Mediterranean has been questioned by PÉRÈS & PICARD (1958) and CARPINE & GRASSHOFF (1975). The present finding in the North Aegean Sea is the first confirmed record in the Eastern Mediterranean. W. Mediterranean,

Adriatic (PAX and MÜLLER, 1962; CARPINE & GRASSHOFF, 1975, etc.), Ibero-Moroccan Gulf (GRASSHOFF, 1989).

Order PENNATULACEA

Family VERETILLIDAE

Veretillum cynomorium (Pallas, 1766)

Veretillum cynomorium, Kükenthal & Broch, 1911, p. 176, pl. 13 (fig. 1), pl. 18 (figs. 32-36). – Gili & Pagès, 1987, p. 27, figs. 1e-f, 4a-c.

69 colonies (stations: 78, 99, 109, 177, A, C, E, J, J₁, K, K₁, V₁) were collected, on silty or sand-silty bottoms, at depths from 25 to 42 m.

Distribution: Aegean (GELDIAY & KOCATAS, 1972), Sea of Marmara (DEMIR, 1952-54), W. Mediterranean, Adriatic (PAX & MÜLLER, 1962; GILI & PAGÈS, 1987, etc.). Cosmopolitan species (KÖLLIKER, 1872; KÜKENTHAL & BROCH, 1911; THOMSON, 1929; TIXIER-DURIVAUULT, 1960, 1963, etc.).

Cavernularia pusilla (Philippi, 1835)

Cavernularia pusilla, Kükenthal & Broch, 1911, p. 192, figs. 25-28. – Gili & Pagès, 1987, p. 26, figs. 1d, 3f-g.

2 colonies from stations 162 and C were found, at depths of 30-80 m, on silty or sandy silty bottoms.

Distribution: First record of this species from the E. Mediterranean. W. Mediterranean (KÜKENTHAL & BROCH, 1911; THOMSON, 1929; GILI & PAGÈS, 1987), from Biscay Gulf to Senegal (NOBRE, 1931; TIXIER-DURIVAUULT, 1963; WILLIAMS, 1989).

Family FUNICULINIDAE

Funiculina quadrangularis (Pallas, 1766)

Funiculina quadrangularis, Kükenthal & Broch, 1911, p. 243, figs. 68-73. – Gili & Pagès, 1987, p. 35, figs. 1b, 3a-e.

10 colonies (stations: 95, C, P, V, Y) were found at depths of 49-91 m, on silty or sand-silty bottoms.

Distribution: S. Aegean Sea (PÉRÈS and PICARD, 1958), W. Mediterranean, Adriatic (THOMSON, 1927; PAX & MÜLLER, 1962; GILI & PAGÈS, 1987; GRASSHOFF, 1989, etc.). Cosmopolitan species (JUNGERSEN, 1904; KÜKENTHAL & BROCH, 1911; DEICHMANN, 1936, etc.).

Family PENNATULIDAE

Pennatula phosphorea Linnaeus, 1758

Pennatula phosphorea, Kükenthal & Broch, 1911, p. 365, figs. 160-170. – Gili & Pagès, 1987, p. 32, figs. 1a, 6a-f.

15 colonies (stations: C, K, V₁, Y) were collected, on silty or sand-silty bottoms, at depths from 25 to 91 m. On the specimen of station K, the gastropod *Odostomia clavulus* (Lovén) was found.

Distribution: First record from the Aegean Sea. Sea of Marmara (DEMIR, 1952-54), W. Mediterranean, Adriatic (PAX & MÜLLER, 1962; PARENZAN, 1973; GRASSHOFF, 1989, etc.). Cosmopolitan species (JUNGERSEN, 1904; KÜKENTHAL & BROCH, 1911; TIXIER-DURIVAUULT & D'HONDT, 1975, etc.).

***Pennatula rubra* Pallas, 1766**

Pennatula rubra, Kükenthal & Broch, 1911, p. 382, figs. 182-187. – Gili & Pagès, 1987, p. 33, figs. 1c, 5g-k.

4 colonies (stations: J₁, K, V₁) on silty or sand-silty bottoms, at depths from 25 to 40 m.

Distribution: First record from the E. Mediterranean. W. Mediterranean (THOMSON, 1929; BERENQUIER, 1954; GILI & PAGÈS, 1987, etc.), British Channel (GRAY, 1860), coast of Portugal (GRAY, 1870), Ibero-Moroccan Gulf (KÜKENTHAL & BROCH, 1911), Guinea, Sierra Leone, Ivory coast (TIXIER-DURIVAUULT, 1963).

Family **PTEROEIDIDAE**

***Pteroeides griseum* (Linnaeus, 1767)**

Pteroeides griseum, Kükenthal & Broch, 1911, p. 400, figs. 199-205.

Pteroeides spinosum, Gili & Pagès, 1987, p. 30, figs. 1g, 5a-g.

10 colonies (stations: 177, A, C, D, E, J, J₁) were found at depths of 20-90 m, on silty or sand-silty bottoms.

Distribution: First record from the Aegean Sea. Sea of Marmara (DEMIR, 1952-54), W. Mediterranean, Adriatic (THOMSON, 1927; PAX & MÜLLER, 1962; GILI & PAGÈS, 1987, etc.), Atlantic coasts of Europe (KÜKENTHAL & BROCH, 1911; THOMSON, 1927; NOBRE, 1931).

Crassophyllum thessalonicae

Vafidis & Koukouras, 1991

Crassophyllum thessalonicae, Vafidis & Koukouras, 1991, p. 201, figs. 1-3, Tab. I, II.

Crassophyllum thessalonicae, recently described by VAFIDIS & KOUKOURAS (1991) from a former collection from Thermaikos Gulf (N. Aegean Sea) was not obtained at any additional station. The holotype was found at a depth of 37-40 m, on a silty substrate. The community was that of *Amphiura filiformis* characterized primarily by the dominance of polychaetes and secondarily by the gastropod *Turritella communis*.

The new material from the North Aegean Sea includes 24 species, 9 of which are new records for the Eastern Mediterranean, and 14 are new records for the Aegean Sea.

The review of the literature showed that, previously, the number of octocoral species known from the Aegean Sea was 11. Combining that information with the new results, the number raised to 25 species.

THE OCTOCORAL FAUNA
OF THE MEDITERRANEAN:
CHECK LIST AND COMPARISONS

WILLIAMS (1992) roughly estimated the number of the octocoral species known from the Mediterranean to be 40. Our thorough review of the relevant literature revealed 43 valid Mediterranean octocoral species belonging to the orders Stolonifera (6), Alcyonacea (5), Gorgonacea (22), and Pennatulacea (10), listed in *table I*.

The estimated number of the Mediterranean octocoral species is based on the following references: KÜKENTHAL & BROCH (1911), THOMSON (1927), CARPINE (1963, 1964b), VERSEVELDT (1964), CARPINE & GRASSHOFF (1975, 1985), WEINBERG (1976, 1977, 1978, 1986), GROOT & WEINBERG (1982), GILI & PAGÈS (1987), GRASSHOFF (1989, 1992), VAFIDIS & KOUKOURAS (1991). The latest important contribution was by GRASSHOFF (1992), who showed that *Leptogorgia viminalis* (Pallas) is not a Mediterranean species, but Atlantic, and that *Spinimuricea atlantica* Johnson and *Eunicella gazella* Studer occur in the Alboran Sea.

27 of the 43 Mediterranean species are found predominantly in the Eastern Atlantic (*table I*); 11 species are known only from the Mediterranean (possibly endemics) and only 5 species, all belonging to the order Pennatulacea, are cosmopolitan. There is no evidence of octocoral Lessepsian immigrants in the Mediterranean Sea. The distribution of octocoral species in the various Mediterranean areas and the Black Sea (*fig. 2*), is as follows:

– Catalan coast and Balearic Islands (CC): 25 species, 58.1% of the octocoral Mediterranean fauna (GILI, 1981, 1987; GILI & PAGÈS, 1987; GILI *et al.*, 1989).

– Alboran Sea (AL): 25 species, 58.1% of the Mediterranean fauna (WEINBERG, 1986; GRASSHOFF, 1989, 1992).

– Mediterranean coast of France and Monaco (FC): 34 species, 79.1% of the Mediterranean fauna (KÖLLIKER, 1872; MARION, 1882, LACAZE-DUTHIERS, 1888, 1900; ROULE, 1900; JUNGERSEN, 1904; THOMSON,

TABLE I. – Check list of Mediterranean octocorals. Distribution of octocorals in various areas of the Mediterranean and the Black Sea (symbols of areas, as in figure 2). Zoogeographical characterization (ZC): E, possibly endemic species; AM, Atlanto-Mediterranean species; C, cosmopolitan species. Species marked ** are reported for the first time from the Eastern Mediterranean and those with * are reported for the first time from the Aegean Sea.

TABLEAU I. – Liste des octocoraux de la Méditerranée. Répartition des octocoraux dans les différentes régions de la Méditerranée et en mer Noire (pour les symboles des zones, voir la figure 2). Caractérisation zoogéographique (ZC) : E, espèce potentiellement endémique ; AM, espèce atlantico-méditerranéenne ; C, espèce cosmopolite. Les espèces mentionnées pour la première fois de la Méditerranée orientale sont notées avec **, et celles nouvelles pour la faune de la mer Égée avec *.

Mediterranean octocorals	CC	AL	FC	WI	AT	AD	IB	LB	AS	MS	BS	ZC
Stolonifera												
** <i>Cornularia cornucopiae</i> (Pallas, 1766)	+		+	+		+			+			AM
* <i>Clavularia crassa</i> (Milne-Edwards, 1848)	+	+	+	+		+			+	+		E
<i>Clavularia marioni</i> Koch, 1891				+								AM
<i>Clavularia carpediem</i> Weinberg, 1986		+										E
<i>Sarcodictyon roseum</i> (Philippi, 1842)	+	+	+	+	+	+			+			AM
<i>Scleranthelia rugosa</i> (Pourtalès, 1867)			+									AM
Alcyonacea												
<i>Alcyonium palmatum</i> Pallas, 1766	+		+	+	+	+	+		+	+		AM
<i>Alcyonium acaule</i> Marion, 1878	+	+	+	+		+			+			AM
* <i>Alcyonium coralloides</i> (Pallas, 1766)	+	+	+	+		+			+	+		AM
<i>Maasella edwardsi</i> (Lacaze-Duthiers, 1888)	+	+	+	+	+	+	+					E
** <i>Paralcyonium spinulosum</i> (Delle Chiaje, 1822)	+	+	+	+	+				+			AM
Gorgonacea												
<i>Corallium rubrum</i> (Linnaeus, 1758)	+	+	+	+	+	+	+	+	+			AM
<i>Acanthogorgia hirsuta</i> Gray, 1857		+	+	+								AM
* <i>Paramuricea clavata</i> (Risso, 1826)	+	+	+	+	+	+			+	+		E
<i>Paramuricea macrospina</i> (Koch, 1882)	+		+	+	+	+	+		+	+		E
<i>Bebryce mollis</i> Philippi, 1842		+	+	+	+		+					AM
<i>Spinimuricea atlantica</i> (Johnson, 1862)		+										AM
<i>Spinimuricea klavereni</i> (Carpine & Grasshoff, 1975)		+	+	+	+				+	+		E
<i>Muriceides lepida</i> Carpine & Grasshoff, 1975		+	+									AM
<i>Placogorgia coronata</i> Carpine & Grasshoff, 1975			+									AM
<i>Placogorgia massiliensis</i> Carpine & Grasshoff, 1975		+	+									E
<i>Swiftia dubia</i> Thomson, 1929		+	+						+			AM
** <i>Villogorgia bebrycoides</i> (Koch, 1887)				+	+				+			AM
** <i>Eunicella singularis</i> (Esper, 1791)	+	+	+	+	+	+	+		+			E
<i>Eunicella cavolini</i> (Koch, 1887)	+		+	+	+	+	+		+	+		E
** <i>Eunicella verrucosa</i> (Pallas, 1766)	+	+	+	+	+		+		+			AM
<i>Eunicella filiformis</i> Studer, 1901		+										AM
<i>Eunicella gazella</i> Studer, 1901		+										AM
<i>Leptogorgia sarmentosa</i> Esper, 1789	+	+	+	+	+	+						E
<i>Ellisella paraplexauroides</i> Stiasny, 1936					+							AM
<i>Ellisella flagellum</i> (Johnson, 1863)			+									AM
** <i>Callogorgia verticillata</i> (Pallas, 1766)	+		+	+	+				+			AM
** <i>Isidella elongata</i> (Esper, 1788)	+	+	+	+	+	+			+			AM
Pennatulacea												
<i>Veretillum cynomorium</i> (Pallas, 1766)	+		+	+	+	+	+		+	+		C
** <i>Cavernularia pusilla</i> (Philippi, 1835)	+		+	+					+			AM
<i>Kophobelemnion stelliferum</i> (O. F. Müller, 1776)	+	+	+				+			+		C
<i>Funiculina quadrangularis</i> (Pallas, 1766)	+	+	+	+		+	+	+	+			C
<i>Virgularia mirabilis</i> (Linnaeus, 1758)	+			+	+	+				+	+	C
<i>Pennatula aculeata</i> Danielsen, 1860			+									AM
* <i>Pennatula phosphorea</i> Linnaeus, 1758	+	+	+	+	+	+	+		+	+		C
** <i>Pennatula rubra</i> Pallas, 1766	+		+	+	+	+			+			AM
* <i>Pteroeides griseum</i> (Linnaeus, 1767)	+		+	+	+	+	+		+	+		AM
<i>Crassophyllum thessalonicae</i> Vafidis & Koukouras, 1991									+			E
Total number of species:	25	25	34	29	22	20	13	2	25	12	1	

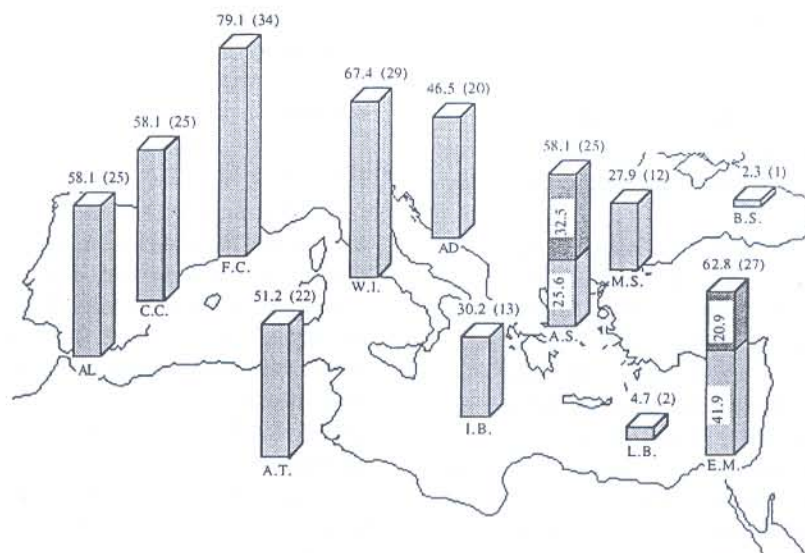


FIG. 2. – Distribution of octocorals in various areas of the Mediterranean and the Black Sea, as percentages of the total Mediterranean species – in parenthesis the total number of species of each area. The darker part of the columns shows the percentages added by the present study. AL = Alboran Sea, CC = Catalan coast, FC = French coast, WI = Western Italian coast, AT = Tunisian and Algerian coasts, IB = Ionian Basin, LB = Levantine Basin, AD = Adriatic Sea, AS = Aegean Sea, MS = Marmara Sea, BS = Black Sea, EM = Eastern Mediterranean (east of 21°).

FIG. 2. – Répartition des octocoraux dans différentes régions de la Méditerranée et en mer Noire, en % du nombre total d'espèces méditerranéennes; le nombre total d'espèces de chaque zone est donné entre parenthèses. Les pourcentages réévalués par la présente étude sont donnés dans les colonnes supérieures, plus foncées. AL = mer d'Alboran, CC = côte catalane, FC = côte française, WI = côte occidentale de l'Italie, AT = côtes tunisiennes et algériennes, IB = bassin Ionien, LB = bassin Levantin, AD = mer Adriatique, AS = mer Égée, MS = mer de Marmara, BS = mer Noire, EM = Méditerranée orientale (à l'est de 21°)

1927, 1929; STIASNY, 1940; BERENGUIER, 1954; CARPINE, 1963, 1964a, 1965; LAUBIER, 1966; TIXIER-DURIVALT & LAFARGUE, 1968; WEINBERG, 1975, 1977, 1978, 1979, 1980; CARPINE & GRASSHOFF, 1975, 1985).

– Western coast of Italy (WI): 29 species, 67.4% of the Mediterranean fauna (DELLE CHIAJE, 1822, 1828; VON KOCH, 1887, 1891; LO BIANCO, 1909; TORTONESE, 1936; STIASNY, 1942; ROSSI, 1950, 1958a, 1959, 1971; PÉRÈS & PICARD, 1958; SCHMIDT, 1972; MORRI *et al.*, 1991).

– Algerian and N. Tunisian coasts (AT): 22 species, 51.2% of the Mediterranean fauna (LACAZE-DUTHIERS, 1888, 1900; VIGUIER, 1888; KÜKENTHAL & BROCH, 1911; THOMSON, 1929; STIASNY, 1940; AZOUZ, 1968, 1973; CARPINE & GRASSHOFF, 1975; PARENZAN, 1977; WEINBERG, 1978).

– Adriatic coasts (AD): 20 species, 46.5% of the Mediterranean fauna (GRAEFFE, 1884; STOSSICH, 1885; BROCH, 1935, 1953; STIASNY, 1940; PAX & MÜLLER, 1953, 1955a, b, 1962; GAMULIN-BRIDA, 1967).

– Ionian Basin (Ionian Sea, E. Tunisian coast, North African coast-east of 21°) (IB): 13 species, 30.2% of the Mediterranean fauna (ROSSI, 1958b; LABOREL, 1960; CARPINE, 1963; MARCHETTI, 1965; MICALLEF & EVANS, 1968; AZOUZ, 1969; PARENZAN, 1973; CARPINE & GRASSHOFF, 1975).

– Sea of Marmara (MS): 12 species, 27.9% of the Mediterranean fauna (MARION, 1898; DEMIR, 1952-54; TORTONESE, 1959; TIXIER-DURIVALT, 1961; ÖZTÜRK & BOURGUET, 1990).

– Only two species are known from the Levantine Basin (LB), both reported from its NW part (between Rhodes Island and Megisti Islet), making 4.7% of the Mediterranean octocoral fauna: *Funiculina quadrangularis* reported by PÉRÈS & PICARD (1958) and *Corallium rubrum* by ZIBROWIUS (1979).

– In the Black Sea (BS) octocorals are represented only by the species *Virgularia mirabilis* (2.3%). The presence of this species in the Black Sea is restricted in

the area near Bosphorus. Its first report from this area was by OSTROUMOV (1893), according to BACESCU *et al.* (1971). Later on, it was found by NIKITIN (1931), according to CASPERS (1957). The most recent report of the species is that by BACESCU *et al.* (1971) who found a dense population of *V. mirabilis* (st. 665) at a depth of about 100 m, and 19-20‰ bottom salinity.

As mentioned above, 25 species (58.1%) are known from the Aegean Sea (AS); to this percentage the present study contributed 32.5%.

The species known from the Eastern Mediterranean are 27, representing 62.8% of the Mediterranean octocoral fauna (fig. 2); to this percentage this study also contributed 20.9%.

13 species found in the western Mediterranean basin have not yet been reported from the central and eastern basins (table I). These species are 3 Stolonifera (*Clavularia marioni*, *C. carpediem* and *Scleranthelia rugosa*), 9 Gorgonacea (*Acanthogorgia hirsuta*, *Spinimuricea atlantica*, *Muriceides lepida*, *Placogorgia coronata*, *P. massiliensis*, *Eunicella filiformis*, *E. gazella*, *Ellisella paraplexauroides* and *E. flagellum*) and 1 Pennatulacea (*Pennatula aculeata*). Only two of these (*C. carpediem* and *P. massiliensis*) are exclusively known from the Mediterranean (possibly endemics ?) while the remaining 11 are Atlanto-Mediterranean. None of them is cosmopolitan. On the other hand, only one species is missing from the western basin, the recently described *Crassophyllum thessallonicae* (VAFIDIS & KOUKOURAS, 1991), unique representative of the genus in the Mediterranean. Four of the 13 species have been found only in the Alboran Sea (one of which is not yet known elsewhere; possibly endemic ?), 4 only from the French coast, 1 only from the western Italian coast and 1 only from the Algerian-Tunisian coast. The remaining 3 species have been found in two or more areas of the western basin. Consequently, the higher species diversity in the western basin can be explained by a number of Atlantic species having their eastern limit in the Mediterranean, *i.e.* in various areas of the western basin. Among the areas of the western basin, the richest in species is the French coast. This can be partly explained by the more intensive research effort there. The diversity on the western Italian coast is closer to that of the French coast, also due to intensive research. In the Adriatic, although well studied, the lower number of species can be explained by its shallowness, relatively low winter temperatures and lower salinities.

Concerning the Black Sea, only one octocoral species has been summarily mentioned, despite satisfactory

research carried out in this area. This is undoubtedly due to the very peculiar oceanographic conditions prevailing there, especially the low salinity and temperature, making it a separate, different ecosystem. Furthermore, the number of species found in the Sea of Marmara is considerably lower than in the Aegean, in spite of the relatively adequate research carried out; influx from the Black Sea appears decisive. This area should be considered as a transitional zone between the Black Sea and the Aegean. Similar conclusions result from research on other animal groups, such as echinoderms (TORTONESE & DEMIR, 1960) and decapod crustaceans (KOCATAS, 1981; KOUKOURAS *et al.*, 1992).

The Levantine basin in the overall most oligotrophic area of the Mediterranean, being an extremely stressed marine environment with a 30% impoverishment in the general diversity of its biota (POR & DIMENTMAN, 1989). Recently, KOUKOURAS & RUSSO (1991) showed that this impoverishment is obvious in the soft substrata of the midlittoral zone. However, the report of only two octocoral species from this basin should not be attributed exclusively to the general impoverishment, but also to the poor sampling efforts in the basin. This later reason, should also be considered in view of the small number of octocoral species found up to the present in the Ionian Basin (central Mediterranean).

Because some biotopes, such as submarine caves, can be very rich in octocoral species, and have not been sufficiently studied throughout the Mediterranean, and also because the various Mediterranean areas are not equally studied with reference to octocorals, an estimation and discussion of the affinities among them cannot be made. However, we considered it useful to present the numbers of species in common among them (table II).

TABLE II. - Numbers of species in common among the octocoral faunas of certain areas of the Mediterranean (symbols of areas, as in figure 2).

TABLEAU II. - Nombre d'espèces communes aux faunes des différentes régions de la Méditerranée (mêmes symboles que pour la figure 2).

	AS	AD	AT	WI	FC	AL
CC	21	20	18	24	24	15
AL	14	12	12	17	21	
FC	23	19	19	26		
WI	23	20	21			
AT	17	15				
AD	17					

REFERENCES

- AZOUZ A., 1968.— Contribution à l'étude du golfe de Tunis. *Rapports et procès-verbaux de la Commission internationale pour l'exploration scientifique de la mer Méditerranée*, **19** : 125-127.
- AZOUZ A., 1969.— Invertébrés benthiques récoltés lors de la campagne du "Dauphin" en Libye (avril-mai 1965). *Bulletin de l'Institut national scientifique et technique d'océanographie et de pêche, Salammbô*, **1** : 139-144.
- AZOUZ A., 1973.— Les fonds chalutables de la région Nord de la Tunisie. 1. Cadre physique et biocénoses benthiques. *Bulletin de l'Institut national scientifique et technique d'océanographie et de pêche, Salammbô*, **2** : 473-563.
- BACESCU M., MÜLLER G., GOMOIU H.-T., 1971.— Cercetari de ecologie bentala in Marea Neagra (Analiza cantitativa si comparata a faunei bentale pontice). In: *Ecologie Marina*. Vol. IV : 1-357. A.R.S.R., Bucuresti.
- BÉRENGUIER A., 1954.— Contribution à l'étude des Octocoralliaires de Méditerranée occidentale. *Recueil des travaux de la Station marine d'Endoume*, **12** : 53-96.
- BORY DE SAINT-VINCENT J.-B., 1834.— Notice sur les Polypiers de la Grèce. In: *Expédition scientifique en Morée* : 204-209. Paris.
- BROCH H., 1935.— Beobachtungen an einigen adriatischen Seichtwasser - Anthozoen von Split. *Biologia Generalis*, **11** : 1-14.
- BROCH H., 1953.— Octocorals and stony corals of the High Adriatic trawling grounds. *Izvestija Inst. Océanogr. Split*, **6** : 1-22.
- CARPINE C., 1963.— Contribution à la connaissance des Gorgones Holaxonia de la Méditerranée occidentale. *Bulletin de l'Institut océanographique*, Monaco, **60** : 1-52.
- CARPINE C., 1964a. Contribution à l'étude bionomique de la Méditerranée occidentale. (Côte du Var et des Alpes-Maritimes – côte occidentale de Corse). Fascicule 3. La côte de l'Esterel, de la pointe des Lions à la pointe de l'Aiguille (région A₂). *Bulletin de l'Institut océanographique*, Monaco, **63** : 1-52.
- CARPINE C., 1964b.— Contribution à l'étude bionomique de la Méditerranée occidentale. (Côte du Var et des Alpes-Maritimes – côte occidentale de Corse). Fascicule 6. Un Octocoralliaire nouveau pour la Méditerranée: *Scleranthelia musiva* Studer, 1878. *Bulletin de l'Institut océanographique*, Monaco, **64** : 1-10.
- CARPINE C., 1965.— Quelques observations sur la faune bathyale dans le canal de Corse. *Rapports et procès-verbaux de la Commission internationale pour l'exploration scientifique de la mer Méditerranée*, **18** : 2.
- CARPINE C., GRASSHOFF M., 1975.— Les Gorgonaires de la Méditerranée. *Bulletin de l'Institut océanographique*, Monaco, **71** : 1-140.
- CARPINE C., GRASSHOFF M., 1985.— Catalogue critique des Octocoralliaires des collections du Musée océanographique de Monaco. I. Gorgonaires et Pennatulaires. *Bulletin de l'Institut océanographique*, Monaco, **73** : 1-71.
- CASPERS H., 1957.— Black Sea and Sea of Azov. *Geol. Soc. America Mem.*, **67** : 801-890.
- CHINTIROGLOU H., DOUNAS C., KOUKOURAS A., 1989.— The presence of *Corallium rubrum* (Linnaeus, 1758) in the Eastern Mediterranean Sea. *Mitteilungen aus dem zoologischen Museum in Berlin*, **65** : 145-149.
- DEICHMANN E., 1936.— The Alcyonaria of the western part of the Atlantic ocean. *Mem. Mus. comp. Zool.*, **53** : 1-317.
- DELLE CHIAJE J., 1822.— Memorie sulla storia e notonomia degli animali senza vertebre del regno di Napoli. Atlas : Tav. I-IV, I-LXIX. Società Tipografica, Napoli.
- DELLE CHIAJE J., 1828.— Memorie sulla storia e notonomia degli animali senza vertebre del regno di Napoli. 3 : I-XX, 1-232. Società Tipografica, Napoli.
- DEMIR M., 1952-54.— The invertebrate benthos of the Bosphorus and of the litoral of the Sea of Marmara closer to the Bosphorus. *Hidrobiol. arast. enst. yayinl.*, **3** : VIII-615. (in Turkish).
- D'HONDT M.J., TIXIER-DURIVAUULT A., 1975.— *Clavularia steveninoae* n. sp., nouvel Octocoralliaire Stolonifera de Méditerranée. *Cahiers de Biologie marine*, **16** : 575-592.
- FORBES E., 1844.— Report on the Mollusca and Radiata of the Aegean Sea, and on their distribution, considered as bearing on geology. *Rep. Brit. Assoc. Adv. Sci.*, **13** : 130-193.
- GAMULIN-BRIDA H., 1967.— The benthic fauna of the Adriatic Sea. *Oceanography and marine Biology, an annual review*, **5** : 535-568.
- GELDIAY R., KOCATAS A., 1972.— Note préliminaire sur les peuplements benthiques du golfe d'Izmir. *Sci. Monogr., Fac. Sci., Ege Univ.*, **12** : 1-34.
- GILI J.M., 1981.— Estudio bionómico y ecológico de los cnidarios bentónicos de las islas Medes (Girona). *Oecologia aquatica*, **5** : 105-123.
- GILI J.M., 1987.— Estudio sistemático y faunístico de los cnidarios de la costa Catalana. PhD. Thesis, Autonomous University of Barcelona, 565 p.
- GILI J.M., PAGÈS F., 1987.— Pennatulaceos (Cnidaria, Anthozoa) recolectados en la plataforma continental catalana (Mediterráneo occidental). *Misc. Zool.*, **11** : 25-39.
- GILI J.M., ROS J.D., PAGÈS F., 1987.— Types of bottoms and benthic Cnidaria from the trawling grounds (littoral and bathyal) off Catalonia (NE Spain). *Vie et Milieu*, **37** : 85-98.
- GILI J.M., J. MURILLO, ROS J.D., 1989.— The distribution pattern of benthic cnidarians in the western Mediterranean. *Scientia marina*, **53** : 19-35.
- GRAEFFE E., 1884.— Uebersicht der Seethierfauna des Golfes von Triest, nebst Notizen über Vorkommen, Lebensweise, Erscheinungs- und Fortpflanzungszeit der einzelnen Arten. III. Coelenteraten. *Arb. zool. Inst. Wien u. Triest*, **5** : 333-362.
- GRASSHOFF M., 1977a.— Die Hornkorallen (Gorgonaria) der Kanarischen Region. *Vieraea*, **7** : 23-40.
- GRASSHOFF M., 1977b.— Die Gorgonaria des östlichen Nordatlantik und des Mittelmeeres. III. Die Familie Paramuriceidae (Cnidaria : Anthozoa). Auswertung der "Atlantischen Kuppenfahrten 1967" von F.S. "METEOR". *"Meteor" Forsch. Ergebn.*, **27** : 5-76.
- GRASSHOFF M., 1985.— Die Gorgonaria und Antipatharia der Grossen Meteor-Bank und der Josephine-Bank (Cnidaria : Anthozoa). *Senckenbergiana maritima*, **17** : 65-87.

- GRASSHOFF M., 1989.— Die Meerenge von Gibraltar als Faunen-Barriere: Die Gorgonaria, Pennatularia und Antipatharia der BALGIM-Expedition (Cnidaria: Anthozoa). *Senckenbergiana maritima*, **20**: 201-223.
- GRASSHOFF M., 1992.— Die Flachwasser - Gorgonarien von Europa und Westafrika (Cnidaria, Anthozoa). *Courier Forsch. Inst. Senckenberg*, **149**: 1-135.
- GRAY J.E., 1860.— Revision of the Family Pennatulidae, with descriptions of some new Species in the British Museum. *Annals and Magazine of natural History*, **5**: 20-25.
- GRAY J.E., 1870.— Catalogue of Sea-Pens or Pennatulariidae in the Collection of the British Museum. Trustees British Museum, London, 51 p.
- GROOTS S., WEINBERG S., 1982.— Biogeography, Taxonomical Status and Ecology of *Alcyonium (Parerythropodium) coralloides* (Pallas, 1766). *Marine Ecology*, **3**: 293-312.
- JUNGENSEN H.F.E., 1904.— Pennatulida. *Danish Ingolf Expedition*, **5**: 1-95.
- KOCATAS A., 1981.— Liste préliminaire et répartition des Crustacés Décapodes des eaux Turques. *Rapports et procès-verbaux de la Commission internationale pour l'exploration scientifique de la mer Méditerranée*, **27**: 161-162.
- KOCH G. VON, 1887.— Die Gorgoniden des Golfes von Neapel und der angrenzenden Meeresabschnitte. Erster Theil einer Monographie der Anthozoa Alcyonaria. *Fauna und Flora del Golfo di Napoli*, **15**: 1-90.
- KOCH G. VON, 1891.— Die Alcyonacea des Golfes von Neapel. *Mitteilungen aus der zoologischen Station zu Neapel*, **9**: 652-676.
- KÖLLIKER A., 1872.— Anatomisch-systematische Beschreibung der Alcyonarien. Die Pennatuliden. *Abhandl. Senckenb. naturf. Ges.*, **7-8**: 1-458.
- KOUKOURAS A., RUSSO A., 1991.— Midlittoral soft substratum macrofaunal assemblages in the North Aegean Sea. *Marine Ecology*, **12**: 293-316.
- KOUKOURAS A., DOUNAS C., TÜRKAY M., E. VOULTSIADOU-KOUKOURA, 1992.— Decapod Crustacean Fauna of the Aegean Sea: New Information, Check List, Affinities. *Senckenbergiana maritima*, **22**: 217-244.
- KÜKENTHAL W., BROCH H., 1911.— Pennatulacea. *Wiss. Ergeb. Deutsche Tiefsee Exp. ("Valdivia" 1898-1899)*, **13**: 113-576.
- LABOREL J., 1960.— Contribution à l'étude directe des peuplements benthiques sciaphiles sur substrat rocheux en Méditerranée. *Recueil des travaux de la station marine d'Endoume*, **33**: 117-173.
- LACAZE-DUTHIERS H. DE, 1888.— Les progrès du laboratoire de Roscoff et du laboratoire Arago. *Comptes rendus de l'Académie des sciences*, Paris, **106**: 1770-1777.
- LACAZE-DUTHIERS H. DE, 1900.— Coralliaires du Golfe du Lion. Alcyonaires. *Archives de zoologie expérimentale et générale*, **3**: 353-462.
- LAFARGUE F., 1969.— Peuplements sessiles de l'archipel de Glénan. I. Inventaire: Anthozoaires. *Vie et Milieu*, **20**: 415-436.
- LAUBIER L., 1966.— Le coralligène des Albères. Monographie biocénotique. *Annales de l'Institut océanographique*, Paris, **43**: 139-316.
- LO BIANCO S., 1909.— Notize biologiche riguardanti specialmente il periodo di maturità sessuale degli animali del golfo di Napoli. *Mitteilungen aus der zoologischen Station zu Neapel*, **19**: 513-761.
- MADSEN F.J., 1970.— Remarks on *Swiftia rosea* (GRIEG) and related species (Coelenterata, Gorgonaria). *Steenstrupia*, **1**: 1-10.
- MANUEL R.L., 1981.— British Anthozoa. Synopses of the British Fauna (New Series). Academic Press, London, 241 p.
- MARCHETTI R., 1965.— Ricerche sul corallo rosso della costa ligure e toscana. I. Distribuzione geografica. *Rendic. Istit. Lomb. Sci. e Lett.*, **99**: 255-278.
- MARION A.F., 1882.— Les Alcyonaires du Golfe de Marseille. *Comptes rendus de l'Académie des sciences*, Paris, **94**: 985-988.
- MARION A.F., 1898.— Notes sur la faune des Dardanelles et du Bosphore. *Annales du Musée d'Histoire naturelle de Marseille*, **1**: 163-182.
- MICALLEF H. & F. EVANS, 1968.— The marine fauna of Malta. *Cont. Mar. Sci. Roy. Univ. Malta*, **1**: 143-172.
- MORRI C., BAVESTRELLO G., BIANCHI C.N., 1991.— Faunal and Ecological notes on some benthic Cnidarian species from the Tuscan Archipelago and Eastern Ligurian Sea (Western Mediterranean). *Boll. Mus. Ist. biol. Univ. Genova*, **54-55**: 27-47.
- NOBRE A., 1931.— Contribuições para o estudo dos Coelenterados de Portugal. Instituto de Zoologia da Universidade do Porto, 82 p.
- ÖZTÜRK B., BOURGET J.P., 1990.— Données préliminaires sur le corail noir de la mer de Marmara (Turquie) *Gerardia savaglia* (Bertolini, 1819). *Istanbul universitesi su urunleri dergisi* [= Istanbul university journal of aquatic products], **4**: 45-48.
- PARENZAN P., 1973.— L'anello di san cataldo nel mar grande di Taranto. Sue condizioni fisiche e biologiche. *Fondo a Veretillum. Thalassia Salentina*, **6**: 3-24.
- PARENZAN P., 1977.— Nuovi reporti di *Maasella edwardsi* (De Lacaze-Duthiers, 1888) nel Mediterraneo (Octocorallia: Alcyonacea). *Thalassia Salentina*, **7**: 71-80.
- PAX F., MÜLLER I., 1953.— Die Anthozoenfauna der Bucht von Kastela bei Split. *Acta Adriatica*, **5**: 1-35.
- PAX F., MÜLLER I., 1955a.— Gli Antozoi del Golfo di Trieste. *Atti Mus. civ. St. nat. Trieste*, **20**: 49-102.
- PAX F., MÜLLER I., 1955b.— Gli Antozoi del Museo Civico di Storia Naturale di Trieste, Part I: Antipatharia, Ceriantharia, Zoantharia, Actiniaria, Alcyonaria e Pennatularia. *Atti Mus. civ. St. nat. Trieste*, **20**: 103-129.
- PAX F., MÜLLER I., 1962.— Die Anthozoenfauna der Adria. *Fauna et Flora Adriatica*, **3**: 1-343.
- PÉRÈS J.M., PICARD J., 1958.— Recherches sur les peuplements benthiques de la Méditerranée nord-orientale. *Annales de l'Institut océanographique*, Paris, **34**: 213-291.
- POR F.O., DIMENTMAN C., 1989.— The Legacy of Tethys: an aquatic biogeography of the Levant. In: *Monographiae Biologicae*, **63**: xi + 214 p. Dumont H.J., Wergel M.J.A. (eds). Kluwer Academic Publishers, Dordrecht.
- ROSSI L., 1950.— Celenterati del Golfo di Rapallo (Riviera Ligure). *Boll. Ist. Zool. Univ. Torino*, **2**: 193-235.
- ROSSI L., 1958a.— Contributo allo studio della fauna di profondità vivente presso la Riviera Ligure di Levante. *Doriana*, **2**: 1-13.
- ROSSI L., 1958b.— Osservazioni sul bentos coralligeno dei dintorni di Catania. *Archivio di oceanografia e limnologia*, **11**: 161-165.
- ROSSI L., 1959.— Le specie di *Eunicella* (Gorgonaria) del golfo di Genova. *Ann. Mus. Stor. nat. Genova*, **71**: 203-225.

- ROSSI L., 1971.— Guida a Cnidari e Ctenofori della fauna italiana. *Quad. Civ. St. Idrob., Milano*, 2 : 1-101.
- ROULE L., 1900.— Notice sur les Anthozoaires des côtes de la Corse. *Bulletin de la Société zoologique de France*, 25 : 125-135.
- SCHMIDT H., 1972.— Bionomische Studien an mediterranen Anthozoen : die Anthozoenfauna des Strombolicchio (Äolische Inseln). *Marine Biology*, 15 : 265-278.
- SOEST R.W.M. VAN, WEINBERG S., 1980.— A note on the sponges and octocorals from Sherkin Island and Loughe Ine, Co. Cork. *Irish Naturalists' Journal*, 20 : 1-15.
- STEINDACHNER F., 1891.— Vorläufiger Bericht über die Commission für Erforschung des östlichen Mittelmeeres. *Sitz. Ber. Akad. Wiss. Wien*, 100 : 435-447.
- STIASNY G., 1940.— Gorgonides et Alcyonides des collections du Muséum National d'Histoire Naturelle (Première partie). *Archives du Muséum national d'Histoire naturelle*, Paris, 16 : 109-145.
- STIASNY G., 1942.— Alcyonaria und Gorgonaria aus dem Golf von Neapel. *Pubblicazioni della Stazione zoologica di Napoli*, 19 : 1-47.
- STOSSICH M., 1885.— Prospetto della fauna del Mare Adriatico. 6. Coelenterata. *Boll. Soc. Adriat. Sc. nat. Trieste*, 9 : 112-155.
- STUDER T., 1901.— Alcyonaires provenant des campagnes de "l'hirondelle" (1886-1888). *Résultats des Campagnes scientifiques du Prince Albert I^{er} de Monaco*, 20 : 1-64.
- THOMSON J.A., 1927.— Alcyonaires provenant des campagnes scientifiques du Prince Albert I^{er} de Monaco. *Résultats des Campagnes scientifiques du Prince Albert I^{er} de Monaco*, 73 : 1-77.
- THOMSON J.A., 1929.— Alcyonaires des environs de Monaco et de localités diverses. *Bulletin de l'Institut océanographique*, Monaco, 534 : 1-10.
- TIXIER-DURIVAUULT A., 1960.— Les octocoralliaires de l'île Inhaca. *Bulletin du Muséum national d'Histoire naturelle*, Paris, (2), 32 : 359-367.
- TIXIER-DURIVAUULT A., 1961.— Sur un nouvel Alcyonaire: *Parerythropodium bosphorense*. *Bulletin du Muséum national d'Histoire naturelle*, Paris, (2), 33 : 322-325.
- TIXIER-DURIVAUULT A., 1963.— Alcyonacea et Pennatulacea de l'Afrique occidentale. *Atlantide Rep.*, 7 : 63-76.
- TIXIER-DURIVAUULT A., LAFARGUE F., 1966.— Quelques Alcyonaires des îles de Glénan. *Bulletin du Muséum national d'Histoire naturelle*, Paris, 38 : 456-460.
- TIXIER-DURIVAUULT A., LAFARGUE F., 1968.— Quelques Octocoralliaires des côtes françaises. *Bulletin du Muséum national d'Histoire naturelle*, Paris, 40 : 621-629.
- TIXIER-DURIVAUULT A., D'HONDT M.J., 1975.— Les Octocoralliaires de la campagne Biacores. *Bulletin du Muséum national d'Histoire naturelle*, Paris, 252 : 1361-1433.
- TORTONESE E., 1936.— I Gorgonarii del golfo di Genova. *Boll. Zool.*, 7 : 113-125.
- TORTONESE E., 1959.— Osservazioni sul bentos del Mar di Marmara e del Bosforo. *Natura*, Milano, 50 : 18-26.
- TORTONESE E., DEMIR M., 1960.— The Echinoderm fauna of the Sea of Marmara and the Bosphorus. *Hidrobiologi Istanbul*, 5 : 1-16.
- VAFIDIS D., KOUKOURAS A., 1991.— *Crassophyllum thessalonicae* sp. n. (Octocorallia, Pennatulacea), from the Aegean Sea. *Zoologica Scripta*, 20 : 201-205.
- VERSEVELDT J., 1964.— Notes on Mediterranean Alcyonium species (Coelenterata: Octocorallia). *Zool. Meded.*, 39 : 153-167.
- VIGUIER C., 1888.— Études sur les animaux inférieurs de la baie d'Alger. *Archives de Zoologie expérimentale et générale*, 6 : 351-373.
- WEINBERG S., 1975.— Contribution à la connaissance de *Parerythropodium coralloides* (Pallas, 1766) (Octocorallia : Alcyonacea). *Beaufortia*, 23 : 53-73.
- WEINBERG S., 1976.— Revision of the common Octocorallia of the Mediterranean circalittoral. I. Gorgonacea. *Beaufortia*, 24 : 63-104.
- WEINBERG S., 1977.— Revision of the common Octocorallia of the Mediterranean circalittoral. II. Alcyonacea. *Beaufortia*, 25 : 131-166.
- WEINBERG S., 1978.— Revision of the common Octocorallia of the Mediterranean circalittoral. III. Stolonifera. *Beaufortia*, 27 : 139-176.
- WEINBERG S., 1979.— Autecology of shallow-water Octocorallia from Mediterranean rocky substrata, I. The Banyuls area. *Bijdragen tot de Dierkunde*, 49 : 1-15.
- WEINBERG S., 1980.— Autecology of shallow-water Octocorallia from Mediterranean rocky substrata, II. Marseille, côte d'Azur and Corsica. *Bijdragen tot de Dierkunde*, 50 : 73-86.
- WEINBERG S., 1986.— Mediterranean Octocorallia : description of *Clavularia carpediem* n. sp. and synonymy of *Clavularia crassa* and *C. ochracea* on etho-ecological grounds. *Bijdragen tot de Dierkunde*, 56 : 232-246.
- WILLIAMS G.C., 1989.— The pennatulacean genus *Cavernularia* Valenciennes (Octocorallia : Veretillidae). *Zoological Journal of the Linnean Society*, 95 : 285-310.
- WILLIAMS G.C., 1992.— Biogeography of the octocorallian coelenterate fauna of southern Africa. *Biological Journal of the Linnean Society*, 46 : 351-401.
- ZIBROWIUS H., 1979.— A propos du corail rouge en Méditerranée orientale. *Rapports et procès-verbaux de la Commission internationale pour l'exploration scientifique de la mer Méditerranée*, 25/26 : 121-122.
- ZIBROWIUS H., MONTEIRO MARQUES V., GRASSHOFF M., 1984.— La répartition du *Corallium rubrum* dans l'Atlantique (Cnidaria: Anthozoa: Gorgonaria). *Téthys*, 11 : 163-170.