

Segonzactis hartogi sp. n. (Condylanthidae) and other sea anemones of the Aegean deep water

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ABSTRACT. A new deep-water actiniarian species, *Segonzactis hartogi* sp.n. is described from the Mediterranean (Aegean Sea). This is the first record of the family Condylanthidae from the Mediterranean Sea. Morphometric and ecological differences between the new species and *S. platypus* Riemann-Zürneck, 1979, the only known species of the genus, are discussed. Another six species of the Actiniarian fauna of the deep Aegean are also presented. Information is given on their geographical distribution and habitat.

KEY WORDS: *Segonzactis*, Actiniaria, Deep water fauna, Aegean Sea.

INTRODUCTION

Forty nine valid actiniarian species belonging to 16 families were previously known from the Mediterranean and the Black Sea (ANDRES, 1884; CARLGREN, 1949; PAX & MÜLLER, 1962; SCHMIDT, 1972; DOUMENC et al., 1985; Gili, 1987; CHINTIROGLOU et al., 1997; VAFIDIS et al., 1997; WILLIAMS, 1997; etc.). Twenty nine of them belonging to 10 families have been reported from the Aegean Sea (DOUMENC et al., 1985; DOUMENC et al., 1987; CHINTIROGLOU & DEN HARTOG, 1995; LOUKMIDOU et al., 1996; VAFIDIS et al., 1997).

During the biological cruises of the RV "FILIA" in the Aegean Sea, in 1987, at depths ranging from 80 to 1200 m, and from investigations of the University of Thessaloniki in the N. Aegean Sea, since 1992, at depths from 150 to 1200 m, seven actiniarian species were collected from deep water. One of those anemones collected belongs to the genus *Segonzactis* Riemann-Zürneck, 1979. This is the first record of the family Condylanthidae Stephenson, 1922 in the Mediterranean Sea. World-wide, *Segonzactis* is represented by only one species, *S. platypus*, found on the abyssal region of the Bay of Biscay between 4237 and 4850 m by RIEMANN-ZÜRNECK (1979) and from Porcupine abyssal plain at 4845 m depth by RIEMANN-ZÜRNECK (1998).

The main goal of the present paper is to give a detailed description of the new species, to compare it with *S. platy-*

pus, and to present and discuss the actiniarian fauna of the deep Aegean Sea.

MATERIAL AND METHODS

Specimens have been collected since 1987 from 17 sampling stations in the Aegean Sea (Fig. 1), at depths varying

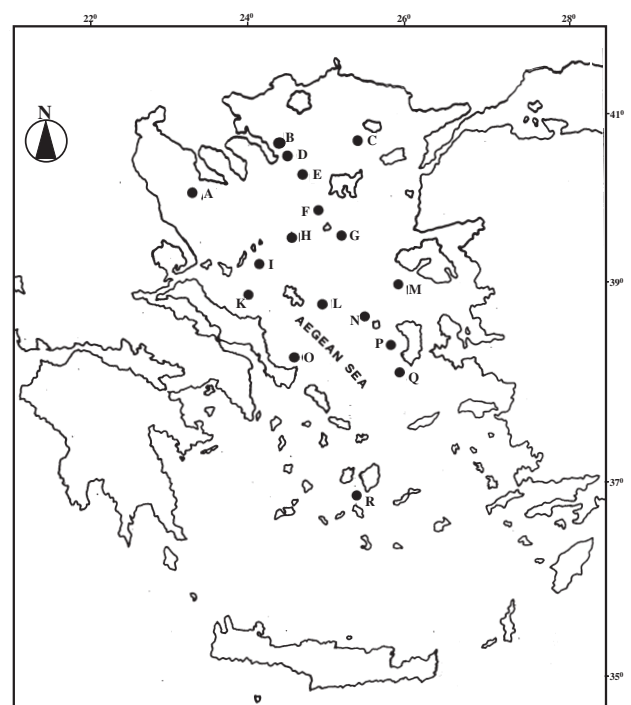


Fig. 1. – Map of the Aegean Sea, indicating the sampling stations.

from 80 to 1200 m using Smith-McIntyre grab, fishing and Agassiz trawls. All samples were preserved in 6% formalin/sea-water. Paraffin sections, 8 μ m thick and stained with hematoxylin and eosin, were prepared for histological study according to DOUMENC et al. (1985). Measurements of cnidae were taken from undischarged capsules in squash preparations (CHINTIROGLOU et al., 1997). Nematocyst nomenclature used was as proposed by ENGLAND (1991). The specimens are deposited in the Museum of the Department of Zoology in the Aristoteleion University of Thessaloniki (MZDAUT) and in the Museum of the Fisheries Research Institute of Kavala (MFRI).

RESULTS

Order ACTINIARIA R.Hertwig, 1882

Subtribe ENDOMYARIA Stephenson, 1921

Family CONDYLANTHIDAE Stephenson, 1922

Segonzactis hartogi sp.n.

(Figs 2, 3, 4, Table 1)

Type locality. Holotype, from Mount Athos, (40°17'50"N, 26°23'20"E), North Aegean Sea at 750 m depth, on silty bottom. Paratype (1) Mount Athos, (40°13'30"N, 27°26'40"E), North Aegean Sea at 800 m depth, on silty bottom. Paratypes (2) and (3) from Ios island (36°38'50"N, 25°16'40"E) Central Aegean Sea at 80 m depth, on sand-silty bottom.

Type Material. Holotype Museum of the Fisheries Research Institute of Kavala (MFRI IA₂₄, collected 2.06.91). One paratype (MFRI IA₂₅, collected 2.06.91), Museum of the Fisheries Research Institute of Kavala and two paratypes (MZDAUT B₇₈₄, MZDAUT B₇₈₅ collected 29.05.91), Museum of the Department of Zoology, University of Thessaloniki.

Etymology. The specific name is dedicated in the memory of Dr. Koos den Hartog, Curator of Coelenterata et al., at the National Museum of Natural History of Leiden, The Netherlands.

Biometry of polyps. Diameter of scapus 5-7 mm; height of column 10-19 mm; diameter of base 15-27 mm; specimens weigh 0.2-2.3gr.

Colour. Pedal disc and column transparent with visible insertions of the mesenteries (Fig 2a-d).

External morphology. Column divided in scapus and scapulus (Fig. 2a). Scapus short and covered by a cuticula. Scapulus with membranous appendages of the mesogloea. When totally contracted the scapus disappears and the animal then becomes disc-shaped (Fig. 2b). There are eight tentacles, short and thick. Actinopharynx with only one ventral siphonoglyph.

Internal anatomy. Mesenteries separable into macrocnemes and microcnemes, only 8 macrocnemes. Mesenteries in five cycles, arranged hexamerously, several pairs of the fifth cycle often lacking. Mesenteries

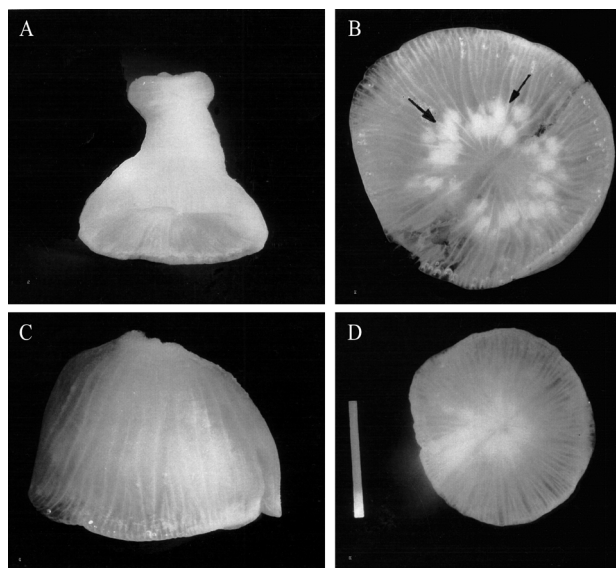


Fig. 2. – *Segonzactis hartogi* sp.n. a-b. Holotype. – a. Side view of the anemone (slightly contracted animal). – b. Lower side (pedal disc) of the anemone. – c. Side view of a completely contracted animal (paratype). – d. Lower side (pedal disc), showing the presence of gonads (paratype).

from the third up to the fifth cycle only present in the lower-most part of the body (Fig. 2c). Radial muscles of the oral disc weak, meso-ectodermal. Marginal sphincter endodermal, weak (Fig. 3a). Retractors of the eight macrocnemes circumscribed reniform and very strong (Fig. 3b). Parietobasilar muscles strong (Fig. 3c). Absence of basilar muscles. Female gonads present in three specimens occurring in the eight macrocnemes (Fig. 2d).

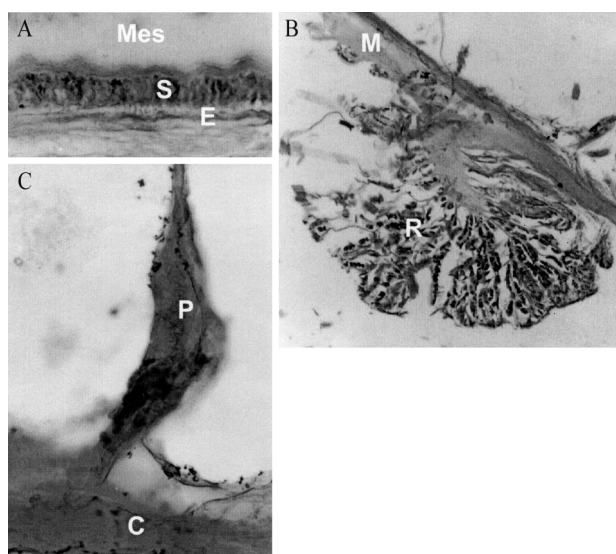


Fig. 3. – *Segonzactis hartogi* sp.n. a-c. – a. Vertical section showing diffuse sphincter muscle. – b. Transverse section of macrocneme showing retractor muscle. – c. Transverse section of macrocneme showing parietobasilar muscle. C column; E endoderm; M macrocneme; Mes mesogloea; P parietobasilar muscle; R retractor muscle; S sphincter muscle.

Cnidom. Cnidom* consists of spirocysts, basitrichs and microbasic p-mastigophores (Fig. 4a-e).

(a) Tentacles. basitrichs - length: 7.0-13.0 μm (mean $10.40 \pm 1.7 \mu\text{m}$, $n = 60$), width: 1.0-3.0 μm (mean $1.8 \pm 0.47 \mu\text{m}$, $n = 60$); spirocysts - length: 6.0-21.8 μm (mean $13.19 \pm 3.53 \mu\text{m}$, $n = 58$), width: 1.0-4.0 μm (mean $1.9 \pm 0.6 \mu\text{m}$, $n = 58$).

(b) Filament. basitrichs - length: 10.0-24.0 μm (mean $17.02 \pm 2.69 \mu\text{m}$, $n = 20$), width: 1.5-4.0 μm (mean $2.7 \pm 0.73 \mu\text{m}$, $n = 20$); mi-p. mastigophores (a) - length: 14.0-29.5 μm (mean $21.44 \pm 4.35 \mu\text{m}$, $n = 47$), width: 2.5-7.0 μm (mean $4.9 \pm 1.27 \mu\text{m}$, $n = 47$), shaft 8.0-24.0 μm (mean $13.16 \pm 3.26 \mu\text{m}$, $n = 47$); mi-p. mastigophores (b) - length: 9.0-9.5 μm (mean $9.25 \pm 0.29 \mu\text{m}$, $n = 4$), width: 3.0-4.0 μm (mean $3.37 \pm 0.48 \mu\text{m}$, $n = 4$), shaft 5.0-7.0 μm (mean $6.25 \pm 0.96 \mu\text{m}$, $n = 4$).

Diagnosis. Column divided in scapus and scapulus. Scapus short and covered by a cuticula. Pedal disc without basilar muscles. Sphincter endodermal, very weak. Eight tentacles, short and thick. Mesenteries in five cycles,

arranged hexamerously. Eight mesenteries developed as macrocnemes, with circumscribed retractors, gonads and mesenterial filaments. Only one very strong siphonoglyph. Parietobasilar muscles strong. Cnidom: Spirocysts, basitrichs, microbasic p-mastigophores (two types).

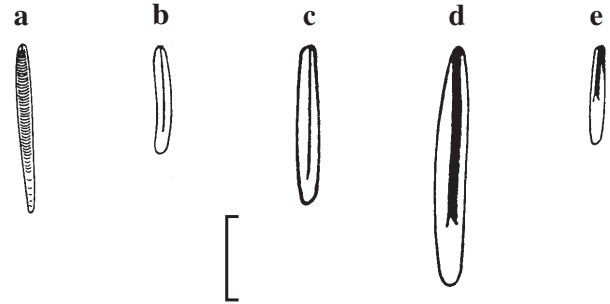


Fig. 4. – *Segonzactis hartogi* sp.n. (nematocyst signature) (see also Table 1). a-b. Tentacle. – a. Spirocyst. – b. Basitrich. c-e. Filament. – c. Basitrich. – d. Microbasic p-mastigophore (a). – e. Microbasic p-mastigophore (b) (scale 8 μm).

TABLE 1

Comparison between *Segonzactis platypus* Riemann- Zürneck, 1979 and *Segonzactis hartogi* sp.n.

	<i>S. platypus</i>	<i>S. hartogi</i>
Height of column (mm)	—	10-19
Diameter of scapus (mm)	5-10	5-7
Diameter of pedal disc (mm)	18-35	15-27
Weight (gr)	0.65-1.7	0.2-2.3
Tentacle		
spirocysts (μm)	81 x 3.5-4.5	6-21.8 x 1-4
basitrichs (μm)	27-32 x 3-4	7-13 x 1-3
Scapus	14.5-23 x 3-3.5	—
Filament		
basitrichs 1 (μm)	32-33 x 4-4.5	—
basitrichs 2 (μm)	14-18 x 3-3.5	10-24 x 1.5-4
mi-p.mastigophores (a) (μm)	25-30 x 5-5.5	14-29.5 x 2.5-7
Shaft (μm)	—	8-24
mi-p.mastigophores (b) (μm)	—	9-9.5 x 3-4
Shaft (μm)	—	5-7
Geographical distribution	Bay of Biscay, Porcupine abyssal plain	Mediterranean (Aegean Sea)
Vertical distribution (m)	4237-4850	80-800
References	RIEMANN-ZÜRNECK (1979, 1998)	Present work

Subtribe ACONTIARIA CARLGRÉN
(in Stephenson, 1935)

Family HORMATHIIDAE Carlgrén, 1925

Hormathia coronata (Gosse, 1858)

Hormathia coronata, SCHMIDT, 1972, p. 29, Abb. 20 a, b.- DEN HARTOG, 1977, p. 237, fig. 5.- MANUEL, 1981, p.

166, fig. 57.- DOUMENC et al., 1985, p. 515.- GILI, 1987, p. 390, fig. 4.107 a, c.

Material examined. 29 specimens (stations: A, C, D, O, P) attached to various types of substrata including gastropod and bivalve shells, stones, rocks and biogenic detritus, between 150 and 170 m.

Distribution. This Atlanto-Mediterranean species is known from: – Mediterranean basin: Western Mediterranean (CARUS, 1885; SCHMIDT, 1972; AZOUZ, 1973; GILI, 1987; etc.); Central Mediterranean (PARENZAN, 1973; ARENA & LI GRECI, 1973; etc.); Adriatic Sea (PAX, 1952; PAX & MÜLLER, 1962; GAMULIN-BRIDA, 1974;

* Histological sections did not reveal any conspicuous nematocysts in the scapus.

etc.); Eastern Mediterranean (DOUMENC et al., 1985) – Atlantic ocean: Eastern Atlantic, from all coasts of western Europe and Britain (STEPHENSON, 1935; CARLGREN, 1949; LAFARGUE, 1969; DEN HARTOG; 1977; MANUEL, 1981; etc.).

Short description. Base broad and moderately adherent. Column divided into scapus and scapulus. Scapus with small solid tubercles, which tend to form 12 longitudinal rows distally, leading into 12 low, inconspicuous longitudinal ridges on the scapulus. Thin periderm is usually present on the scapus. Tentacles moderate in length, neatly and hexamerously arranged in five cycles. Sphincter perioral mesogloean. Retractor muscles diffuse and not well developed. Cnidom: Spirocysts, basitrichs, microbasic p-mastigophores, microbasic b-mastigophores.

***Actinauge richardi* (Marion, 1882)**

Actinauge richardi, STEPHENSON, 1935, p. 289, text-figs. 7(D), 20, 31, 40, 94-98.- MANUEL, 1981, p. 172, fig. 60. – DOUMENC et al., 1985, p. 513, fig. 3. – GILI, 1987, p. 389, fig. 4.107 b, e.

Material examined. 42 specimens (stations: B, E, F, G, K, M, N, Q) were collected on silty bottoms at depths from 105 to 320 m.

Distribution. This Atlanto-Mediterranean species is known from: – Mediterranean basin: Western Mediterranean (GRAVIER, 1922; STEPHENSON, 1935; ROSSI, 1958; GILI, 1987; etc.); Central Mediterranean (ARENA & LI GRECI, 1973); Adriatic Sea (BOMBACE & FROGLIA, 1973); Eastern Mediterranean (DOUMENC et al., 1985) – Atlantic ocean: Eastern Atlantic, from Norway to Senegal (STEPHENSON, 1935; CARLGREN, 1949; MANUEL, 1981; etc.).

Short description. Basal disc forming a rounded cavity enclosing mud or sand. Column divided into scapus and scapulus. Scapus with numerous often large solid tubercles and periderm. Tentacles hexamerously arranged in five cycle. Sphincter mesogloean very strong. Retractor muscles diffuse and not well developed. Cnidom: Spirocysts, basitrichs, microbasic p-mastigophores (two types), microbasic b-mastigophores.

***Calliactis parasitica* (Couch, 1842)**

Calliactis parasitica, SCHMIDT, 1972, p. 40, Abb. 20 d.- MANUEL, 1981, p. 174, figs. 2C, 3, 61. – DOUMENC et al., 1985, p. 516. – GILI, 1987, p. 393, fig. 4.105 e, 4.106 a, d.

Material examined. 77 specimens (stations: A, C, F, H, K, L, N, O, Q, R) attached to various types of substrata including gastropod and bivalve shells, stones, rocks and biogenic detritus, between 5 and 160 m.

Distribution. This Atlanto-Mediterranean species is known from: – Mediterranean basin: Western Mediterranean (CARUS, 1885; SCHMIDT, 1972; AZOUZ, 1973; GILI, 1987; etc.); Central Mediterranean (PARENZAN, 1973; ARENA & LI GRECI, 1973; MICALLEF & EVANS, 1968; etc.); Adriatic Sea (PAX, 1952; PAX & MÜLLER, 1953, 1962; GAMULIN-BRIDA, 1974; etc.); Eastern Mediterranean (GELDIAY & KOÇATAS, 1972; DOUMENC et al., 1985; CHINTIROGLOU & KOUKOURAS, 1991) – Atlantic ocean: Eastern Atlantic, from North Sea and around to south-west Europe (STEPHENSON, 1935; CARLGREN, 1949; MANUEL, 1981; etc.).

Short description. Cinclides fairly prominent in a zone just above the limbus. Tentacles moderate in length and very numerous, hexamerously arranged. Acontia are readily emitted from cinclides and actinopharynx. Column fairly wide. Sphincter mesogloean very strong. Retractor muscles diffuse and not well developed. Cnidom: Spirocysts, microbasic p-mastigophores, microbasic b-mastigophores.

***Adamsia palliata* (Bohadsch, 1761)**

Adamsia palliata, SCHMIDT, 1972, p. 35, Abb. 19 c.- GILI, 1987, p. 394, figs. 4.101 b, 4.106 c.

Adamsia carciniopados, Manuel, 1981, p. 176, fig. 62.- Doumenc et al., 1985, p. 517.

Material examined. 12 specimens (stations: D, G, I, O, R) attached to gastropods cells of the species *Gibbula magus* and *Lunatia catena* inhabited by hermit crab *Pagurus alatus*, between 90 and 120 m.

Distribution. This Atlanto-Mediterranean species is known from: – Mediterranean basin: Western Mediterranean (CARUS, 1885; SCHMIDT, 1972; GILI, 1987; etc.); Central Mediterranean (PARENZAN, 1973; ARENA & LI GRECI, 1973; etc.); Adriatic Sea (PAX, 1952; PAX & MÜLLER, 1953, 1962; etc.); Eastern Mediterranean (PÈRES & PICARD, 1958; DOUMENC et al., 1985) – Atlantic ocean: Eastern Atlantic, from all coasts of western Europe and Britain (STEPHENSON, 1935; CARLGREN, 1949; LAFARGUE, 1969; MANUEL, 1981; etc.).

Short description. Base forming two lobes enveloping a hermit crab and its gastropod shell so that the disc is beneath the crab with the two lobes meeting on its dorsal side. Tentacles very numerous and short. Cinclides are present on low mounds on the lower part of the column. Retractor muscles diffuse and not well developed. Cnidom: Spirocysts, microbasic p-mastigophores, microbasic b-mastigophores.

***Amphianthus dohrnii* (Koch, 1878)**

Amphianthus dohrnii, SCHMIDT, 1972, p. 40, Abb. 20 d. – MANUEL, 1981, p. 178, fig. 63.- GILI, 1987, p. 392, fig. 4.106 g, i.

Material examined. 4 specimens (station: D) found on the gorgonian *Eunicella verrucosa* at 100 m depth.

Distribution. This Atlanto-Mediterranean species is known from: – Mediterranean basin: Western Mediterranean (ANDRES, 1884; CARUS, 1885; SCHMIDT, 1972; ROSSI, 1950; GILI, 1987); Central Mediterranean (ARENA & LI GRECI, 1973); Adriatic Sea (PAX & MÜLLER, 1962); Eastern Mediterranean (VAFIDIS et al., 1997) – Atlantic ocean: Eastern Atlantic, from Portugal, west coasts of France and southern of British Isles (NOBRE, 1931; STEPHENSON, 1935; CARLGREN, 1949; MANUEL, 1981).

Short description. Base adherent, often elongated along the axis of the substratum (usually gorgonians or hydroids). Column short and flaring out widely to the disc, not divided into regions. Cinclides are few. Tentacles short or moderate, irregularly arranged in four or five cycles. Cnidom: Spirocysts, basitrichs, atrichs, microbasic p-mastigophores (two types).

Family SAGARTIIDAE Gosse, 1858

Sagartiogeton undatus (O.F. Müller, 1788)

Sagartiogeton undatus, SCHMIDT, 1972, p. 55. – MANUEL, 1981, p. 158, figs. 54A-C. – DOUMENC et al., 1985, p. 519, fig. 4. – GILI, 1987, p. 385, fig. 4.108 g, h.

Material examined. 19 specimens (stations: B, C, F, K, L, N, Q) attached to various types of substrata including gastropod shells, stones, rocks, between 15 and 260 m.

Distribution. This Atlanto-Mediterranean species is known from: – Mediterranean basin: Western Mediterranean (CARUS, 1885; SCHMIDT, 1972; FEBVRE, 1968; GILI, 1987; etc.); Central Mediterranean (PARENZAN, 1973); Adriatic Sea (CARUS, 1885; PAX & MÜLLER, 1962; etc); Eastern Mediterranean (DOUMENC et al., 1985); Black Sea (PASPALLEFF, 1933; BACESCU et al., 1971; MÜLLER, 1971, 1973) – Atlantic ocean: Eastern Atlantic, from Scandinavia and around south-west Europe (STEPHENSON, 1935; CARLGREN, 1949; MANUEL, 1981; etc.).

Short description. Base wide, usually wider than the disc, its outline relatively smooth as basal laceration does not occur (cf. *S. laceratus*). Column very tall in full extension, cylindrical but when tightly contracted it may become remarkably flat. Disc translucent, pale grey or brown, usually with narrow opaque cream lines on the mesenteric insertions. Tentacles long or very long and gracefully displayed, hexamerously arranged. Cnidom: Spirocysts, basitrichs, microbasic p-mastigophores (two types), microbasic b-mastigophores.

DISCUSSION

Sixteen families of actiniarian fauna were previously known from the Mediterranean. Of those only the Hormathiidae and Sagartiidae have representatives in the bathyal zone. Six species – *Actinauge richardi* (Marion, 1882), *Calliactis parasitica* (Couch, 1842), *Adamsia palliata* (Bohadsch, 1761), *Hormathia coronata* (Gosse, 1858), *Amphianthus dohrnii* (Koch, 1878) and *Sagartiogeton undatus* (O.F. Müller, 1788) – have been reported in the deep Mediterranean waters. Three of them, i.e. the species *A. richardi*, *H. coronata* and *A. dohrnii* have been characterized as real residents of the lower circalittoral or the upper bathyal, because the other three have a wide bathymetrical range, from the upper infralittoral to bathyal zone (CARLGREN, 1949; SCHMIDT, 1972; PÉRÈS, 1985; DOUMENC et al., 1985).

The family Condylanthidae Stephenson, 1922, has not previously been recorded from the Mediterranean Sea. It consists of six genera – *Condylanthus* Carlgren, 1899; *Pseudormathia* Carlgren, 1928; *Macrocnema* Carlgren, 1928; *Charisea* Torrey, 1902; *Charisella* Carlgren, 1949, *Segonzactis* Riemann-Zürneck, 1979 – which differ from each other by the presence/absence of the pseudospherules, the presence of tubercles of the column, and by the number of the macrocnemes (CARLGREN, 1949; DOUMENC & VAN PRAËT, 1987). Their geographical distribution is limited to polar zones with the exception of species *Charisella elongata* (Carlgren, 1950) and *Macrocnema nicobarica* Carlgren, 1928, which are tropical, and *Segonzactis platypus* Riemann-Zürneck, 1979, which was found in the abyss of the Bay of Biscay. Only *M. nicobarica* and *S. platypus* have been found in deep waters, in the bathyal and abyssal zone respectively (CARLGREN, 1928; RIEMANN-ZÜRNECK, 1979).

S. platypus Riemann-Zürneck, 1979 and *S. hartogi* sp. n. are distinguished from each other on the cnidae biometry (Table 1). Other important characteristics, geographical and vertical distribution of the two species are also given in Table 1.

In order to explain the very low degree of endemism and a low diversity of the deep-sea fauna of the Mediterranean compared to the fauna of the Northeast Atlantic, BOUCHET & TAVIANI (1992), suggest that the larval ecology of individual species is the most important factor governing the composition of the deep Mediterranean benthos. Primarily on the basis of research on gastropods, they suggest that much of this Mediterranean deep-sea fauna consists of reproductively sterile pseudo-populations that are constantly derived through larval inflow from Atlantic mother populations. The presence of female gonads in the macrocnemes of *S. hartogi* in the Aegean Sea suggests the reproduction ability of this species and consequently the existence of a real population in this area.

The occurrence of *S. hartogi* in the Aegean Sea raises the number of the Actiniarian species known from Mediterranean to fifty and those from Aegean Sea to thirty. *S. hartogi* is considered an endemic Mediterranean species.

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REFERENCES

- ANDRES, A. (1884). Le attinie. *Fauna Flora Golf Neapel*, 9: 1-460.
- ARENA, P. & F. LI GRECI (1973). Indagini sulle condizioni faunistiche e sui rendimenti di pesca dei fondali batiali della Sicilia occidentale e della bordura settentrionale dei banchi della soglia Siculo-Tunisina. *Quad. Lab. Tecnol. Pesca Ancona*, 1 (5): 157-201.
- AZOUZ, A. (1973). Les fonds chalutables de la région Nord de la Tunisie. I. Cadre physique et biocoenoses benthiques. *Bull. Inst. Océanogr. Pêche, Salammbô*, 2: 473-563.
- BACESCU, M.C., G.I. MÜLLER & M.-T. GOMOIU (1971). *Recherches d'écologie benthique en mer Noire*. Édité, Academia R.S.R. Bucaresti, 4: 1-357.
- BOMBACE, G. & C. FROGLIA (1973). Premières remarques sur les peuplements de l'étage bathyal de la basse Adriatique. *Rev. Trav. Inst. Pêcher Marit., Nantes*, 37 (2): 156-161.
- BOUCHET, P. & M. TAVIANI (1992). The Mediterranean deep-sea fauna: pseudopopulations of Atlantic species? *Deep-Sea Research*, 39 (2): 169-184.
- CARLGRÉN, O. (1928). Actiniaria der Deutschen Tiefsee-Expedition. *Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia" 1898-1899*, 22: 126-266.
- CARLGRÉN, O. (1949). A survey of the Ptychodactiaria, Corallimorpharia and Actiniaria. *Kungliga Svenska Vetenskaps Akademiens Handlingar*, 4 (1): 1-121.
- CARUS, J.V. (1885). *Prodromus faunae mediterraneae. Vol. I: Coelenterata, Echinodermata, Vermes, Arthropoda*. Stuttgart: E. Schweizerbart'sche Verlagshandlung, 1: 1-525.
- CHINTIROGLOU, Ch., D. DOUMENC & M. ZAMPONI (1997). Commented list of the Mediterranean Actiniaria and Corallimorpharia (Anthozoa). *Acta Adriatica*, 38 (1): 65-70.
- CHINTIROGLOU, Ch. & J.C. DEN HARTOG (1995). Additional records of Actiniaria (Anthozoa) from Greece. *Zoologische Mededelingen*, 69: 353-364.
- DOUMENC, D., Ch. CHINTIROGLOU & Ath. KOUKOURAS (1985). Actinies de la mer Egée méthodes d'identification, zoogéographie. *Bull. Mus. natn. Hist. Nat., Paris* 4 (7), section A, 3: 497-529.
- DOUMENC, D., K.W. ENGLAND & Ch. CHINTIROGLOU (1987). A new species of sea-anemone in the genus *Paranemonia* Carlgrén (Anthozoa, Actiniaria) from the Aegean Sea. *Zoologica Scripta*, 16: 271-275.
- DOUMENC, D. & M. VAN PRAËT (1987). *Ordre des Actiniaires ordre des Ptychodactiniaires ordre des Corallimorphaires*. In P. GRASSE (Ed), *Traite de Zoologie. Vol. III. Fasc. 3. Cnidaires Anthozoaires*. Masson et Cie, Paris, 257-401.
- ENGLAND, K.W. (1991). Nematocysts of the sea anemones (Actiniaria, Ceriantharia and Corallimorpharia: Cnidaria): nomenclature. In R.B. WILLIAMS, P.F.S. CORNELIUS, R.G. HUGHES & E.A. ROBSON (Eds), *Coelenterate biology: Recent Research on Cnidaria and Ctenophora, Hydrobiologia*, 691-697.
- FEBVRE, J. (1968). Etude bionomique des substrats meubles de l'étang de Berre. *Rec. Trav. Stat. Mar. Endoume*, 44 (60): 297-355.
- GAMULIN-BRIDA, H. (1974). Biocoenoses benthiques de la Mer Adriatique. *Acta Adriatica*, 15: 1-103.
- GELDIAY, R. & A. KOÇATAS (1972). Note préliminaire sur les peuplements benthiques du golfe d'Izmir. *Sci. Monogr., Fac. Sci., Ege Univ.*, 12: 1-34.
- GILI, J.M. (1987). *Estudio sistematico y faunistico de los cnidarios de la costa Catalana*. Ph. D. Thesis, Autonomous University of Barcelona, Barcelona, 565 pp.
- GRAVIER, Ch. (1922). Hexactiniidés provenant des Campagnes des yachts Hironnelle I y II et Princesse-Alice I y II (1888-1913). *Res. Camp. Sci. Albert Ier Monaco*, 63: 1-104.
- HARTOG DEN, J.C. (1977). Notes on the little know sea anemone *Cataphellia brodricii* and on the closely allied *Hormathia coronata* and *Paraphellia expansa* (Actiniaria, Hormathiidae). *Neth. J. Zool.*, 27 (3): 237-244.
- LAFARGUE, F. (1969). Peuplements sessiles de l'archipel de Glénan. 1-Inventaire: Anthozoaires. *Vie Milieu*, 20: 415-436.
- LOUKMIDOU, S., Ch. CHINTIROGLOU & D. DOUMENC (1996). Inventaire du cnidome des Actiniaires et Corallimorphaires de Mediterranee (Cnidaria, Anthozoa). *Bios*, 4: 63-114.
- MANUEL, R.L. (1981). British Anthozoa. Synopses of the British Fauna (New Series). No 18. Linnean Society Academic Press, London, 241 pp.
- MICALLEF, H. & F. EVANS (1968). The marine fauna of Malta. *Marine Science Royal University, Malta*, 1: 143-172.
- MÜLLER, J.G. (1971). Neue Angaben über die Bionomie des Zoobenthos der Sedimentboden im Litoralsystem an der Westküste des Schwarzen Meeres. *Cerceteri marine, L.R.C.M.*, 1: 167-194.
- MÜLLER, J.G. (1973). Note sur la faune des fonds infralittoraux condhylifères de la partie nord-ouest de la Mer Noire. *Rapp. Comm. Int. mer Médit.*, 21 (9): 627-629.
- NOBRE, A. (1931). *Contribuições para o estudo dos Coelenterados de Portugal*. Instituto de zoologia da Universidade do Porto, 82 pp.
- 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.
- PASPALLEFF, W.G. (1933). Hydrobiologische Untersuchungen über den Golf von Varna. *Ann. Univ. Sofia*, 2: 1-18.
- PAX, F. (1952). Die Antipatharien, Zoantharien und Actiniarien der "Hvar" Expedition. *Ribarstv. biološka eksped. m/b "Hvar"*, *Izvešća institut za oceanografiju i Ribarstvo*, 6: 1-24.
- PAX, F. & I. MÜLLER (1953). Die Anthozoenfauna der Bucht von Kastela bei Split. *Acta Adriatica*, 5: 1-35.

- PAX, F. & I. MÜLLER (1962). Die Anthozoenfauna der Adria. *Fauna et Flora Adriatica*, 3: 1-343.
- PÉRÈS, J.M. (1985). History of the Mediterranean biota and the colonization of the depths. In R. MARGALEF (Ed), *Western Mediterranean*. Pergamon Press, Oxford, 198-232.
- PÉRÈS, J.M. & J. PICARD (1958). Recherches sur les peuplements benthiques de la Méditerranée. *Recueil des travaux de la Station marine d'Endoume*, 31: 1-137.
- RIEMANN-ZÜRNECK, K. (1979). Two Disc-Shaped Deep Sea Anthozoa from the Gulf of Biscay, with a Survey of Adaptation Types in the Actiniaria. *Zoomorphologie*, 93: 227-243.
- RIEMANN-ZÜRNECK, K. (1998). How Sessile are Sea Anemones? A Review of Free-living Forms in the Actiniaria (Cnidaria: Anthozoa). *Mar. Ecol.*, 19(4): 247-261.
- ROSSI, L. (1950). Celenterati del Golfo di Rapallo (Riviera Ligure). *Boll. Ist. Zool. Univ. Torino*, 2: 193-235.
- ROSSI, L. (1958). Contributo allo studio della fauna di profondità vivente presso la Riviera Ligure di Levante. *Doriana*, 2: 1-13.
- SCHMIDT, H. (1972). Prodrömus zu einer Monographie der mediterranen Aktinien. *Zoologica*, 42(2): 1-146.
- STEPHENSON, T. A. (1935). *The British Sea Anemones. Vol. 2*. The Ray Society, London, 426 pp.
- VAFIDIS, D., A. KOUKOURAS & E. VOULTSIADOU-KOUKOURA (1997). Actiniaria, Corallimorpharia, and Scleractinia (Hexacorallia, Anthozoa) of the Aegean Sea, with a checklist of the eastern Mediterranean and Black Sea species. *Israel Journal of Zoology*, 43: 55-70.
- WILLIAMS, R.B. (1997). *Actinöthoe sphyrodeta* (Cnidaria, Actiniaria): The first records from Portugal and the Mediterranean Sea. *Journal of the Marine Biological Association of the United Kingdom*, 77: 245-248.

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