Hydroids (Cnidaria: Hydrozoa) from the Aegean Sea, mostly epiphytic on algae

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Abstract: The hydroid fauna of the Mediterranean Sea is one of the best known in the world, nevertheless in the Aegean Sea this fauna remains nearly unexplored. This paper reports on 31 species collected in the two Aegean islands of Kos, in the Dodecanese, and Milos, in the Cyclades. Twenty-two species were collected on algae, chiefly on Cystoseira. Different hydroid species occupy specific regions of algal thalli, and different algal species harbour different hydroid assemblages. Five species were collected among the fouling communities on oceanographic instruments, eight species on other substrata. All the species collected were already known from the Western Mediterranean and showed consistent ecology and depth distribution. The present record raises to 67 the total of hydroid species (or subspecific taxa) known from the Aegean Sea and nearby waters of Greece and Turkey. This figure is extremely low by comparison with the 379 species known for the Mediterranean Sea.


Keywords : Hydroids - epiphytes - Cystoseira - fouling - Aegean Sea - Eastern Mediterranean Sea

Introduction

When studying the relationships between geographic distribution and life cycle patterns in hydromedusae (taking into account both their hydroid and medusa stages), Boero & Bouillon (1993) chose the Mediterranean Sea as a model because the hydroid fauna living in this sea is one of the better known in the world. It must be recognized, however, that virtually all of our knowledge on Mediterranean hydroids comes from the western and central parts of the basin, especially Spanish and Italian Seas (Avian et al.,
1995; Medel & López-González, 1996; Boero et al., 1997), whereas the eastern basin is nearly unexplored.

The available information on the hydroid fauna of the Eastern Mediterranean is summarized in the papers by Picard (1958), Yamada (1965), Marinopoulos (1979b) and Vervoort (1993). Also of interest are the papers on hydromedusae collected in the plankton of eastern Mediterranean waters (Schmidt, 1973; Goy et al., 1988). Discussing the scarcity of species resulting from his investigation, Schmidt (1973) offered two explanations: i) lack of research and specialists for this group in the considered area; ii) lack of substrata for hydropolyps, hard substrates being relatively scarce.

While the first explanation seems obvious, the second might be adequate for the Levant Sea (where Schmidt’s material came from) but does not seem tenable for the Aegean Sea, which is rich in islands with rocky shores.

This paper reports on a small collection of hydroids coming from two Aegean islands (Fig. 1): Kos, in the Dodecanese, and Milos, in the Cyclades. Most species were collected on algae, one of the preferred substrata for many hydroids (Nishihira, 1965; Shepherd & Watson, 1970; Gili & Hughes, 1995), but a number of other substrata were considered as well, including oceanographic instruments which were fouled by hydroids and other organisms (Bianchi et al., in press; Morri et al., in press).

Material and methods

At Kos, hydroids were collected in August 1981 by snorkelling in shallow water in two sites: Kos Bay (KB), to the Northeast of the island, and Agios Nikolaos (AN), near Kephals, to the Southwest (Fig. 1). A description of the benthic communities around Kos was given by Bianchi & Morri (1983 a,b). At Milos, a larger sampling effort was possible and hydroids were collected in June 1996 by snorkelling or SCUBA diving down to 44 m depth in 6 sites (SR, E, ST, CR, S and VS) off Palaeochori Bay, at the southeast of the island (Fig. 1). The epibenthic communities living in that area were described by Bianchi et al. (1997) and Cocito et al. (in press). Additional hydroid material from Milos came with the fouling communities settled on oceanographic instruments left in situ for about three months (recovered on September 1996) at 10 and 90 m depth (A, C) and nine months (recovered on June 1997) at 50 m depth (L). A more complete information on sampling is given in Table 1. All the species are deposited in the first author’s collection.

Results

A total of 31 species was found. Their depth and substrate distributions are summarized in Tables 2 and 3, respectively.
Other details are given in the annotated list below. Systematic order and species names mostly follow the
check list of the Italian fauna (Avian et al., 1995).

**Bougainvillia muscus** (Allman)

Occurrence: A, L, C, VS.
Depth: 44 to 90 m.
Substratum: Sargassum acinarium (L.) C. V. Agardh, other
algae and recovered oceanographic instruments.
Remarks: Always found fertile. Stem polysiphonic, 4 to
10 cm high. This species has been known for a long time
under the invalid name *Bougainvillia ramosa* (van
Beneden) (Calder, 1988).

**Eudendrium armatum** Tichomiroff

Occurrence: CR, S, ST.
Depth: 10 to 20 m.
Substratum: massive sponges (*Ircinia, Petrosia*).
Remarks: Stout colonies, under rock overhangs.

**Eudendrium capillare** Alder

Occurrence: AN.
Depth: 0.5-2 m.
Substratum: the brown alga *Cystoseira crinita*
(Desfontaines) Bory.
Remarks: Creeping hydrorhizae with short stems, mostly
unbranched.

**Eudendrium glomeratum** Picard

Occurrence: VS.
Depth: 44 m.
Substratum: *Sargassum acinarium*.
Remarks: A single colony.

**Eudendrium racemosum** (Gmelin)

Occurrence: AN, SR.
Depth: 0.5 to 12 m.
Substratum: rock and encrustations by the coralline alga
*Mesophyllum lichenoides* (Ellis) Lemoine.
Remarks: Some polyps showed the typical finger-shaped
cnidophore. Colonies up to 15 cm tall and densely branched,
dominated the sessile community on rock walls just below
sea surface.

**Eudendrium ramosum** (L.)

Occurrence: VS.
Depth: 44 m.
Substratum: bioconcretion.
Remarks: Small colonies, with most stems deprived of
polyps, on thickets of the coralline alga *Mesophyllum lichenoides*.

**Eudendrium sp.**

Occurrence: SR.
Depth: 8 m.
Substratum: bioconcretion.
Remarks: A small colony on a side branch of the alga.

**Cladocoryne floccosa** Rotch

Occurrence: AN.
Depth: 0.5-2 m.
Substratum: *Cystoseira crinita*.
**Table 3.** Distribution of the hydroids on the different sampled substrata. Hydroid species and substrata were ordered to show reciprocal connections. Open circle: present; full circle: frequent and/or abundant.

**Tableau 3.** Distribution des hydriaires sur les différents substrats échantillonnés. Les espèces d’hydriaires et les substrats ont été classés afin de montrer les relations réciproques. Cercles vides: présent; cercles pleins: fréquent et/ou abondant.

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<tr>
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<td>Obelia bidentata</td>
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<td>Sertularia ornata</td>
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**Mitrocoma annae** Haeckel

Occurrence: A, AN, C, VS.
Depth: 0.5 to 90 m.
Substratum: other hydroids.
Remarks: Abundant on *Sertularia ornata*, but frequent on several other hydroid species (*Aglaophenia tubiformis*, *Bougainvillia muscus*, *Clytia hemisphaerica*, *C. linearis*, *Obelia dichotoma*).

**Halecium mediterraneum** Weismann

Occurrence: VS.
Depth: 44 m.
Substratum: *Sargassum acinarium*.
Remarks: A colony on a *Sargassum* blade.

**Halecium pusillum** (M. Sars)

Occurrence: AN.
Depth: 0.5-2 m.
Substratum: *Cystoseira crinita*.
Remarks: Several small colonies on the apical portion of the alga.

**Aglaophenia elongata** Meneghini

Occurrence: VS.
Depth: 44 m.
Substratum: *Sargassum acinarium*.
Remarks: A few colonies.

**Aglaophenia octodonta** (Heller)

Occurrence: AN, SR.
Depth: 0.5 to 12 m.
Substratum: two species of *Cystoseira*.
Remarks: Extremely abundant on *C. crinita*, one colony on *C. barbata* C. Agardh.

*Aglaoephenia picardi* Svoboda
Occurrence: SR.
Depth: 12 m.
Substratum: *Cystoseira barbata*.
Remarks: A single colony.

*Aglaoephenia tubiformis* Marktanner-Turneretscher
Occurrence: AN, Depth: 0.5-2 m.
Substratum: *Cystoseira crinita*.
Remarks: Few colonies with hydrothecae about 1.5 times longer than broad.

*Antennella secundaria* (Gmelin)
Occurrence: AN, E.
Depth: 0.5 to 13 m.
Substratum: two species of *Cystoseira*.
Remarks: Abundant on *C. crinita*, one colony on *C. spinosa* Sauvageau. Gonothecae present in both cases.

*Halopteris catharina* (Johnston)
Occurrence: E.
Depth: 13 m.
Substratum: *Cystoseira spinosa*.
Remarks: A single colony.

*Halopteris diaphana* (Heller, 1868)
Occurrence: AN.
Depth: 2 m.
Substratum: *Cystoseira corniculata* (Wulfen) Zanardini.
Remarks: A colony, with gonothecae.

*Kirchenpaueria pinnata* (L.)
Occurrence: AN, VS.
Depth: 0.5 to 44 m.
Substratum: two species of *Cystoseira* and the green alga *Flabellia petiolata* (Turra) Nizamuddin.
Remarks: There are contrasting views about the status of several species of *Kirchenpaueria* in European waters (e.g., Roca & Moreno, 1987; Cornelius, 1995). According to Medel & Vervoort (1995), *K. pinnata* is a highly variable species, and the other three nominal species *K. echinulata* (Lamarck), *K. similis* (Hincks) and *K. elegantula* (G. O. Sars) should be considered as synonyms.

*Plumularia obliqua* (Thompson)
Occurrence: S.
Depth: 15 m.
Substratum: *Cystoseira barbata*.
Remarks: Several colonies on the basal part of the algal thallus.

*Plumularia setacea* (L.)
Occurrence: VS.
Depth: 44 m.
Substratum: bioconcretion.
Remarks: A colony, with gonothecae.

*Sertularella ellisi* (Deshayes & Milne-Edwards)
Occurrence: AN, SR, CR, S, VS.
Depth: 0.5 to 44 m.
Remarks: After Cornelius (1979), the Mediterranean hydroids called *S. ellisi* by Picard (1956) have been often synonymized with *S. gaudichaudi* (Lamouroux) in recent literature. This view has been contrasted by Ramil et al. (1992) and Vervoort (1993). According to Cornelius (1995) the true identity of the nominal species *gaudichaudi* and *ellisi* remains problematic.

*Sertularella ornata* (Lamouroux)
Occurrence: A.
Depth: 90 m.
Substratum: recovered instruments.
Remarks: Many colonies, some with gonothecae. We follow Medel Soteras et al. (1991) and Vervoort (1993) in keeping this species separated from both *S. ellisi* and *S. gaudichaudi* (see also above).

*Sertularia distans* Lamouroux
Occurrence: AN, VS.
Depth: 0.5 to 44 m.
Substratum: two species of *Cystoseira*.
Remarks: Many colonies on the apical parts of *Cystoseira* thalli. Stem up to 15 mm high. Gonothecae in August on *C. crinita*.

*Clytia hemisphaerica* (L.)
Occurrence: AN, C, SR, VS.
Depth: 0.5 to 44 m.
Substratum: *Cystoseira crinita*, *Sargassum acinarium*, recovered instruments and sessile animals: the bryozoan *Myriapora truncata* (Pallas) and the sponge *Ircinia variabilis* (Schmidt).
Remarks: gonothecae observed throughout the depth range, in both June and September. When found on algae, the species occurred mostly on side branches and apical portions (Cystoseira) and on blades and bladders (Sargassum).

_Clytia linearis_ (Thornely)
Occurrence: AN.
Depth: 0.5-3 m.
Substratum: two species of Cystoseira.
Remarks: Several colonies, on the apical parts of the algal thalli. Gonothecae only found on _C. crinita_.

_Clytia noliformis_ (Mc Crady)
Occurrence: S.
Depth: 15 m.
Substratum: Cystoseira barbata.
Remarks: A few colonies on the basal portion of the thallus.

_Laomedea angulata_ (Hincks)
Occurrence: KB.
Depth: 3-4 m.
Substratum: the seagrass Cymodocea nodosa (Ucria) Ascherson.
Remarks: Epiphytic on the seagrass leaves.

_Obelia bidentata_ Clarke
Occurrence: A.
Depth: 90 m.
Substratum: recovered instruments.
Remarks: Many colonies, with polysiphonic stems up to 6 cm high.

_Obelia dichotoma_ (L.)
Occurrence: A, C, VS.
Depth: 10 to 90 m.
Substratum: Sargassum acinarium, recovered instruments.
Remarks: Gonothecae in September, at 90 m. On Sargassum, colonies were found on blades, bladders and branchlets.

_Orthopyxis integra_ (MacGillivray)
Occurrence: AN.
Depth: 0.5-3 m.
Substratum: two species of Cystoseira.
Remarks: Many colonies, with gonothecae, on the apical portions and side branches of the algal thalli.

**Discussion**

The tall and frondose brown alga _Cystoseira crinita_ provided the greatest number of species (12), including four species found exclusively there. Similarly, three further hydroid species were exclusive to _C. barbata_, one to _C. spinosa_ and one to _C. corniculata_ (Table 3). _C. schifferi_ Hamel, on the contrary, showed no exclusive hydroid species, all being also found on _C. crinita_. _Sargassum acinarium_ provided seven species, three of which exclusive. This might suggest species-specific relationships between certain hydroids and the alga, but our records were too few to allow any conclusion in this respect. Although many hydroids colonize algae (Nishihira, 1965; Shepherd & Watson, 1970; Genzano & Rodriguez, 1998), substratum selectivity is known for only a few species (Gili & Hughes, 1995). Kokatas (1976) found seven hydroid species epiphytic on _C. crinita_ in a different Aegean locality (Gulf of Izmir), and only four were in common with our record.

As a general rule, most epiphytic hydroids settled preferentially on the apical portions, the only exceptions being _Plumularia obliqua_ and _Clytia noliformis_, which preferred the basal parts. The occupation of specific regions of algal thalli by different hydroid species has been described by many authors (see Hayward, 1980, and Gili & Hughes, 1995, for reviews). This can be the outcome of response to environmental gradients along the thalli (Seed & O’ Connor, 1981) or competition for the substratum, both within hydroids and with other organisms (Katô et al., 1961). On the _Cystoseira_ species observed, and especially on _C. crinita_, hydroids were by far the principal epiphytes. The dominant species, such as _Orthopyxis integra_ and _Sertularia distans_, occupied different tufts of the same algal thallus, monopolizing the whole branch. On _Sargassum_, hydroids coexisted with serpuloideans and many bryozoan species, and no substratum monopolization was evident. The remaining algal species (_Flabellia petiolata_, _Osmundaria volubilis_, etc.) had less epiphytes.

_Laomedea angulata_ was the only species collected on seagrass leaves. Several Mediterranean hydroids are obligate epiphytes of _Posidonia oceanica_ (L.) Delile (Boero, 1987). _Posidonia_ meadows are known for both Kos (Bianchi & Morri, 1983a,b) and Milos (Aliani et al., 1998), but we had only samples of _Cymodocea nodosa_. _Laomedea angulata_ seems characteristic of this seagrass (Morri et al., 1991). A study on the hydroid epiphytes of _P. oceanica_ in the Eastern Mediterranean, as the one done by Hayward (1975) for bryozoans, would be of interest to allow comparisons with the western basin.

_Mitrocoma annae_ was always found epizootic on other hydroid species, a frequent habit among hydroids (Genzano, 1998). Even when collected on algae, _M. annae_ was attached to epiphytic hydroids, rather than to the alga itself. Six species, among which four _Eudendrium_ species, where found on massive sponges or directly on the primary substratum. The observed depth distribution of the different species of _Eudendrium_ is consistent with that known in the Western Mediterranean (e. g., Marinopoulos, 1979a).
Table 4. Espèces d'hydaires signalées de la Mer Égée et des régions avoisinantes de Grèce et de Turquie d’après la littérature et notre collection.

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<td>Halecium pusillum</td>
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<tr>
<td>Halocoryle disticha</td>
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<td>Halopteris catharina</td>
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<td>Polyplumaria</td>
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<td>Halopteris diaphana</td>
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<td>Hebella parasitica</td>
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<td>Hebella scandens</td>
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<tr>
<td>Hydractinia (?) sp.</td>
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<tr>
<td>Kirchenpaueria echinulata</td>
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<td>Kirchenpaueria echinulata</td>
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<tr>
<td>I. minut</td>
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<tr>
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<td>Laodicea undulata</td>
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<td>Laomedea angulata</td>
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<td>Laomedea calceolfera</td>
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<td>Mitrocoma annae</td>
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<td>Monothea posidonias</td>
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<td>Obelia bidentata</td>
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</table>

Examination of other authors' collections was not possible and no taxonomic revision was attempted. Species are therefore cited under the names originally used by the authors. Putative correspondences are suggested when species were likely to be in common with the present collection. L’examen des collections des autres auteurs n’a pas été possible et aucune révision taxinomique n’a été entreprise. Par conséquent, les espèces sont citées sous les noms utilisés par les auteurs. Les correspondances probables sont suggérées pour les espèces qui paraissent identiques à celles de notre collection.

Finally, five species were obtained with the fouling on oceanographic instruments. All of them, but Sertularella ornata, are common constituent of coastal fouling communities in European waters (Morri & Boero, 1986). Clytia hemisphaerica was collected on a buoy at 10 m depth, the remaining species in deeper (50 to 90 m) water. Bougainvillia muscus was abundant in comparably deep fouling on offshore platforms in the Ionian and Adriatic seas (Montanari & Morri, 1977: B. ramosa). S. ornata was collected on shell at about 80 m depth in the Levant Sea (Vervoort, 1993).

The present record of 31 species, all of which already known in the Western Mediterranean, constitutes a significant increase in the number of hydroid species recorded in the Aegean Sea. Yamada (1965) reported twelve species from near Athens, Kocatas (1976) (hydroids identified by Picard) seven species from the Gulf of Izmir, Marinopoulos (1979b) 45 species (or subspecific taxa) from several Turkish and Greek localities (Table 4). Taking into account the species in common to two or more inventories, the total of hydroid species (or subspecific taxa) known from the Aegean Sea and nearby waters of Greece and Turkey rises to 67. Picard (1958) reported 13 species and Vervoort (1993) 26, from the Mediterranean coasts of Israel (Levant Sea).
These figures are extremely low by comparison with the 379 species known for the whole Mediterranean (Boero et al., 1997) and clearly underline the need of further investigations on the Eastern Mediterranean hydroid fauna. Recent work on other faunal taxa (e.g., bivalves; Zenetos, 1997) showed that the biodiversity of the Aegean Sea is not as low as traditionally believed, and we see no reason to think that future research will not demonstrate that the same is true also for the hydroids.

Acknowledgements

Part of this study received support from the project AG-HY-FL of the European Community (contract MAS3-CT95-0021). Logistics were organized by S. Varnavas in Milos, by E. Bacci and E. Morri in Kos, A. Peirano (La Spezia) collected samples at Milos, whereas S. Aliani (La Spezia) and P. Dando (Bangor) let us have the fouling communities settled on their oceanographic instruments. Thanks are also due to G. Bressan (Trieste) and G. Sartoni (Firenze) for the identification of the algae on fouling communities settled on their oceanographic instruments. G. Bavestrello (Genova) for help with species of the genus Eudendrium.

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Marinopoulos J. 1979. Distribution des *Eudendrium* dans la région marseillaise (étude préliminaire). *Rapports et procèsvs-


