

AN ACCOUNT OF OUR KNOWLEDGE OF THE AMPHIPOD FAUNA OF THE AEGEAN SEA

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ABSTRACT

During benthic surveys in the northern Aegean Sea, 188 amphipod species were found; 39 among these comprise new records for the amphipod fauna of the eastern Mediterranean Sea, 41 are reported for the first time from the Aegean Sea and 62 are new for the fauna of the northern Aegean Sea. A checklist of the amphipods known from the Aegean Sea up to the present is given (239 species), along with their distribution in certain Mediterranean areas. For the most interesting species found, information on their distribution and their habitat is given. The amphipod fauna of the above areas is estimated, on the basis of the relevant literature. Finally, the affinities among these areas using the coefficient of Czekanowski, along with the number of species common to each pair of areas, are estimated.

RÉSUMÉ

Pendant des recherches benthiques dans le nord de la mer Egée, 188 espèces d'amphipodes ont été trouvées, dont 39 n'avaient encore jamais été signalées en Méditerranée orientale, alors que 41 l'étaient pour la première fois de la mer Egée, et que 62 étaient nouvelles pour la faune du nord de cette mer. Une liste des amphipodes connus jusqu'à présent de la mer Egée (239 espèces) est donnée, en même temps que leur distribution dans certaines régions de la Méditerranée. Pour les espèces les plus intéressantes, des informations sont fournies à la fois sur leur distribution et sur leur habitat. La faune d'amphipodes des régions mentionnées ci-dessus est évaluée sur les bases de la littérature afférente. Enfin, les affinités entre elles, d'après le coefficient de Czekanowski, sont également évaluées, de même que le nombre des espèces communes à chaque couple de régions.

INTRODUCTION

The Aegean Sea is one of the most poorly studied areas of the Mediterranean, although its fauna is for several reasons of special interest (Pérès, 1967).

Amphipods, being one of the most important crustacean groups, are very little studied in the Aegean Sea, and also in the whole of the eastern Mediterranean. The information concerning the amphipod fauna of the Aegean Sea from a systematic, ecological, and zoogeographical point of view is included in a very restricted number of papers: Vecchi (1929), Stock (1967), Myers (1969a, b, 1972a, b), Geldiay et al. (1970), Karaman (1971, 1973), Kocataş (1976a), Bellan-Santini & Kaim-Malka (1977), Bellan-Santini et al. (1982, 1989), Bellan-Santini (1985), Karakiri & Nicolaidou (1986, 1988), and Kevrekidis & Koukouras (1988).

Scattered information on the amphipods of this area can also be found in general faunistic or ecological papers such as those by Guérin (1832), Ghigi et al. (1929), Drensky (1951), Demir (1952-1954), Pérès & Picard (1958), Tortonese (1959), Jacquotte (1962), Jones (1969), Kocataş (1976b), Geldiay et al. (1977), Koukouras et al. (1985, 1992), and Voultziadou-Koukoura et al. (1987).

The main objectives of the present paper are (1) to provide new information on the amphipod fauna of the Aegean Sea, (2) to present for the first time a check-list of the amphipod species and (3) to compare the amphipod fauna of the Aegean with those of the other Mediterranean areas as well as with that of the Mediterranean as a whole.

MATERIALS AND METHODS

The present study is a part of a broad research program started in 1976, aiming to study the benthic macrofauna of the North Aegean Sea. During this study material was collected from 245 stations, in depths between 0 and 850 m, in various types of substrates scattered all over the northern Aegean Sea, excluding the Turkish coasts. These stations are given on the map of fig. 1.

Samplings were made either by fishing nets and Agassiz trawl (stations marked with a line and a capital letter), or by dredges (e.g., Charcot-Picard), grabs, and free or SCUBA diving (stations marked with a black point and a number). Samplings were carried out both on soft and hard substrates.

Specimens were preserved in 5% formalin and have been deposited in the Museum of the Department of Zoology, University of Thessaloniki. The systematic arrangement follows Bellan-Santini et al. (1982, 1989) as regards Gammaridea, and the catalogue of McCain & Steinberg (1970) for Caprellidea.

To estimate the affinities among the amphipod faunas of certain Mediterranean areas, the qualitative coefficient of Czekanowski was used (Bray & Curtis, 1957).

RESULTS AND DISCUSSION

Material examined and check-list

The examination of the collected material from the northern Aegean Sea revealed the presence of 188 amphipod species. Thirty-nine comprise new records for the fauna of the eastern Mediterranean Sea, 41 are new records for the Aegean Sea, and 62 species are reported for the first time from the northern Aegean Sea.

Review of the relevant literature showed that the number of amphipod species known from the Aegean Sea before this work was 198. Combining the existing information with the results of our study, this number was enlarged to 239 species. These species are presented in table I, in which their distribution in the various Mediterranean areas is also given.

In this table, 14 species are not included, even though they have been

reported from the Aegean Sea. One of these, *Gammarus peloponnesius* Guérin, 1832 is not included because of its doubtful systematic validity; this species has originally been described from the Greek coasts (Almyros), and Lucas (1846) also recorded its presence in Algeria. Della Valle (1893) considered *G. peloponnesius* a synonym of *G. locusta* Fabricius, 1775 (partim). Finally, Stebbing (1906) also considered this species to be of uncertain taxonomic status. Thirteen more species are not included in the list, because their presence in the Mediterranean Sea has not yet been confirmed satisfactorily. The species *Corophium volutator* (Pallas, 1766), *Hippomedon denticulatus* (Bate, 1854), *Jassa falcata* (Montagu, 1808), *Jassa pusilla* (Sars, 1894) and *Lysianassa ceratina* (Walker, 1889) have been recorded from the Aegean Sea and other Mediterranean areas, but according to Bellan-Santini et al. (1982, 1989) their presence in the Mediterranean requires confirmation. *Apherusa jurinei* (H. Milne-Edwards, 1830) has been reported from the Aegean Sea by Makkaveeva (1963), but we think that probably this record refers to another Mediterranean species of the genus. The same holds true for the species *Ampithoe* (*Pleonexes*) *gammaroides* (Bate, 1856), which has been reported by Koukouras et al. (1985). After examination of the material used by the above authors, we found that it belongs to the species *Ampithoe helleri* G. Karaman, 1975. Also, *Aora typica* Krøyer, 1845 has been recorded from the Aegean Sea and other Mediterranean areas, but according to Bellan-Santini et al. (1982) these records may be referable either to *A. gracilis* (Bate, 1857) or to *A. spinicornis* Alfonso, 1976. *Liljeborgia pallida* (Bate, 1857) has been reported by Karakiri & Nicolaidou (1988) from the Northern Sporades under the name *L. brevicornis* Lilljeborg, 1852, while also *Socarnes erythrophthalmus* Robertson, 1892 and *Urothoe marina* (Bate, 1857) were reported from this area. However, their presence requires confirmation as well. Finally, *Microdeutopus damnoniensis* (Bate, 1856) and *Caprella linearis* (Linnaeus, 1767), were reported by Kocataş (1978) from the Gulf of Izmir, but their actual presence is doubtful.

The 239 species known from the Aegean are classified in 32 families and 95 genera. The richest in number of species are the Gammaridae followed by the Aoridae and the Lysianassidae.

For 16 of the most interesting species, new zoogeographical data and habitat information are given below. Most of these species were known up till now only from the western part of the Mediterranean, so they all comprise new records for the amphipod fauna of the eastern Mediterranean, and they are therefore considered as Mediterranean endemics.

AMPELISCIDAE

Ampelisca provincialis Bellan-Santini & Kaim-Malka, 1977

One female individual from station F, at a depth of about 80 m on a detritic bottom. This species has been reported only once before from Cassis, near

TABLE I

Amphipod species known up to date from the Aegean Sea. The presence of a species in the northern Aegean Sea and Aegean Sea is marked with an o instead of a + in case it is reported for the first time by the present study. a, NA (northern Aegean Sea); b, AS

Species	a	b	c	d	e	f	g	h	i	j	k
ACANTHONOTOZOMATIDAE											
<i>Iphimedia minuta</i> G.O.Sars, 1882	+	+	+	+	+	+			+	+	
<i>Iphimedia quasimodus</i> Ruffo & Schiecke, 1979	+	+									
AMPELISCIDAE											
<i>Ampelisca brevicornis</i> (A. Costa, 1853)	+	+	+	+	+	+			+	+	+
<i>Ampelisca calypsonis</i> Bellan-Santini & Kaim-Malka, 1977	o	+									+
<i>Ampelisca dalmatina</i> G. Karaman, 1975	o	o			+	+			+		
<i>Ampelisca diadema</i> (A. Costa, 1853)	+	+	+	+	+	+			+	+	+
<i>Ampelisca gibba</i> G. O. Sars, 1882	+	+	+						+		
<i>Ampelisca jaffaensis</i> Bellan-Santini & Kaim-Malka, 1977	o	+									+
<i>Ampelisca ledoyeri</i> Bellan-Santini & Kaim-Malka, 1977	o	+			+	+					+
<i>Ampelisca massiliensis</i> Bellan-Santini & Kaim-Malka, 1977	+	+			+	+					
<i>Ampelisca multispinosa</i> Bellan-Santini & Kaim-Malka, 1977	o	o			+	+					+
<i>Ampelisca provincialis</i> Bellan-Santini & Kaim-Malka, 1977	o	o			+						
<i>Ampelisca pseudospinimana</i> Bellan-Santini & Kaim-Malka, 1977	+	+	+	+					+		+
<i>Ampelisca rubella</i> A. Costa, 1864	+	+	+	+	+	+			+	+	
<i>Ampelisca ruffoi</i> Bellan-Santini & Kaim-Malka, 1977	o	+			+	+			+	+	
<i>Ampelisca sarsi</i> Chevreux, 1888	+	+	+						+	+	
<i>Ampelisca spinipes</i> Boeck, 1861	o	+	+		+	+					+
<i>Ampelisca tenuicornis</i> Liljeborg, 1855	+	+	+	+	+	+	+	+	+	+	+
<i>Ampelisca typica</i> (Bate, 1856)	o	+	+	+	+	+	+	+	+	+	+
<i>Haploops dellavallei</i> Chevreux, 1900	o	+	+		+	+					+
AMPHILOCHIDAE											
<i>Amphilocheus brunneus</i> Della Valle, 1893	o	o		+	+	+			+	+	
<i>Amphilocheus neapolitanus</i> Della Valle, 1893	+	+		+	+	+	+	+	+	+	+
<i>Amphilocheus picadurus</i> J. L. Barnard, 1962	+				+	+			+		
<i>Amphilocheus spencebatei</i> (Stebbing, 1876)	o	o			+	+					+
<i>Gitana sarsi</i> Boeck, 1871	o	+		+	+	+					+
<i>Peltocoxa marioni</i> Catta, 1875	+	+		+	+	+			+	+	
<i>Peltocoxa mediterranea</i> Schiecke, 1977	+	+	+		+	+					+
AMPITHOIDAE											
<i>Ampithoe ferox</i> (Chevreux, 1902)	o	o			+	+					+
<i>Ampithoe helleri</i> G. Karaman, 1975	+	+		+	+	+				+	+
<i>Ampithoe ramondi</i> Audouin, 1826	+	+	+	+	+	+	+	+	+	+	+
<i>Ampithoe riedli</i> Schickel, 1968	+	+			+	+			+	+	+
<i>Cymadusa crassicornis</i> (A. Costa, 1857)	+	+		+	+	+	+	+	+	+	+
<i>Spinampithoe pelagica</i> (Milne Edwards, 1830)	+	+		+	+	+	+	+	+	+	+
AORIDAE											
<i>Aora gracilis</i> (Bate, 1857)	+	+	+	+	+	+	+	+			+
<i>Aora spinicornis</i> Afonso, 1976	+	+			+	+			+	+	+
<i>Lembos angularis</i> Ledoyer, 1970	o	o			+	+					
<i>Lembos rubromaculatus</i> Ledoyer, 1973	+	+			+	+					
<i>Lembos viduarum</i> Myers, 1974	o	o			+						
<i>Lembos viguieri</i> Chevreux, 1911	+	+	+	+	+	+	+				
<i>Lembos websteri</i> Bate, 1857	+	+	+	+	+	+	+	+	+	+	+
<i>Leptocheirus bispinosus</i> Norman, 1908	+	+	+	+	+	+	+	+	+	+	+
<i>Leptocheirus guttatus</i> (Grube, 1864)	+	+	+	+	+	+	+	+	+	+	+
<i>Leptocheirus mariae</i> G. Karaman, 1973	+	+			+	+					
<i>Leptocheirus pectinatus</i> (Norman, 1869)	+	+	+	+	+	+	+	+	+	+	+
<i>Leptocheirus pilosus</i> Zaddach, 1844	+	+	+	+	+	+	+	+	+	+	+
<i>Microdeutopus algicola</i> Della Valle, 1893	+	+			+	+			+	+	+
<i>Microdeutopus anomalus</i> (Rathke, 1843)	+	+	+	+	+	+	+	+	+	+	+
<i>Microdeutopus bifidus</i> Myers, 1977	o	o			+						
<i>Microdeutopus chelifer</i> (Bate, 1862)	+	+	+		+	+			+	+	+
<i>Microdeutopus gryllotalpa</i> A. Costa, 1853	+	+			+	+	+	+	+	+	+
<i>Microdeutopus obtusatus</i> Myers, 1973	+	+			+				+		
<i>Microdeutopus similis</i> Myers, 1977	+	+	+								
<i>Microdeutopus sporadhi</i> Myers, 1969	+	+									
<i>Microdeutopus stationis</i> Della Valle, 1893	+	+		+	+	+	+	+	+	+	+
<i>Microdeutopus versiculatus</i> (Bate, 1856)	+	+		+	+	+			+	+	+
ARGISSIDAE											
<i>Argissa stebbingi</i> Bonnier, 1896	o	+			+	+					
BIANCOLINIDAE											
<i>Biancolina algicola</i> Della Valle, 1893	o	o			+	+			+	+	+
CALLIOPIDAE											
<i>Apherusa alacris</i> Krapp-Schickel, 1969	+	+			+	+	+	+			
<i>Apherusa bispinosa</i> (Bate, 1857)	+	+	+	+	+	+	+	+	+	+	+
<i>Apherusa chiereghinii</i> Giordani-Soika, 1950	+	+			+	+	+	+	+	+	+

Species	a	b	c	d	e	f	g	h	i	j	k
MELPHIDIPPIDAE											
<i>Melphidippella macra</i> (Norman, 1869)	o	+	+		+				+		
OEDICEROTIDAE											
<i>Monoculodes acutipes</i> Ledoyer, 1983	+	+			+	+					
<i>Monoculodes carinatus</i> (Bate, 1857)	+	+	+	+	+	+			+	+	+
<i>Monoculodes gibbosus</i> Chevreux, 1888	+	+	+		+	+				+	+
<i>Monoculodes griseus</i> (Della Valle, 1893)	o	o			+	+					
<i>Monoculodes packardii</i> Boeck, 1871	+	+			+	+					
<i>Monoculodes subnudus</i> Norman, 1889	+	+	+		+	+				+	+
<i>Periculodes longimanus</i> (Bate & Westwood, 1868)	+	+	+	+	+	+			+	+	+
<i>Periculodes longimanus angustipes</i> Ledoyer, 1983	+	+			+						
<i>Pontocrates arenarius</i> (Bate, 1858)	+	+	+	+	+						
<i>Synchelidium haplocheles</i> (Grube, 1864)	o	+			+	+			+		+
<i>Synchelidium longidigitatum</i> Ruffo, 1947	o	o				+					
<i>Synchelidium maculatum</i> Stebbing, 1906	+	+	+		+	+				+	+
<i>Westwoodilla caecula</i> (Bate, 1857)	+	+			+	+					
<i>Westwoodilla rectirostris</i> (Della Valle, 1893)	+	+	+	+	+	+			+	+	+
PARAMPHITHOIDAE											
<i>Epimeria cornigera</i> (Fabricius, 1779)	o	+			+				+		
PARDALISCIDAE											
<i>Halice abyssi</i> Boeck, 1871	o	o			+	+			+		
<i>Halice walkeri</i> (Ledoyer, 1972)	o	o			+	+			+		
<i>Nicippe tumida</i> Bruzelius, 1859	+	+			+	+			+		
PHLIANTIDAE											
<i>Pereionotus testudo</i> (Montagu, 1808)	+	+			+	+	+		+	+	+
PHOXOCEPHALIDAE											
<i>Harpinia crenulata</i> (Boeck, 1871)	+	+	+		+	+				+	
<i>Harpinia dellavallei</i> Chevreux, 1911	+	+	+		+	+			+	+	+
<i>Harpinia pectinata</i> Sars, 1891	+	+	+	+	+	+				+	+
<i>Metaphoxus fultoni</i> (Scott, 1890)	+	+	+	+	+	+			+		+
<i>Metaphoxus pectinatus</i> (Walker, 1869)	+	+	+	+	+	+		+	+	+	+
<i>Paraphoxus oculatus</i> (Sars, 1879)	+	+			+	+					
PODOCERIDAE											
<i>Dulichlopsis nordlandica</i> Boeck, 1891	+	+			+						
<i>Laetmatophilus ledoyeri</i> Ruffo, 1986	o	o			+				+		
<i>Podocerus variegatus</i> Leach, 1814	+	+	+	+	+	+			+	+	+
STEGOCEPHALIDAE											
<i>Phippsiella pseudophippsia</i> Bellan-Santini, 1985	+	+									
<i>Stegocephaloides christianiensis</i> (Boeck, 1871)	+	+	+	+	+						
STENOTHOIDAE											
<i>Stenothoe antennulariae</i> Della Valle, 1893	o	o				+					
<i>Stenothoe bosporana</i> Sowinsky, 1898	o	o			+	+			+		+
<i>Stenothoe cavimana</i> Chevreux, 1908	+	+			+	+					
<i>Stenothoe dollfusi</i> Chevreux, 1887	+	+	+		+	+			+	+	
<i>Stenothoe gallensis</i> Walker, 1904	o	o			+	+				+	
<i>Stenothoe monoculoides</i> (Montagu, 1815)	+	+	+	+	+	+			+	+	+
<i>Stenothoe tergestina</i> (Nebeski, 1880)	+	+	+	+	+	+			+	+	
SYNOPIIDAE											
<i>Bruzelia typica</i> Boeck, 1871	+	+			+						
<i>Pseudotiron bouvieri</i> Chevreux, 1895	+				+	+					
TALITRIDAE											
<i>Hyalé camptonyx</i> (Heller, 1866)	+	+	+	+	+	+			+		
<i>Hyalé crassipes</i> (Heller, 1866)	+	+			+						
<i>Hyalé grimaldii</i> Chevreux, 1900	o	o			+	+					
<i>Hyalé minor</i> Chevreux & Fage, 1925	o	o	+		+				+	+	+
<i>Hyalé perieri</i> (Lucas, 1846)	+	+			+	+			+	+	+
<i>Hyalé schmidti</i> (Heller, 1866)	+	+	+	+	+	+			+	+	+
<i>Hyalé stebbingi</i> Chevreux, 1888	+	+			+	+			+		
<i>Orchestia cavimana</i> Heller, 1865	o	+			+			+		+	+
<i>Orchestia gammarella</i> (Pallas, 1766)	+	+			+	+		+	+	+	+
<i>Orchestia mediterranea</i> Costa, 1853	+		+	+	+	+		+	+	+	+
<i>Orchestia montagui</i> Audouin, 1826	+	+	+	+	+	+		+	+	+	+
<i>Orchestia platensis</i> Kroyer, 1845	+	+	+	+	+	+		+	+	+	+
<i>Orchestia stephenseni</i> Cecchini, 1928	+	+			+	+		+	+	+	+
<i>Parhyale aquilina</i> (A. Costa, 1857)	+	+			+	+		+	+	+	+
<i>Taljitrus saltator</i> (Montagu, 1808)	o	+	+	+	+	+		+	+	+	+
<i>Talorchestia brito</i> Stebbing, 1891	+	+			+	+		+	+	+	+
<i>Talorchestia deshavesi</i> Audouin, 1826	+	+			+	+		+	+	+	+

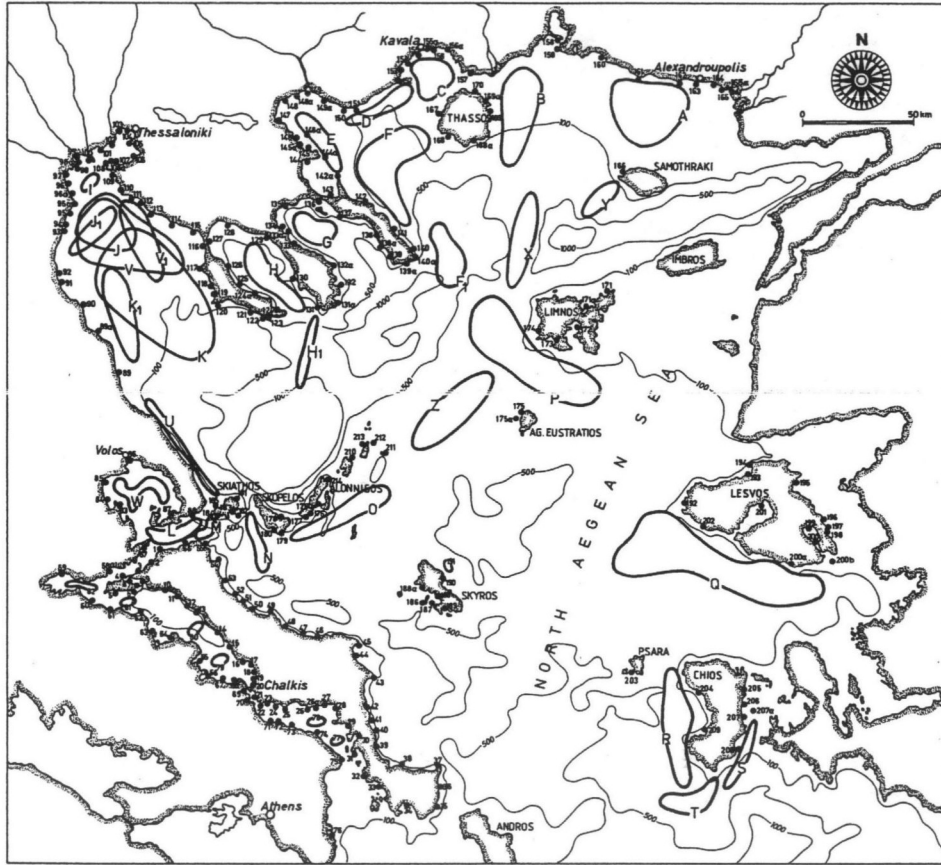


Fig. 1. Map showing the location of sampled areas in the northern Aegean Sea.

Marseille (Bellan-Santini & Kaim-Malka, 1977), so this represents its second record from the whole Mediterranean.

AORIDAE

Lembos viduarum Myers, 1974

Four individuals (1 male and 3 females) collected at station F, at a depth of about 100 m, on a silty bottom. This species was originally described by Myers (1974) from seven specimens found at Ischia (coast of the Tyrrhenian Sea). This consequently is its second record from the Mediterranean.

Microdeutopus bifidus Myers, 1977

Sixty-one individuals (12 males and 49 females) from station 108a, at a depth of 2 m, on a medium sand substrate ($Md = 351 \mu m$); station 131 in a *Posidonia*

oceanica (L.) Delile meadow, at a depth of 6 m; station 96a associated with the sea anemone *Cereus pedunculatus* (Pennant, 1777), at a depth of 2 m; and station 95a associated with the sea anemone *Anemonia viridis* (Forskål, 1775), at 4 m. Myers (1977) described this species based on a large collection from Catania (Sicily). Later it was also recorded from the Amvrakikos Gulf, Ionian Sea (Nicolaidou & Karakiri, 1989). This is the third report from the Mediterranean Sea. It has been considered as a Mediterranean endemic living infralittorally amongst algae (Bellan-Santini et al., 1982).

CAPRELLIDAE

Parvipalpus major A. Carausu, 1941

Forty-one individuals from station F, at a depth of about 200 m on a silty bottom. The only previous reports of this species are those from Banyuls-sur-Mer and Monaco, from various types of substrates and depths (0.5-300 m, among algae and in sandy or silty substrates), according to A. Carausu (1941b). In station F this species was also found together with the species *Phthisica marina* Slabber, 1769 as A. Carausu (1941b) has mentioned.

GAMMARIDAE

Elasmopus affinis Della Valle, 1893

A large number of individuals (1908) were found at stations 108 and 108a in shallow waters (1-2 m), associated with the bivalve *Mytilus galloprovincialis* Lamarck, 1819. In the Mediterranean Sea, this species was known from Genova, Napoli, and the Gulf of Taranto (Diviacco, 1980; Bellan-Santini et al., 1982). It is also known from the Atlantic and Indian Oceans (Bellan-Santini et al., 1982). So, this is its first record from the eastern Mediterranean. In the Mediterranean, it was found among algae and on muddy bottoms.

Melita bulla G. Karaman, 1978

A large number of specimens (3905) was collected at station 130 (Chalkidiki Peninsula), on a sandy substrate in the midlittoral zone. This species has been reported so far from Napoli and the Adriatic Sea (Bellan-Santini et al., 1982). Its finding in the Aegean Sea comprises its second report from the Mediterranean Sea. It should be considered as an endopsammic species of the midlittoral or upper infralittoral zone.

Melita valesi S. Karaman, 1955

Twenty-one individuals from station 130, in the midlittoral zone (sandy substrate), together with *Melita bulla*. The species has been previously reported only from the western coast of Italy and the Adriatic Sea (Bellan-Santini et al.,

1982), and its finding in the Aegean Sea comprises its first report from the eastern Mediterranean.

HAUSTORIIDAE

Bathyporeia sunnivae Bellan-Santini & Vader, 1988

Two individuals from station 100 (Thermaikos Gulf), at a depth of 1 m, on a sandy substrate. It was previously reported only from the type-localities, Messina and Napoli (Bellan-Santini & Vader, 1988), living in sandy bottoms (6-8 m depth). The present report is the second of this species from the Mediterranean Sea, extending its distribution to the eastern basin of it.

ISAEIDAE

Megamphopus brevidactylus Myers, 1976

Eight individuals (1 male, 7 females) and some juveniles were found at station F, at a depth of about 100 m, on a silty bottom. This species has not been reported from the Mediterranean Sea, after its description by Myers (1976), who found it at a depth of 90-110 m at Capri (coast of Western Italy). It is the first time that its presence in the eastern Mediterranean is mentioned.

Megamphopus longicornis Chevreux, 1911

Eight individuals (2 males and 6 females) from station F, at a depth of 100 m on a silty bottom. Its description was based on material from the Algerian coast (Chevreux, 1911), and until now it was known in the Mediterranean Sea only from its type-locality. So, the present report is the first from the eastern Mediterranean. The presence of this species has been reported also from the Portuguese and French Atlantic coasts (Chevreux & Fage, 1925; Myers, 1976; Marques & Bellan-Santini, 1991). Up till now it was known to live in depths of 16-80 m, on coralligenous substrates, and also associated with the decapod *Maja squinado* (Herbst, 1788) (cf. Bellan-Santini et al., 1982).

LILJEBORGIIDAE

Liljeborgia psaltrica Krapp-Schickel, 1974

Three individuals from station I, at depths of 30-40 m (silty bottom), two individuals from station C (Kavala Gulf), at depths of 21-36 m (silty bottom) and two individuals from station 155, at a depth of 38 m (silt). This species was described by Krapp-Schickel (1974a), from the Dalmatian coast (Adriatic), and has been also reported from Banyuls (Bellan-Santini et al., 1989). This is the first time it is reported from the eastern Mediterranean.

LYSIANASSIDAE

Aroui setosus Chevreux, 1911

Twenty-four individuals from station F, at a depth of 80 m, inside a broken shell of the echinoid *Spatangus purpureus* O.F. Müller, 1776, on a silty bottom. This species has been described by Chevreux (1911) from the Algerian coast, and it is also known from Sardegna (Bellan-Santini et al., 1989). According to Bellan-Santini et al. (1989) it is considered a Mediterranean endemic, living down to 65 m, associated with the echinoid *Spatangus* and the sponge *Suberites*.

Lysianassa caesarea Ruffo, 1987

A large number of individuals (394) from stations 65, 123, 131, 133, 180, and 207, in depths between 2 and 12 m, on various types of substrates (*Posidonia*, algae, rocks, and *Lithophaga lithophaga* (L., 1758) assemblages). This species has been reported only from the type-locality, Caesarea, Israel (Ruffo, 1987). So, its finding in the Aegean Sea consists the second record for the whole Mediterranean Sea and it must be considered an eastern Mediterranean endemic, of which the habitat was previously unknown.

OEDICEROTIDAE

Synchelidium longidigitatum Ruffo, 1947

One individual from station 106, at a depth of 3.5 m on a sandy bottom, five individuals from station 131 (6-11 m), in *Posidonia* meadows, one individual from station 131 (4-8 m), on a rocky substrate, and two individuals from station F at about 80 m depth, on a detritic bottom. The species was known only from the western Mediterranean (Ledoyer, 1982; Scipione & Fresi, 1984), and the Portuguese coast (Marques & Bellan-Santini, 1986). This is the first record from the eastern Mediterranean.

PODOCERIDAE

Laetmatophilus ledoyeri Ruffo, 1986

One individual collected in station F, at a depth of about 100 m on a detritic bottom. The only records of this species are those by Ruffo (1986) who described it from Marseille and the Adriatic, and that of Ledoyer (1977), also from Marseille under the name *Laetmatophilus armatus* Norman, 1869. This species is also reported for the first time from the eastern Mediterranean, here.

STENOTHOIDAE

Stenothoe antennulariae Della Valle, 1893

One individual found in association with the ascidian *Asciidiella* sp., in station

W (Pagasitikos Gulf), at a depth of 15-20 m on sandy silt. This species was originally described from Napoli by Della Valle (1893), and was found to be associated with the hydroids *Antennularia* and *Thecocarpus myriophyllum* (L., 1758) (as *Aglaophenia myriophyllum*), in depths of 50-80 m. It was also recorded by Stebbing (1906) and Krapp-Schickel (1976), from the same area. The occurrence of this species in the Aegean Sea constitutes its first record from the eastern Mediterranean.

COMPARISONS AND AFFINITIES

The number of benthic amphipod species known up to the present from the Mediterranean, including the Black Sea, is approximately 440, estimated after a comprehensive review of the relevant literature (Chevreux, 1911; Chevreux & Fage, 1925; A. Carausu, 1941a, b; Mateus & Mateus, 1961; Amanieu & Salvat, 1965; McCain, 1968; Myers, 1969a, b; McCain & Steinberg, 1970; Karaman & Ruffo, 1971; Karaman & Schiecke, 1972; Karaman, 1972 (1973), 1973, 1985, 1986a, b, c, 1987a, b, 1988; Ruffo, 1974, 1986; Krapp-Schickel, 1974b, 1976; Ledoyer, 1977, 1982, 1985; Lincoln, 1979; Cavedini, 1981; Bellan-Santini et al., 1982, 1989; Bellan-Santini, 1985; Dauvin & Bellan-Santini, 1985; Bellan-Santini & Ruffo, 1985, 1991; Krapp-Schickel & Ruffo, 1986; Menioui & Ruffo, 1988; Barnard & Karaman, 1991a, b, etc.).

The number of species found in the Aegean Sea (239) comprises 54.3% of the total number of Mediterranean amphipods. The percentages corresponding to the other Mediterranean areas and the Black Sea are given in fig. 2. The number of species reported from each of these areas was also estimated on the basis of the literature given in the previous paragraph.

So, the present day status of the amphipod fauna in the various areas of the Mediterranean is the following: 125 species are known from the Spanish coast, representing 28.4% of the total Mediterranean amphipod species. From the French Mediterranean coast a total of 327 species (74.3%) has been reported, while from the western Italian coast, including the islands of Corsica and Sardegna, 336 species (76.3%), have been reported. The species known from the Adriatic Sea are 225 in number (51.1%), from the African western Mediterranean coast 178 (40.4%), and only 39 species (8.8%) from the African central Mediterranean coast. 138 species (31.3%) are known from the Ionian Sea and 135 species (30.6%) have been reported from the Levantine basin. Finally, in the Black Sea, 75 (17.1%) amphipod species were found.

From fig. 2 it is clear, that the richest areas in numbers of species are the western Italian and French coasts, while the Aegean Sea is the third according to the information available at present. The known fauna of the Aegean Sea has been enriched after the present study with 41 species, corresponding to 9.4% of the total Mediterranean species.

The relatively low species numbers found in areas like the central Mediterranean coast of Africa, the Ionian Sea, the Spanish coasts, or the Levantine

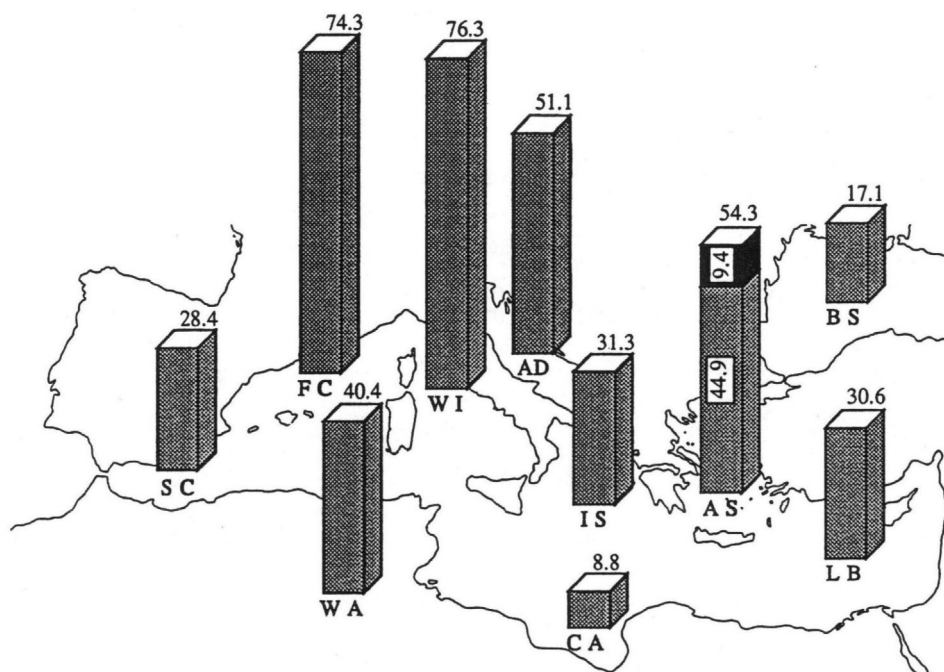


Fig. 2. Distribution of amphipod species in the various areas of the Mediterranean and Black Sea, as percentages of the total of Mediterranean species. The dark part of the column in the Aegean Sea represents the percentage added by the present study (for abbreviations, see table I).

Basin, in comparison with other areas, like the French coast for example, should be mainly attributed to the restricted research efforts carried out in those areas. An additional cause for the low amphipod numbers in the Levantine basin may be the fact that some species of Atlantic origin have not yet extended their distribution to it, and also because the fauna of this area is considered impoverished (Por & Dimentman, 1989). Quite poor in numbers of species is the Black Sea, due to the special conditions prevailing there, among which the most important seems to be the reduced salinity of its waters.

In an attempt at comparing the amphipod faunas of the different Mediterranean areas, we constructed table II, showing the numbers of amphipod species common among the various Mediterranean areas, and their affinities according to the coefficient of Czekanowski. However, we had to choose only six of them, on a basis of a sufficiently high sampling density and a sufficient coverage of different biotopes. These areas are: the French Mediterranean coast, the western Italian coast, the Adriatic Sea, the African west Mediterranean coast, the Aegean Sea, and the Black Sea. For the selected areas a dendrogram showing the amphipod faunal affinities is given in fig. 3.

From table II and fig. 3 it is clear, that the most strongly related amphipod

TABLE II

Numbers of species common (upper, left) and affinities (lower, right), among various Mediterranean areas and the Black Sea. The numbers under the table (N.S.) represent the species known in each area (for abbreviations, see table I).

	SC	WA	FC	WI	AD	AS	BS	CA	IS	LB
LB	72	82	115	118	93	113	40	21	61	
IS	56	80	114	129	100	106	47	19		45.6
CA	17	30	35	37	29	37	15		22	24.2
BS	37	60	72	69	66	67		26.3	45.1	38.2
AS	100	131	217	214	168		42	26	56.2	59.7
AD	92	124	192	193		72.2	44.5	22.3	56.4	52.3
WI	113	149	258		70.6	75.2	34.5	20.3	56.3	51.4
FC	120	150		79.7	70.7	76.6	36.2	19.3	50.1	50.4
WA	90		60.1	59.3	62.3	62.2	47.6	27.7	51.6	52.7
SC		59.6	53.6	50.2	53.1	54.2	37	20.7	43.4	55.2
N.S.	125	178	327	336	225	239	75	39	138	135

faunas are those of the French coast (FC) and western Italian coast (WI), both located in the northern part of the western Mediterranean, showing an affinity of 79.7% (258 species in common). According to Pérès (1967), the two compared areas belong to the northern region of the west Mediterranean, having a typical Mediterranean fauna characterized by the presence of some boreal species existing only in this area, and by the absence of a large number of subtropical species.

The highest faunal affinity with the two previous ones is that of the Aegean (75.9%), having 217 and 214 species in common with each, respectively. Pérès (1967) considers the benthic fauna of Aegean Sea, and especially that of the northern Aegean, very similar to those of the northern area of the W. Mediterranean, even though it is enriched with an important number of warm-water species and some endemics.

The amphipod fauna of the Adriatic Sea (AD) also has a high affinity with the two areas just mentioned (71.16%), although it is lower than the affinity among those. This is also in accordance with Pérès' opinion that the typical Mediterranean fauna is impoverished in the Adriatic, mainly because of the low temperatures and the reduced salinity of its water.

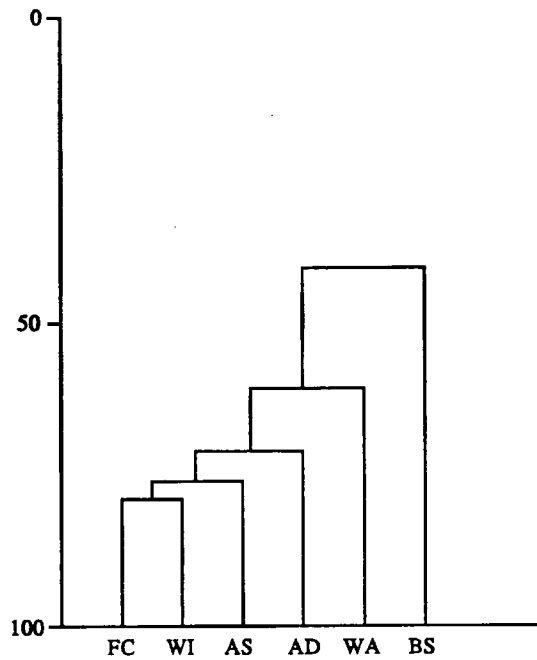


Fig. 3. Dendrogram showing the amphipod faunal affinity among certain areas of the Mediterranean Sea (for abbreviations, see table I).

The fauna of the African west Mediterranean coast (WA) showed a lower affinity with those of the above areas (60.97%), on the basis of a total of 117 species known from this area. This low affinity could possibly be attributed not only to the fact that this area is relatively less studied than the others, but also because of the enrichment from the Strait of Gibraltar with warm-water species of Senegalian origin, the number of which is decreasing from the west to the east. The exposure of these coasts to wave action probably plays an important role in regionally reducing the diversity of the Mediterranean fauna.

Finally, the isolated Black Sea has a very low affinity with all the other areas (40.96%), not only because of the impoverishment of its fauna (mainly due to the reduced salinity), but also because of the presence of endemic species.

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