Decapod Crustaceans associated with the sponge *Sarcotragus muscarum* Schmidt, 1864 (Porifera: Demospongiae) from the Levantine coasts of Turkey

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Abstract

The present study was carried out to determine the Decapod Crustaceans fauna in association with *Sarcotragus muscarum* Schmidt, 1864 from the Levantine Sea coasts of Turkey studied between 13 September 2005 and 07 October 2005. As a result of the present study, a total of 711 specimens belonging to 12 decapod species were identified. Among the species determined, *Synalpheus gambaroloides* (Nardo, 1847) was the most dominant species represented with 616 individuals and dominance value of 86.64%. *Alpheus rapacida* de Man, 1908 is firstly encountered in association with the sponge species.

Keywords: Associated fauna, Diversity, *Sarcotragus muscarum*, Decapod, Levantine Sea, Turkey

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Introduction

So far six species of *Sarcotragus* genus have been described all over the world (Cook and Bergquist, 2002). Sponges are inhabited by a wide variety of organisms. They have been found to provide shelter and food for many other organisms (Wendt et al., 1985). Benefits that sponges offer intimate associates include protection from predators by providing shelter (e.g., juvenile spiny lobsters, small crustaceans, ophiuroids, scyphozoans, zoanthids); and providing food (Wulff, 2006).

Sponges known to consist of a host for many organisms that live in epi or endobiotic relation with them (Koukouras et al., 1992). In addition, environmental factors such as depth and habitat type can also be influential in determining the composition of the fauna associated with sponges (Ribeiro et al., 2003).

Generally the endofauna associated with sponges are dominated by polychaetes, amphipods, decapods, and molluscs, which reside either on the sponge surface as epibionts or within the canal system as endobionts (Wendt et al., 1985; Koukouras et al., 1985; Voultsiadou-Koukoura et al., 1987; Duarte and Nalesso, 1996; Çınar and Ergen, 1998; Ribeiro et al., 2003; Çınar et al., 2002).

Investigations (Koukouras et al., 1985; Çınar and Ergen, 1998; Çınar et al., 2002) have been carried out to date dealing with faunal assemblages in association with *Sarcotragus muscarum* Schmidt, 1864. No specific research has been carried out so far on the Decapod fauna in association with *S. muscarum*.

Fauna associated with the decapod species has never been studied before in the Levantine Sea coast. The aim of the study is to characterize the decapod species composition inside in the specimens of *S. muscarum* species distributing along the Levantine Sea coast of Turkey.

Material and methods

Sponge species were collected by scuba diving and snorkelling from different depths of 0.3-4 m at various 14 stations along the Levantine Sea coasts of Turkey, between 13 September 2005 and 10 October 2005 (Fig. 1; Table 1). The sponge samples were collected and processed according to the methodology of Çınar et al., (2002).

Sponge sample removed from the hard substratum and fixed in 5% formalin solution. Volume was measured by the water displacement method. In the laboratory, 14 sponge specimens were dissected and washed through a 1 mm sieve in fresh water, and sorted under a stereomicroscope. The crustacean specimens were sorted and preserved in 70% ethanol. Specimens belonging to Decapoda were identified and counted. Salinity, temperature and dissolved oxygen concentrations were measured *in situ*.

These species were identified according to the studies of Zariquiey Álvarez (1968), Noël (1992), Ingle (1993) and, Falciai and Minervini (1996). The nomenclature for these species follows Marinespecies (2009).

Soyer's (1970) frequency index (f%) was used to determine the frequencies of species at the stations, and in biotopes as well. The results were evaluated as continuous (F≥50%), common

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(50%>F≥25%) and rare (F<25%). The frequency index of a particular species was estimated by *f*=m/M*100, where m= number of stations where the species was found and M= numbers of all stations.

Bellan-Santini's (1969) quauntitative dominance index (DI%) were calculated. The dominance index of certain species was estimated by DI=m/M*100, where m= individual number of species in the stations and M= total individual numbers of all species.

Results

Physico-chemical analyses

The pattern of the main abiotic parameters showed some differences in relation to the location of the sampling stations (Table 1). In the study area, sea surface salinity level ranged from 37.3 ‰ and 39.3 ‰. The maximum temperature value (30 °C) was measured at station K9 while the minimum value (24.7 °C) was detected at station K44. Dissolved oxygen values fluctuated in accordance with the location ranging from 4.55 mg/l and 6.55 mg/l respectively.

Data analyses

The Decapod fauna associated to 14 specimens of *S. muscarum* in Levantine Sea coast of Turkey, with 9 decapod families represented by 12 species and 711 individuals (Table 2, Fig 2). Among those species encountered, *Synalpheus gambarelloides* (Nardo, 1847) was the most dominant species represented with 616 individuals (86.64% of total individuals) followed by *Cestopagurus timidus* (P.Roux, 1830) with 45 individuals (6.33%) (Fig. 4 and Table 2). The less dominant species were *Pagurus anachoretus* Risso, 1827, *Porcellana platycheles* (Pennant, 1777) and *Acanthonyx lunulatus* (Risso, 1816) each represented with one individual only (0.14%).

These stations were observed in terms of number of species and individuals (Fig. 2; Table 2). Maximum numbers of species (7) was found at station K53, followed by station K20 (4 species). Maximum numbers of individuals (122; 115; 111) were found at station K45, K37 and K44, respectively. The lowest numbers of species (1) were recorded at 8 stations (K6, K10, K21, K27, K29, K35, K37 and K45). The lowest numbers of individuals (1) were recorded at stations K6 and K10. According to frequency-index values of the species inhabitant in the sponge, 1 species could be classified as 'Continuous' (F≥50%), 2 species as 'Common' (*F* between 25 and 50%) and 9 species as 'Rare' (F<25%). The continuous species, *S. gambarelloides* achieved the highest value (64.29%), followed by *Alpheus dentipes* Guérin-Méneville, 1832 (28.57%) (Fig. 3).

S. gambarelloides which represented with highest frequency and dominancy values (616 individuals, 86.64%; 64.29%) in this study has typical relationships with some sponge species (Koukouras et al., 1985; Çınar et al., 2002). This species followed by *C. timidus* (45 individuals and 6.33% frequency value) and *Pilumnus hirtellus* (Linnaeus, 1761) with a value of frequency, (10 individuals and 35.71%) dominancy (Fig. 4). Within this group, 3 species represented by the frequency value of 0.14%. High dominacy of *S. gambarelloides* in certain sponge species could be explained by greater body size of this species, limited surface area and

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volume of the sponges and biotic and abiotic factors of the habitat.

The exotic species (Lessepsian migrant) *Alpheus rapacida* de Man, 1908 now is a firstly reported among the component fauna of the sponge *S. muscarum*

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Figure 1: Map of the study area, with locations of sampling stations

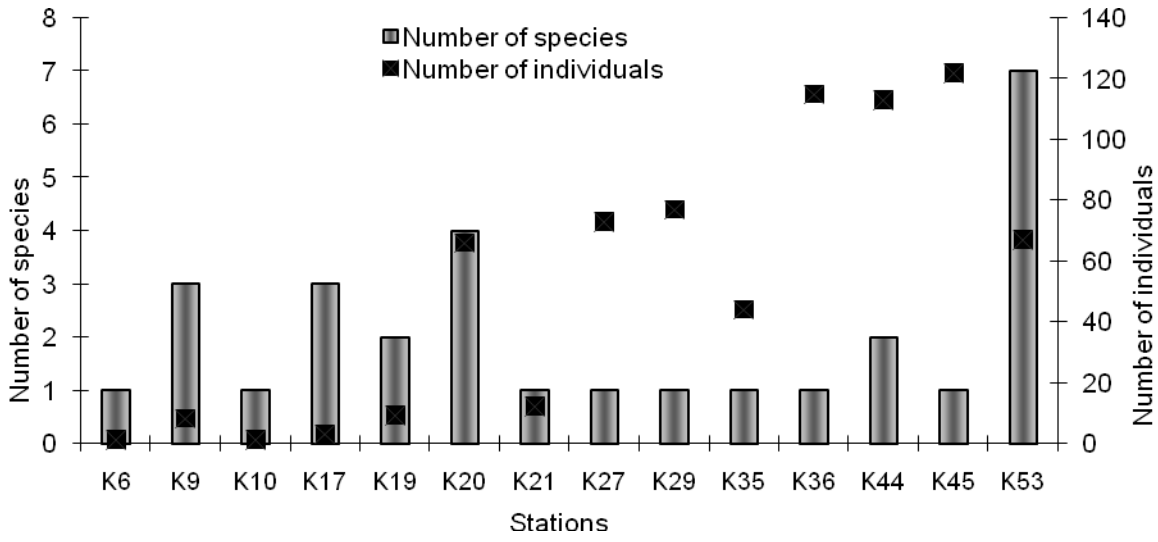

Figure 2: Total number of individuals of the decapod species encountered

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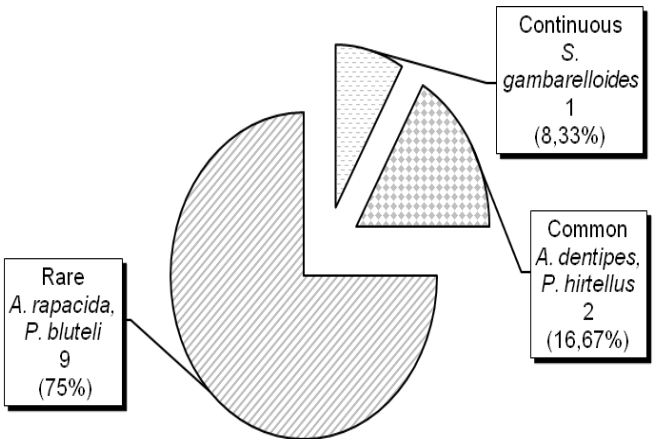

Figure 3: Dispersion of species as a result of 3 frequency index group

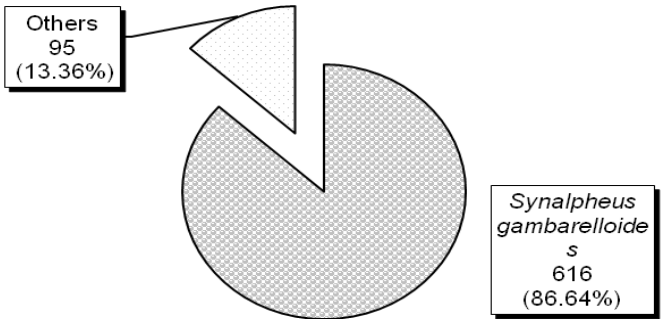

Figure 4: Relative dominance of the number of individuals of the species

Table 1: Abiotic characteristics of the stations

Stations	Date	Coordinates	Sal (‰)	Tem (ºC)	O2 (mg/l)
K6	13.09.05	36º19'30" N-35º54'30" E	39,2	28,5	4,7
K9	14.09.05	36º54'22" N-35º58'05" E	39,2	30	4,6
K10	15.09.05	36º45'59" N-35º47'18" E	39,1	29,1	6,5
K17	19.09.05	36º28'42" N-34º10'21" E	39,3	28,3	4,6
K19	19.09.05	36º18'51" N-33º51'47" E	39,3	28,4	6,4
K20	20.09.05	36º17'24" N-33º50'10" E	39,3	28,4	4,5
K27	22.09.05	36º01'17" N-32º48'14" E	39,2	28	5,0
K29	24.09.05	36º06'03" N-32º33'37" E	39,2	26,9	5,5
K30	24.09.05	36º19'16" N-32º14'07" E	39,3	26,9	4,8
K35	28.09.05	36º47'35" N-30º34'31" E	38,7	26,5	4,9
K37	29.09.05	36º17'53" N-30º28'20" E	39,1	25,4	5,3
K44	03.10.05	36º11'26" N-29º50'51" E	37,7	24,7	5,6
K45	03.10.05	36º12'06" N-29º37'30" E	37,3	24,8	5
K53	07.10.05	36º44'20" N-28º55'43" E	38,8	25,2	5,5

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Table 2: List of the species found and their number of individuals at the stations as well as their dominance and frequency results

	K6	K9	K10	K17	K19	K20	K21	K27	K29	K35	K37	K44	K45	K53	F%	D%
***Alpheus Dentipes* Guérin-Méneville, 1832**	-	1	-	1	-	2	-	-	-	-	-	-	-	5	1,27	28,57
***Alpheus rapacida* de Man, 1908**	-	-	-	-	-	2	-	-	-	-	-	-	-	-	0,28	7,14
***Athanas nitescens* (Leach, 1814)**	-	4	-	-	-	-	-	-	-	-	-	-	-	2	0.84	14,29
***Periclimenes scriptus* (Risso, 1822)**	-	-	-	1	-	-	-	-	-	-	-	-	-	8	1,27	14,29
***Synalpheus gambarelloides* (Nardo, 1847)**	-	-	-	-	1	61	12	73	77	44	115	111	122	-	86,64	64,29
***Cestopagurus timidus* (P. Roux, 1830)**	-	-	-	-	-	-	-	-	-	-	-	-	-	45	6,33	7,14
***Pagurus anachoretus* Risso, 1827**	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,14	7,14
***Pisidia bluteli* (Risso, 1816)**	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0,28	7,14
***Porcellana platycheles* (Pennant, 1777)**	-	-	-	1	-	-	-	-	-	-	-	-	-	-	0,14	7,14
***Acanthonyx lunulatus* (Risso,1816)**	1	-	-	-	-	-	-	-	-	-	-	-	-	-	0,14	7,14
***Pachygrapsus marmoratus* (J.C. Fabricius, 1787)**	-	-	-	-	8	-	-	-	-	-	-	-	-	-	1,13	7,14
***Pilumnus hirtellus* (Linnaeus, 1761)**	-	3	1	-	-	1	-	-	-	-	-	2	-	4	1,55	35,71

Discussion

A total of 711 specimens belonging to 12 decapod species were recorded from 14 *S. muscarum* specimens along the Levantine coast of Turkey.

Previous study carried out on *S. muscarum* (Çınar et al., 2002) reported 32 Crustacea with 8 Decapod species [*Athanas nitescens* (Leach, 1814), *S. gambarelloides, Galathea intermedia* Liiljeborg, 1851, *Calcinus tubularis* (Linnaeus, 1767), *Pagurus chevreuxi* (Bouvier, 1896), *Pisidia bluteli* (Risso, 1816), *A. lunulatus* and *P. hirtellus*]. The species *G. intermedia*, *C. tubularis* and *P. chevreuxi*, reported by Çınar et al., (2002), were not recorded in the present study. On the other hand, the decapod species, *A. dentipes*, *A. rapacida*, *Periclimenes scriptus* (Risso, 1822), *C. timidus*, *P. anachoretus*, *P. platycheles* and *Pachygrapsus marmoratus* (J.C. Fabricius, 1787), reported in the present study were not recorded by Çınar et al., (2002).

Koukouras et al., (1985) reported 27 Decapod species assemblages inhabiting the seven sponge species and crustaceans have the highest dominance value in the *S. muscarum*. The family

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Alpheidae is well known sponge inhabitants and the anomura *C. timidus* has also high biological index values in the sponge species (Koukouras et al., 1985).

The present study shows that the *S. muscarum* has formed dense populations along the Levantine coasts of Turkey preferred by 12 decapod species including exotic species (*A. rapacida*).

On the other hand, as a result of dissection of *S. muscarum* in order to see the gastral cavities of it, it's observed that *S. gambaroleides* did not prefer the cavities of the sponge where the Mediterranean brittle star, *Ophiothrix fragilis* (Abildgaard, 1789) exist. It was also observed that the cavities of *S. muscarum* was not preferred by *O. fragilis* when the cavities occupied by *S. gambaroleides* individuals. It can be concluded that these two species do not share the same habitat. This could be the result of the carnivores of the Mediterranean brittle star, *O. fragilis*.

The increase of number individuals and decreasing number of species might relate to environmental parameters (temperature and salinity), degree of longitude, and not sharing the same habitat by species (Mediterranean brittle star *O. fragilis* and snapping shrimps *S. gambaroleides*) (Fig. 2 and Table 1).

Appears with different individuals and species number depending on the ecological environmental factors and habitat forms. According to Çınar et al., (2002) no correlation was found between the size of sponge samples and the total number of individuals of the associated fauna and evenness value of each sponge sample. Also, no relations between the volume of sponge and the individuals and species number (Koukouras et al., 1985).

According to the related investigations by Koukouras et al., 1985 and Çınar et al., 2002, nine species have been previously reported. On the other hand three more species (*A. rapacida, P. scriptus* and *P. marmoratus*) are reported first time in this study inhabitant in the sponge species.

In conclusion, our study shows that the sponges of *S. muscarum* located in intertidal rocky bottoms of the Levantine coasts of Turkey, host twelve species of crustacean decapods. Further studies should be implemented in order to understand the role of sponges on the preservation of the local faunal diversity.

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