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The habitat engineering tunicate *Microcosmus sabatieri* Roule, 1885 and its associated peracarid epifauna

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Abstract

The solitary ascidian *Microcosmus sabatieri* is a common ecosystem engineering species on hard bottom sublittoral communities in the Eastern Mediterranean. Peracarida are common inhabitants of biological substrata, such as algae, sponges and ascidians and have been proven to be very sensitive to changes in environmental conditions. The aim of this study was to present and analyse, for the first time, the structure of the peracarid epifaunal assemblage inhabiting this Mediterranean endemic, edible and commercially exploited species. During sampling in the North Aegean Sea, 41 specimens were collected and examined for their peracarid epifauna. Overall, 38 peracarid species were identified, a high number in comparison to those recorded in the few other relevant studies on ascidian epifauna. The great majority of the species were amphipods. By contrast, in terms of abundance, tanaidaceans was the dominant taxon, with *Leptochelia savigni* being by far the most dominant species. Tube-dwelling suspension-feeders dominated the peracarid epifauna of this tunicate. The suspension feeding mode of epifaunal peracarids is possibly favoured by the high filtration rate of *M. sabatieri* which is large sized and has an extensive branchial surface. It is suggested that the tube-dwelling habit of tanaidaceans and some amphipods offering extra protection, may further explain their dominance as elements of the epifauna, in contrast to other inquiline peracarids which prefer to search for shelter inside the canals of sponges or, in a few cases inside the mantle cavity of ascidians. Differences in peracarid abundance among the ascidian specimens were attributed to the reproductive and dispersal habits of the former. Species richness, abundance and diversity of the motile peracarid epifauna was dependent on the biomass of the ascidian, but most strongly on the biomass of the sessile epibiontic organisms, such as algae and sponges which, in some cases, had a higher biomass than the ascidian itself. Thus, *M. sabatieri* with its wrinkled surface usually supporting a rich sessile epiflora and epifauna provides a favourable habitat for a quite homogenous peracarid assemblage. A thorough study of the entire community associated with *M. sabatieri* and its comparison with that in the surrounding environment could further elucidate the role of this organism in the enrichment of local biodiversity.

Keywords: Peracarida; *Microcosmus sabatieri*; Ascidiacea; ecosystem engineering; epifauna; animal associations; Aegean Sea; Mediterranean Sea

1. Introduction

Ecosystem engineering is the creation, destruction or modification of habitats by living organisms having complex consequences on the structure of biological communities (Jones et al., 1994; Crooks, 2002).

Various marine benthic animals have been considered as ecosystem engineers increasing habitat complexity and consequently influencing local biodiversity. Their study has been recently of increasing interest due to their ecological importance in structuring benthic communities. Sabellariid polychates (Nelson and Demetriades, 1992), bryozoans (Conradi et al., 2000), mussels (Tsuchiya and Bellan-Santini, 1989), sponges (Ribeiro et al., 2003), barnacles and ascidians (Yakovis et al., 2005) have been examined for their relationships with associated fauna. Moreover, since some of the species belonging to the above groups are of commercial interest, their overexploitation might have serious consequences for biodiversity (Coleman and Williams, 2002).

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A rich macro-invertebrate fauna has been found living in the crevices and interstices between the individuals of ascidian species forming dense beds or matrices, such as those of the genus *Pyura* living in intertidal communities (Fielding et al., 1994; Cerda and Castilla, 2001; Monteiro et al., 2002; Sepúlveda et al., 2003; Castilla et al., 2004). Ascidians provide a complex substratum for their epibionts, and are preferably inhabited by suspension feeding macro-invertebrates which may utilize the abundant suspended material available in their vicinity (Sepúlveda et al., 2003). On the other hand, like other sessile macro-invertebrates, i.e. sponges and bryozoans, they produce antifouling substances (e.g. Teo and Ryland, 1994), which might reduce the abundance of some associated organisms.

Peracarida have been studied as common inhabitants of living substrata, such as algae, sponges, corals, polychaetes, mollusks and bryozoans (Stachowitsch, 1980; Koukouras et al., 1985; Costello and Myers, 1987; Nelson and Demetriades, 1992; Conradi and Cervera, 1995; Koukouras et al., 1998; Serejo, 1998; Conradi et al., 2000; Thiel and Vásquez, 2000; Broyer et al., 2001; Cinar et al., 2002; etc.). However, the peracarid epifauna associated with ascidians has been the subject of a restricted number of studies: Monniot (1965a) gave information on the epifauna of *Microcosmus* species forming blocks in the muddy bottoms of the western Mediterranean. Vader (1984) noted some amphipod species associated with tunicates in the Norwegian waters. Finally, a few species of this group have been recorded as epibionts of *Pyura* in the literature mentioned above (for an exception see Sepúlveda et al., 2003).

Microcosmus sabatieri is a solitary ascidian living attached on various hard substrata in the Mediterranean infralitoral zone, on both muddy and rocky bottoms. In contradiction to the ascidians of the genus *Pyura*, this species does not form dense beds, but it is one of the most conspicuous and abundant megabenthic species in this area (Antoniadou et al., 2006). It is a Mediterranean endemic recorded from the Aegean Sea (Koukouras et al., 1995), edible, and of commercial interest in several Mediterranean countries (Monniot and Monniot, 1987). It reaches a large size, sometimes passing 20 cm in height, and its wrinkled tunic, characteristic of the family Pyuridae, is often covered with numerous epibiontic organisms, and accounts for the genus name given by Cuvier in 1815 (micros = small + cosmos = world) (Monniot, 1965a).

This work is part of a broad study on the epifauna associated with *Microcosmus sabatieri* living on the rocky bottoms of the Aegean Sea, Eastern Mediterranean. Main reasons for studying this specific community were the following: (1) the ascidian *M. sabatieri* seems to be an important habitat builder in the Aegean Sea, where other living substrata, such as sponges and corals have been studied for their associated fauna, as mentioned above; the contribution of this ascidian to the benthic community structure, especially in an impoverished ecosystem such as the South Aegean, (see Voultsiadou, 2005) might be significant; (2) it is necessary to first describe the fauna associated with this habitat forming species in order to be able to predict how changes to the habitat may affect marine diversity in the area, given that *M. sabatieri* is commercially exploited; (3) the rich cover of this ascidian by sessile epibionts, i.e. algae, sponges and bryozoans, could possibly provide an extra complex habitat favouring the settlement of motile macro-invertebrates; and (4) Peracarida are reckoned among the most diverse and abundant members of the community associated with living substrata in the Aegean Sea, i.e. corals and sponges (see Koukouras et al., 1985, 1998), and they have been proven to be very sensitive to environmental conditions (Conradi et al., 1997) and changes induced by human activities (Baxevanis and Chintiroglou, 2000).

On the basis of the above considerations, the aim of the present work was to investigate, describe and analyse the structure of the peracarid epifaunal community inhabiting this common Aegean tunicate. This was accomplished primarily through the estimation of faunal composition, species richness, abundance of individuals, dominance and diversity of the peracarid epifauna associated with numerous specimens of *Microcosmus sabatieri* found at a selected site in the North Aegean. Furthermore, in order to test the general hypothesis that the structure of the peracarid epifaunal community may be dependant on the structure of its habitat, in our case a solitary tunicate, the above parameters were correlated with the morphometric characteristics of the ascidian and the sessile epibiontic cover. Specific issues examined were: (1) the similarity among the ascidian individuals studied on the basis of their peracarid epifauna in order to test whether the latter forms a homogenous assemblage; (2) the relationship between the ascidian length and biomass and the peracarid species richness, abundance of individuals and diversity; (3) the possible effect of the sessile epiflora and epifauna on the peracarid community; (4) the possible dominance of certain taxonomic or functional groups, such as the suspension-feeders in the community; and (5) the possibility to predict species richness, which is considered as a very good surrogate for biodiversity (Gaston and Spicer, 2004), of the epibiontic Peracarida using the abundance of individuals.

2. Materials and methods

Sampling was carried out by SCUBA diving at Porto Koufo, a small, deep bay located on the extreme end of Sithonia Peninsula, in the North Aegean Sea (39°57′34″N, 23°55′18″E). In total, 41 *Microcosmus sabatieri* individuals growing on large rocks were collected in June 1994, at depths of 5–12 m and in a total area of 500 m^2. The ascidians were covered with a plastic bag before being removed from the rock surface. Samples, preserved in 10% formalin, were washed over a 0.5 mm mesh sieve in the laboratory. For each specimen, the total wet weight was measured. Before being weighed the ascidians were cut with a knife in order to loose all the formalin kept inside the tunic and they were carefully folded for a while in blotting paper. Then, epiflora and sessile epifauna (sponges, cnidarians, etc.) were separated and their wet weight determined. Additionally, maximum length of the ascidians, from the base of attachment to the base of the oral siphon, was measured. Mobile