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Fouling Bryozoa from some Alexandria harbours, EGYPT. (II) Encrusting species

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Abstract

Polystyrene test panels immersed half a meter deep in the water were used to collect the fouling, encrusting Bryozoa at three harbours in Alexandria city. These were Abu Qir Harbour, the Eastern Harbour and El-Dekheila Harbour. Four species of encrusting bryozoa are recorded in the present study. These are Conopeum reticulum, Watersipora subtorquata, Cryptosula pallasiana and Schizoporella errata. The first species is affiliated to the Membraniporidae family, belonging to the suborder Anasca while the other three species are affiliated to the Watersiporidae, Cryptosulidae and Schizoporellidae families respectively. These families belong to the suborder Ascophora. A re-description, supplied with full structural illustrations of the recorded species is given. Moreover, the temporal and spatial distributions of the species recorded are provided

Keywords: Taxonomy; Encrusting Bryozoa; Marine fouling; Harbours.

Introduction

Bryozoans are predominantly marine colonial invertebrate animals. They occur in almost all marine habitats, mainly coastal, wherever hard, or more rarely, soft substrata exist as supports or bases (ZABALA & MALUQUER, 1988). Bryozoans are one of the main components of communities settling on artificial substrates (PISANO, 1979; BOYER, 1984).

The Mediterranean Bryozoa has been studied by many authors. BUGÉ & DEBOURLE (1977) studied the ecology of the bryozoan fauna of the sea shore in

the area surrounding Tripoli (Libya). POWELL (1969) listed the Indo-pacific Bryozoa new to the Mediterranean coast of Israel; meanwhile, HONDT (1988) studied the Bryozoa from the Mediterranean and Red Sea coasts of Israel. Similar studies were conducted on the coast of Lebanon (BITAR & BITAR, 2001), Turkey (ÜNSAL, 1975; ÜNSAL & HONDT, 1978-1979), Cyprus (KOÇAK *et al.*, 2002) and as well the Italian coastal waters and lagoons (HONDT, 1977; AMBROGI, 1981; AMBROGI & HONDT, 1981; AMBROGI *et al.*, 1988). The Aegean Sea and islands were surveyed

by other authors (HAYWARD, 1974, 1975, 1976; MORRI *et al.*, 1999; KOÇAK, 2007a). HAYWARD & MCKINNEY (2002) investigated the Northern Adriatic Bryozoa from the vicinity of Rovinj, Croatia. Bryozoan fauna are included in the studies of invasive alien species in the Mediterranean Sea (ZENETOS *et al.*, 2006, 2008; STREFTARIS & ZENETOS, 2006). Bryozoan assemblages developed on panels submerged at five marinas located along the Turkish Aegean coast were estimated by KOÇAK (2007b).

Previous studies of Bryozoa in Egypt go back to AUDOUIN (1826) who identified 67 species of Bryozoa collected by SAVIGNY. HASTINGS (1927) recorded 24 species of polyzoa in the collection made by the Cambridge Expedition to the Suez Canal, 1924. O'DONOGHUE & DE WATTEVILLE (1939) investigated the marine Bryozoa in the fishery grounds near Alexandria and recorded 62 species. BALAVOINE (1959) studied bryozoan fauna collected from 24 stations during the mission of Robert Ph. Dollfus in Egypt (December 1927-March 1929) and recorded 44 species. Four species of Cyclostomes and 40 species of Cheilostomes. Recently, HONDT (2006) has given a new explanation of the plates of 'Polyps-Bryozoa' in the description of Egypt presented by AUDOUIN (1826). Meanwhile ABDEL-SALAM & RAMADAN (2008) have reported on the fouling erect species developed in three Alexandria ports.

The present work aims to give taxonomical information about the encrusting fouling bryozoa recorded from three harbours in Alexandria (Egypt) namely Abu Qir Harbour, the Eastern Harbour and El-Dekheila Harbour, as well as the temporal and spatial distributions of the recorded species.

Material and Methods

Using white polystyrene test panels (12.5x12.5 cm), the fouling samples were collected from three harbours along Alexandria city, namely Abu Qir Harbour (A.H.), the Eastern Harbour (E.H.) and El-Dekheila Harbour (D.H.) (Figure 1).

Descriptions of the investigated harbours and a detailed sampling scheme of the experiment are provided in ABDEL-SALAM & RAMADAN (2008).

Samples of encrusting Bryozoa were recorded and isolated for identification. Illustrative drawings of the recorded bryozoan species were carried out by means of a zoom stereoscopic microscope provided with its special camera lucida drawing tube; the full structural re-description of different species was provided as well. Classification keys for the Mediterranean Bryozoa were provided by ZABALA & MALUQUER (1988). The taxonomic order is based on that adopted by HAYWARD & RYLAND (1979 and 1999). All materials were deposited in the laboratory of Taxonomy and Aquatic Biodiversity, National Institute of Oceanography & Fisheries, Alexandria, Egypt.

Results

The present study yields 4 species of encrusting Bryozoa belonging to 4 families.

Family: MEMBRANIPORIDAE

Conopeum reticulum (LINNAEUS, 1767)
Millepora reticulum LINNAEUS, 1767:1284.
Flustra lacroixii AUDOUIN, 1826:240.
Conopeum reticulum (LINNAEUS, 1767);
 RYLAND, 1965:30, fig.13; PRENANT &
 BOBIN, 1966:124, fig.32; RYLAND &

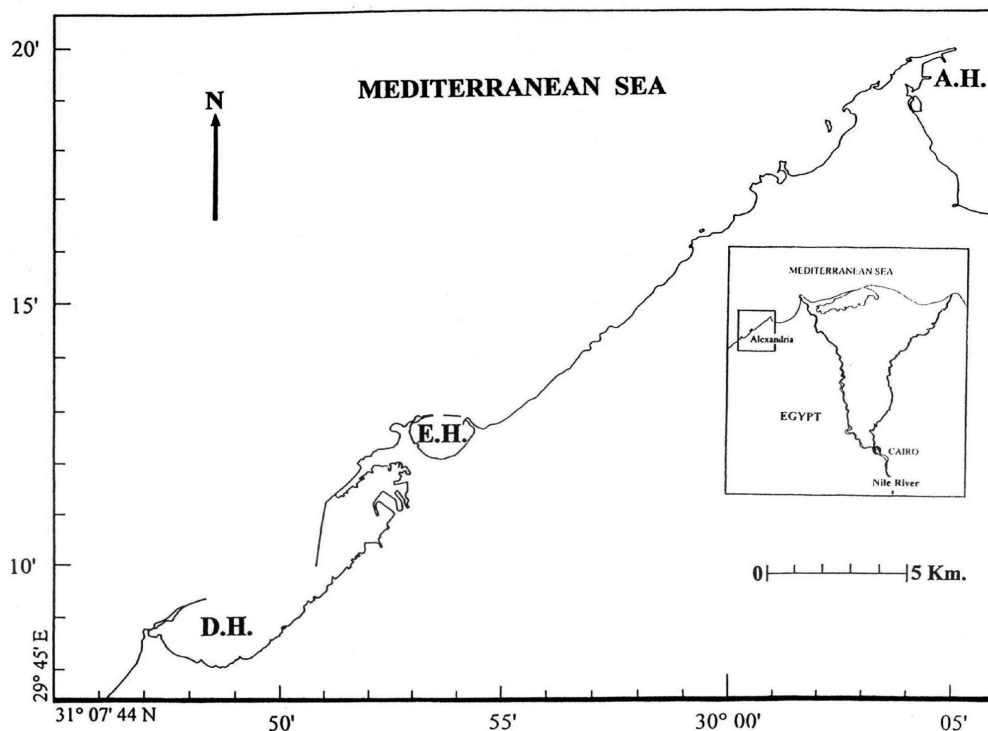


Fig. 1: The area investigated; positions of the three sampled harbours along Alexandria coast.

HAYWARD, 1977:60; ZABALA & MALUQUER, 1988:76, fig.65.

Colony form: Encrusting, sheet-like, calcareous.

Size: Up to 8 cm in diameter.

Description: (Fig. 2)

Thinly encrusting pale brownish-white sheets of zooids. Zooids 0.35-0.55 mm long and 0.19-0.27 mm wide, elongated-oval in shape, with most of the frontal surface membranous; skeletal rim granular. Each zooecium is provided distally with a pair of small, triangular, dwarf, non-feeding zooids (Kenozooid) and a characteristic operculum with a folded membranous edge.

Remarks: This species was absent from the Levantine Sea including the coasts of

Israel (POWELL, 1969; HONDT, 1988), Lebanon (BITAR & BITAR, 2001), Turkey (ÜNSAL & HONDT, 1978-1979; KOÇAK, 2007a, b) and Cyprus (KOÇAK *et al.*, 2002). ZABALA & MALUQUER (1988) who recorded this species from the West Mediterranean mentioned that a pair triangular kenozooids are situated at the distal end of each zooid. Spines, if present, are placed all around the frontal area. On the other hand, RYLAND (1965) reported that in the angles between zooecia, small triangular walled spaces may be present. Present work specimens are in good accordance with the descriptions given by the above authors.

General distribution and habitat: Usually found on stones and shells on the shore or in shallow water, but large colonies may be

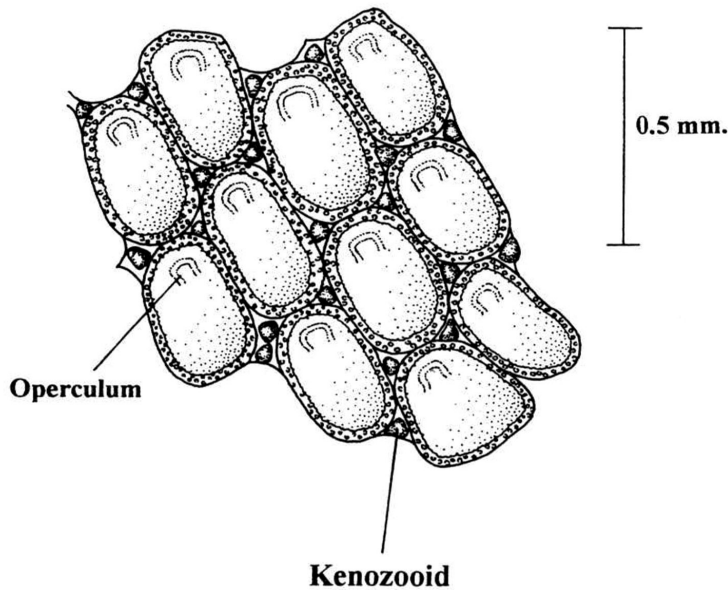


Fig. 2: *Conopeum reticulum*. Group of zooecia.

found on wooden structures. The species occurs in the sea and at river mouths where salinity may be very low (RYLAND, 1965). In European waters the species extends from Skagerrak and Kattegat down the Atlantic coast, perhaps into the Mediterranean; also to the Azores, Canary and Cape Verde islands (RYLAND, 1965). It has been recorded in the West Mediterranean (ZABALA & MALUQUER, 1988) and France (PRENANT & BOBIN, 1966).

Local distribution and association: This species was previously recorded in the list of marine fouling in the Suez Canal (RAMADAN, 1986).

In the present work, on short-term panels this species appeared only at El-Dekheila harbour during the period April 1999 to September 1999, flourishing during May 1999 when it covered about 38%

of the panel area. It is worth mentioning that the water of this harbour is characterized by low salinity, in comparison with the other two harbours.

On long-term panels, it appeared at both Abu Qir and El-Dekheila Harbours. It is weakly represented on the 9 month duration panels at Abu Qir Harbor; it was encountered at El-Dekheila Harbour during different periods of accumulation except for those of the 2 and 4 month duration panels. The maximum representation of the species was noticed on panels after 10 and 11 months of immersion when it covered about 85% and 77.5% of the panel area. The ten and eleven month fouling communities are mainly composed of large numbers of moderate sized barnacles, some polychaete tubes (*Hydroides elegans*), large numbers of associated amphipods and isopods, and the erect bryozoa *Bowerbankia gracilis*, which covered

about 72.5% and 92.5% of the panel area during the ten and eleven month durations, respectively.

Family: WATERSIPORIDAE

***Watersipora subtorquata* (D'ORBIGNY, 1852)**

Escharina torquata D'ORBIGNY, 1847

Lepralia subovoidea D'ORBIGNY, 1852

Cellepora subtorquata D'ORBIGNY, 1852

Watersipora cucullata BUSK, 1854

Watersipora subovoidea (D'ORBIGNY, 1852); GAUTIER, 1962: 183; RYLAND, 1965:68, fig. 33a, b, c, and d; COOK, 1985:149, plates 6B and 16D; ZABALA & MALUQUER, 1988:114, fig. 234 and 9(D).

Watersipora subtorquata (D'ORBIGNY, 1852); HONDT, 1988: 183

Colony form: Encrusting foliaceous.

Size: Variable from few mm to few cm in diameter.

Description: (Fig. 3)

Colonies are encrusting, brownish-purple to almost black in colour. Zooecia are rather large and distinct. The frontal wall is convex, perforated by numerous pores. The aperture and operculum have a mushroom shaped outline, that is, an upper circular area with a broad, rounded extension at the bottom. The lower edge of the aperture around this extension is sometimes raised in a rim or spout. The operculum is strongly pigmented, with a broad, dark, central band, paler peripheral regions, and two shining white points proximally. The operculum is about 0.17 mm long and 0.2 mm wide. Zooids are about 0.65-1.1 mm in length, and 0.25-0.50 mm in width. Spines, avicularia, and ovicells are lacking.

Remarks: *Watersipora subtorquata* may have been previously referred to or record-

ed by many different names, including: *Cellepora subtorquata*, *Escharina torquata*, *Watersipora subovoidea*, *Dakaria subovoidea*, *Cellepora ovoidea*, *Watersipora cucullata*, *Lepralia cucullata*, *Watersipora atrofusca*, *Lepralia atrofusca*, *Schizoporella atrofusca*, *Watersipora atterrma*, and *Watersipora edmondsoni*. *Watersipora subtorquata* is also very similar to *Watersi-*

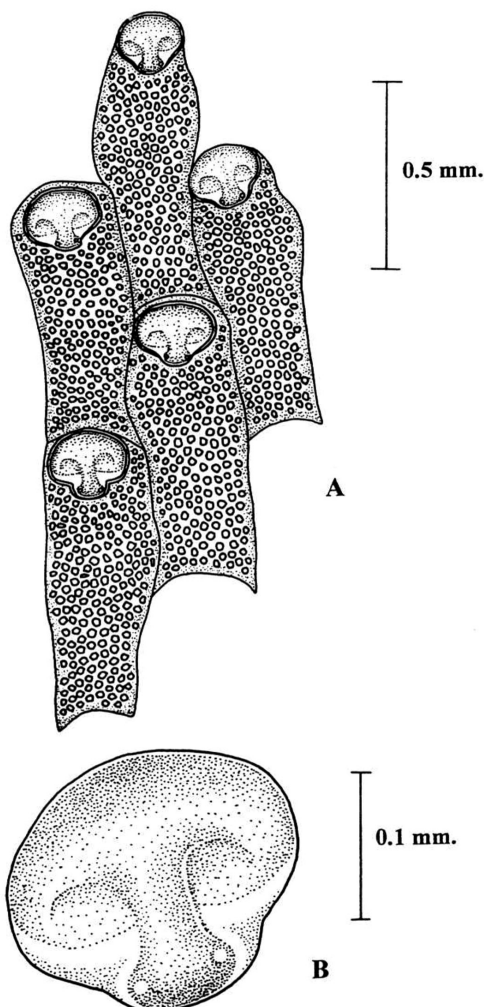


Fig. 3: *Watersipora subtorquata*. A, Group of zooecia, B, Operculum.

pora acurata, and are only differentiated by their apertures and not identifiable in the field, representing yet another source of misidentification (COHEN & CARLTON, 1995; COHEN, 2005; MACKIE *et al.*, 2006). *W. subtorquata* was recorded on the coast of Israel (HONDT, 1988), *W. cucullata* on the coast of Lebanon (BITAR & BITAR, 2001), and *Watersipora subovoidea* on the coast of Turkey and Croatia (KOÇAK, 2007b; HAYWARD & MCKINNEY, 2002).

The attribution of specimens to *Watersipora subovoidea* needs reflection and evaluation, taking into account both older and more recent literature. In fact, although some papers (HAYWARD & MCKINNEY, 2002) continue to treat this species as living in the Mediterranean, the examination of type material of the *Watersipora* species (CHIMENZ GUSSO *et al.*, 2004) and contemporaneous papers such as (ROSSO, 2003; CHIMENZ GUSSO *et al.*, 2006) lead to the view that the Mediterranean specimens actually belong to *W. cucullata* or to *W. subtorquata* and that *W. subovoidea* is at present absent from the Mediterranean Sea.

General distribution and habitat: *Watersipora subtorquata* is common to lower inter-tidal and shallow sub-tidal areas. It is known to inhabit salinities of 25-49 parts per thousand, temperatures of 12-28°C, and depths to tens of meters. It grows on a wide range of substrates including rocks, shells, debris, docks, kelp, ship hulls, pilings, and other bryozoans. Since they are an early successional species, they are especially efficient at colonizing artificial structures (COHEN, 2005). Populations that may include this species have been reported from the western Atlantic, from Bermuda and the Gulf of Mexico to Venezuela, at

numerous sites in the Mediterranean, the Azores, the Cape Verde Islands, West Africa, South Africa, the Red Sea and Suez Canal, India and Sri Lanka, Indonesia and Hawaii, the U.S.A., Australia and New Zealand (COHEN, 2005; MACKIE *et al.*, 2006; GORDON & MAWATARI, 1992).

Local distribution and association:

Watersipora cucullata was previously recorded in Alexandria (O'DONOGHUE & DE WATTEVILLE, 1939; MEGALLY, 1970; GHOBASHY, 1976) and in the southern region of the Suez Canal (GHOBASHY & EL-KOMY, 1981b), while *Watersipora subovoidea* was recorded in Port Said harbour, Suez bay and El-Ghardaqa (RAMADAN, 1986; EL-KOMI *et al.*, 1998 and EL-KOMI, 1992).

In the present work, *W. subtorquata* was encountered on short-term panels only at Abu Qir Harbour where the species was weakly represented during most of sampling months. On long-term panels, this species was recorded at all three harbours. At Abu Qir Harbour it was sampled on panels during different periods of collection, but well represented after 5 and 6 months of immersion, covering about 6.7% and 6.3% of the panel area, respectively. The five and six months fouling communities are mainly composed of moderate numbers of barnacles, some tubes of the polychaete (*Hydroides elegans*), large numbers of the polychaete (*Spirorbis* sp.), the encrusting species (*Schizoporella errata*) and a large numbers of the erect bryozoan species (*Bugula neritina*) giving 50 and 90 colonies, respectively.

At the Eastern Harbour, it was weakly represented only on the 8 and 9 month duration panels, while at El-Dekheila har-

bour it showed weak settlement only on the 7 and 9 month duration panels.

Family: CRYPTOSULIDAE

***Cryptosula pallasiana* (MOLL, 1803)**

Eschara pallasiana MOLL, 1803:64, Pl.3, fig.13.

Lepralia pallasiana HINCKS, 1880:297, Pl.24, fig.4; Pl.33, figs 1-3.

Cryptosula pallasiana (MOLL, 1803); GAUTIER, 1962: 169; RYLAND, 1965:72, fig. 34a, b, and c; ZABALA & MALUQUER, 1988:114, fig. 235; HAYWARD & RYLAND, 1999:194; HAYWARD & MCKINNEY, 2002:81, fig.36 E,F.

Colony form: Encrusting.

Size: Up to 3 cm in diameter.

Description: (Fig. 4)

The colonies form white or pinkish small or extensive patches. Zooecia are hexagonal, sometimes nearly rectangular, with a thick convex frontal wall. Zooids are 0.43-0.65 mm long and 0.26-0.45 mm wide. There are numerous frontal pores, each sunk in a small pit. The orifice is somewhat bell-shaped in outline, and at its widest proximally. Avicularia and ovicells are lacking.

Remarks: This species was absent from studies of the Levantine Sea, including (HONDT, 1988; BITAR & BITAR, 2001; KOÇAK *et al.*, 2002), while KOÇAK (2007b) gave no taxonomical data about this species. RYLAND (1965) mentioned that sometimes an avicularium with a rounded mandible is situated just below the orifice, while HAYWARD & MCKINNEY (2002) indicated that a stout median sub-oral umbo was present in most autozooids; in some populations this position is occu-

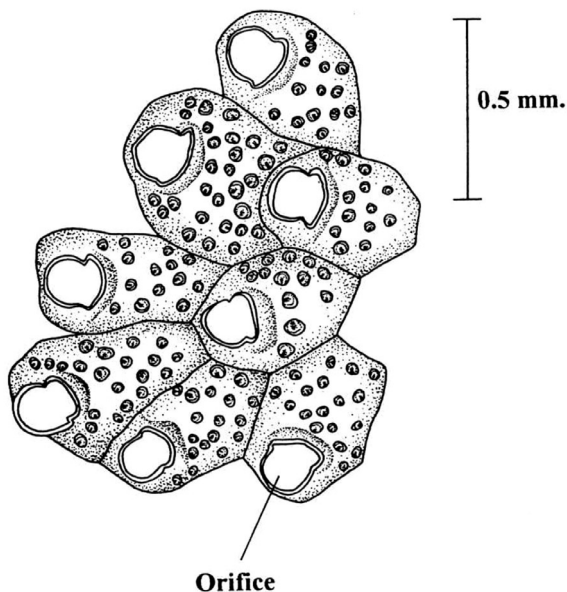


Fig. 4: *Cryptosula pallasiana*. Group of zooecia.

pied by an avicularium with a broadly oval rostrum. These characteristics were not observed in the examined specimens.

General distribution and habitat: The species is found encrusting on any surface that will provide attachment, including ships' hulls, in fairly shallow water (RYLAND, 1965).

It is widespread around the world, particularly in ports, harbours, and estuarine situations (GORDON & MAWATARI, 1992).

Local distribution and association: *Cryptosula pallasiana* was previously recorded from Alexandria (O'DONOGHUE & DE WATTEVILLE, 1939; EL-KOMI, 1991, 1998b), from the Suez Canal (GHOBASHY & EL-KOMY, 1981a, b), from Port Said Harbour (RAMADAN, 1986), from Suez bay (EL-KOMI *et al.*, 1998 and EMARA, 2002), and from El-Ghardaqa (EL-KOMI, 1992).

During the present study, it was weakly represented on the short-term panels at Abu Qir and the Eastern harbours. At Abu Qir Harbour it was collected only during March and April 1999, while at the Eastern Harbour it appeared only during May 1999.

On the long-term panels, the species was recorded at all three harbours. At Abu Qir Harbour it appeared on the 6-9 month duration panels. At the Eastern Harbour it was also weakly represented only on the 9 and 11 month duration panels. At El-Dekheila Harbour it appeared on the 7-9 month duration panels, but was well represented only on the 8 month duration panels, when it covered about 6% of the panel area. The eight month fouling community was mainly composed of a large number of barnacle species (*Balanus perforatus*, *B. amphitrite* and *B. eburneus*), some poly-

chaete tubes (*Hydroides elegans*), large numbers of associated amphipods and isopods, the erect bryozoa (*Bowerbankia gracilis*) and the encrusting bryozoa (*Conopeum reticulum*), each of which covered about 70% of panel area, and the hydrozoan (*Obelia geniculata*), covering about 68% of panel area.

Family: SCHIZOPORELLIDAE

***Schizoporella errata* (WATERS, 1878)**

Lepralia errata WATERS, 1878: 11
Schizoporella violacea (CANU & BASSLER, 1930); GAUTIER, 1962:150.
Schizoporella errata (WATERS, 1878); RYLAND, 1965:64, fig. 31 a & b; HAYWARD & RYLAND, 1979:170, fig. 68; ZABALA & MALUQUER, 1988: 133, fig.308; HAYWARD & RYLAND, 1999:212; HAYWARD & MCKINNY, 2002:67, fig.30 F-I.

Colony form: Encrusting.

Size: Up to 2-3 cm in diameter.

Description: (Fig. 5)

The colonies form white or pinkish patches. Zooecia are almost rectangular in shape, 0.50-0.65 mm in length and about 0.4 mm in width. The frontal wall is covered rather closely with pits, each containing a large round pore. The umbo is little developed, forming a small protrusion below the orifice. The orifice is roughly semi-circular to circular, its proximal margin containing a well-marked central sinus. A raised avicularium may be situated on one side of the orifice, the tapering mandible obliquely outwardly directed.

Remarks: No taxonomical details were provided in studies of the coasts of Israel, Lebanon and Turkey (HONDT, 1988; BITAR & BITAR, 2001; KOÇAK,

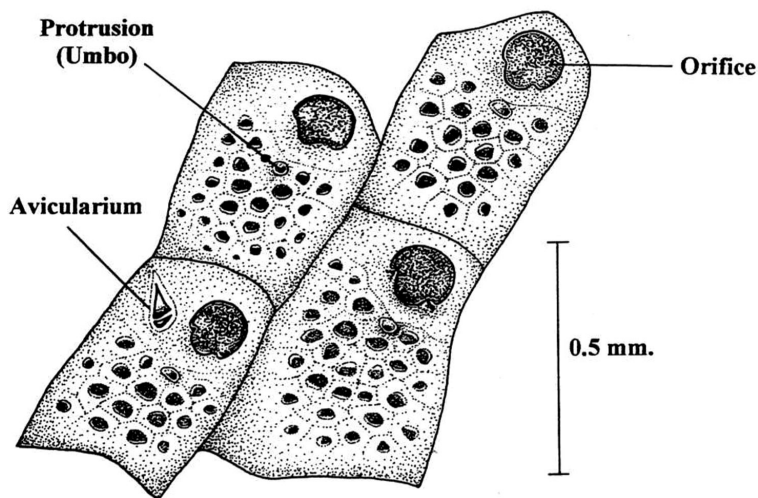


Fig. 5: *Schizoporella errata*. Group of zooecia.

2007b). Although RYLAND (1965) made no comment about the umbo, ZABALA & MALUQUER (1988) mentioned that the frontal wall is without umbo. HAYWARD & MCKINNY (2002) indicated that this species exhibits morphological differences between two studied localities. The structures in the Rovinj Harbour are exposed to vigorous hydrodynamic conditions, whereas the Lim Channel locality is protected, with very low kinetic energy conditions. Colony morphology in the harbour locality is massive, with irregular knobby surfaces and centimeter-wide, millimeter-high cavities in which sediment or other extraneous objects may be immured; colonies are more densely grown and lack such cavities at the mussel-culture station of the Lim Channel locality. At this station, two morphologies predominate: relatively smooth-surfaced multilaminar encrustations, and prolific, commonly hollow, erect branches. These differences in growth habits between the two localities parallel the morphologies

that the species exhibits between high-energy and low-energy localities in the Ligurian Sea along the Italian coast (COCITO *et al.*, 2000).

General distribution and habitat: *Schizoporella errata* is a readily recognized, widely distributed, common fouling species. It is common throughout the Mediterranean and flourishes on man-made substrata as a persistent and sometimes troublesome fouling organism. It is present in similar situations in warm temperate to subtropical waters worldwide, and is a vigorously invasive species (HAYWARD & MCKINNY, 2002). GORDON & MAWATARI (1992) recorded its recent spread to New Zealand ports.

Local distribution and association: *Schizoporella errata* was previously recorded from Alexandria (EL-KOMI, 1991; 1998a), from El-Ghardaqa (EL-KOMI, 1992), from the Suez Canal (GHOBASHY *et al.*, 1980; GHOBASHY & EL-KOMY, 1981b; RAMADAN, 1986) and

from the Suez bay (EL-KOMI *et al.*, 1998).

In the present survey it appeared on short-term panels only at Abu Qir Harbour during the whole period of study, except in April and May 1999. The maximum flourishing was recorded during September 1999 when it covered about 5% of the panel area. The fouling community during this month is mainly composed of large number of polychaeta tubes (*Hydroides elegans* and *Spirorbis* sp.) and some barnacle (*Balanus amphitrite*).

On the long-term panels it was recorded at all three harbours. At Abu Qir Harbour, it appeared during different periods of immersion, being well represented mainly on the 6 and 7 month duration panels, covering about 42% and 35% of the panel area, respectively. During these two periods, the erect bryozoan *Bugula neritina* is well represented, giving rise to 90 and 78 colonies, respectively. At the Eastern Harbour it was weakly represented, only on the 5 and 9 month duration panels. At El-Dekheila harbour it was also weakly represented, only on the 6, 10 and 11 month duration panels.

Discussion

Bryozoa are one of the predominant taxa in a variety of sub-littoral epibenthic environments, including the undersides of foliaceous corals (e.g. PALUMBI & JACKSON, 1982; WINSTON & JACKSON, 1984), rock faces (KEOUGH & DOWNES, 1982), shells (KAY & KEOUGH, 1981), boulders (RUBIN, 1982), artificial pilings (LICHTSCHEIN DE BASTIDA & BASTIDA, 1980; KAY & KEOUGH, 1981) and experimental panels (RUBIN, 1985; LOPEZ JAPPA, 1989; NANDAKUMAR & TANAKA, 1994), and since substratum availability is

often the limiting factor in sessile benthic assemblages (OSMAN, 1977), mechanisms for acquiring and holding space are fundamental for both solitary and colonial organisms (LOPEZ JAPPA, 1989).

Results of occurrence of the encrusting fouling bryozoa at the studied harbours indicated that the four species were recorded at Abu Qir and El-Dekheila harbours, and only *Watersipora subtorquata*, *Cryptosula pallasiana* and *Schizoporella errata* at the Eastern Harbour of Alexandria. KOÇAK (2007b) indicated that the numbers of encrusting bryozoan species (ascophorans) and their frequency values increased with the duration time of the panels, and some species were predominant on the long-term panels in the Aegean Sea. The most important limiting factor for bryozoan colonizing on the long-term panels at the Eastern Harbour, may be the intense settlement of colonial tunicates (*Didemnum* sp., *Symplegma viride* and *Diplosoma listerianum*) which have a maximum percentage cover of 4%, 19% and 25% of the panel area, respectively. In this harbour, the encrusting fouling bryozoa, which were quite frequent at the other harbours, were either weakly represented by a small number of colonies occupying limited space, or completely absent, like *Conopeum reticulum*. This agrees with KOÇAK (2007b) who concluded that the intense settlement of colonial tunicates is the most important and limiting factor for bryozoan colonizing at some marinas in the Aegean Sea.

Conopeum reticulum was absent from the Levantine Sea, including the coasts of Israel (POWELL, 1969; HONDT, 1988), Lebanon (BITAR & BITAR, 2001), Turkey (ÜNSAL & HONDT, 1978-1979; KOÇAK, 2007a, b) and Cyprus (KOÇAK *et al.*, 2002); but recorded in France and

the western Mediterranean (PRENANT & BOBIN, 1966; ZABALA & MALUQUER, 1988). Its occurrence in the eastern Mediterranean may be attributed to passive introduction amongst fouling communities on ships. RYLAND (1965) indicated that *Conopeum reticulum* occurs in the sea and at river mouths, where salinities may be very low. This species is well represented on the long-term panels at El-Dekheila harbour, covering about 85% and 77.5% of the panel area after 10 and 11 months of immersion, respectively. At El-Dekheila Harbour the salinity ranged between 21.9 and 38.2 ‰ with a monthly average of 29.8 ‰ while, at Abu Qir Harbour the salinity varied from 31.1 to 38.9 ‰, with a monthly average of 37.5 ‰. Monthly values of salinity at the Eastern Harbour fluctuate over a very limited range, with a monthly average of 36.9 ‰ (RAMADAN *et al.*, 2006). So, salinity may favor the higher representation of this species at El-Dekheila Harbour.

At Abu Qir Harbour, *Schizoporella errata* was well represented on long-term panels mainly on the 6 and 7 month duration panels, covering about 42% and 35% of the panel area, respectively. During these two periods, the erect bryozoan *Bugula neritina* was well represented giving rise to 90 and 78 colonies, respectively. COCITO *et al* (2000) indicated that *Scrupocellaria reptans* and *Bugula neritina* occurred in dense clumps of many colonies on the external surface of the build-ups of *Schizoporella errata* at Lerici Harbour, Italy, where *Schizoporella errata* grew close to a sewer drain. Abu Qir Harbour represents a eutrophic polluted harbour, with the highest concentrations of nitrate, ammonia, total phosphorus, copper and cadmium (RAMADAN *et al.*, 2006).

All the species described in this paper have previously been reported from other areas outside the Levantine Sea. It is therefore important to update the taxonomical data regarding these species on the Egyptian coast and in the Levantine Sea.

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