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Recent Brachiopoda of the Marine Protected Area "Secche di Tor Paterno", Central Tyrrhenian Sea

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Abstract: The Brachiopoda of the infralittoral substrates of the Marine Protected Area "Secche di Tor Paterno", Central Tyrrhenian Sea, are described and illustrated. Four species are reported: *Novocrania anomala*, *Megathiris detruncata*, *Argyrotheca cuneata* and *Joania cordata*. The diversity is lower than the potential infralittoral Mediterranean brachiopod fauna, but further explorations of the reefs may increase the number of species. Most specimens were found as empty shells in the sediments. *A. cuneata* and *J. cordata* are the most abundant species (96.6% of the total examined material) thus indicating that the reef is a suitable environment for both species. A few live specimens of both species were found in the coralligenous and in the *Posidonia* rhizomes (only *J. cordata*). The occurrence of brachiopods in the *Posidonia* rhizomes is poorly documented in literature. Moreover, in this habitat, one specimen of *J. cordata* was found attached to a live *Muricopsis aradasii* (Gastropoda, Muricidae), thus representing an interesting case of phoresis.

Résumé : *Brachiopodes de l'Aire Marine Protégée "Secche di Tor Paterno", Mer tyrrhénienne centrale.* Les Brachiopodes de l'infralittoral de l'aire marine protégée de "Secche di Tor Paterno", Mer Tyrrhénienne centrale sont décrits et illustrés. Quatre espèces sont signalées : *Novocrania anomala*, *Megathiris detruncata*, *Argyrotheca cuneata* et *Joania cordata.* La diversité des Brachiopodes rencontrée est faible comparée à la richesse potentielle de l'infralittoral méditerranéen, mais de futures récoltes pourraient augmenter le nombre d'espèces. La plupart des espèces ont été récoltées sous forme de coquilles vides dans le sédiment. *A. cuneata* et *J. cordata* sont les deux espèces les plus abondantes (96,6% du total des échantillons) indiquant que ce milieu leur est très favorable. Quelques spécimens vivants des deux espèces ont été récoltés dans le coralligène, alors que seul *J. cordata* se rencontre dans les rhizomes de posidonies. La présence de Brachiopodes dans les rhizomes de Posidonies a été peu documentée dans la littérature. Dans ce même environnement, nous avons recueilli un spécimen de *J. cordata* attaché à un *Muricopsis aradasii* (Gastropoda : Muricidae), montrant un cas intéressant de phorésie.

Keywords: Brachiopoda ● Secche di Tor Paterno ● Tyrrhenian Sea ● *Posidonia oceanica* ● Coralligenous ● Phoresis

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Introduction

The Marine Protected Area "Secche di Tor Paterno" lies in the Central Tyrrhenian Sea, off the coasts of Lazio (Fig. 1). It is an off-shore reef 12 nautical miles off the coast. This kind of reefs are rocky outcrops in the sedimentary substrate which generally host rich assemblages of the coralligenous biocenosis, detritic pools and other biocoenoses depending on their depth. The top of the reef is at 18 m, its maximum depth is around 70 m where muddy substrate is found.

This area is of great conservation interest for several reasons. First, it is the only Italian marine protected area totally off-shore, without any coastal zone. It is therefore a peculiar conservation experiment and its fauna and biology may be representatives of other off-shore reefs which do not enjoy any kind of protection. Secondly, it hosts two important benthic biocoenoses: the coralligenous and *Posidonia* meadows. The former are calcareous formations of biogenic origin typical of Mediterranean benthic environments, produced by the accumulation of encrusting algae growing in dim light conditions which host several associations and facies. This habitat is considered important for conservation by the Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean of the Barcelona Convention. Relini (2002) considers most of the associations and facies of the coralligenous Mediterranean substrates remarkable or extremely important for conservation purposes. The latter consists in meadows of the endemic Mediterranean seagrass *Posidonia oceanica* (Linnaeus) Delile, 1813. It is a habitat enlisted in Annex I of the Council Directive 92/43/EEC "on the conservation of natural habitats and of wild fauna and flora" of the European Union. Annex I lists the "natural habitat types of Community interest whose conservation requires the designation of special areas of conservation". Moreover, *Posidonia* beds (*Posidonion oceanicae*) (code 1120) are marked as priority habitats for conservation. Due to this presence, the Marine Protected Area "Secche di Tor Paterno" is a site of Community importance of the Natura 2000 network (code IT6000010). The site is 27 hectares, with a maximum depth of 25 m (lower depth at which *Posidonia* patches are found) and its *Posidonia* cover is extimated at 5% (Ministero dell'Ambiente e della Tutela del Territorio, 2002). *Posidonia* rarely occurs as a meadow *sensu stricto*: it is more often present as patches in the coralligenous substrate. Small meadows occur where a large enough sedimentary area is present.

Last, but not least, the brachiopod fauna of the area has never been studied. A study of the benthic biocoenoses was carried out at the beginning of the '90s (Università La

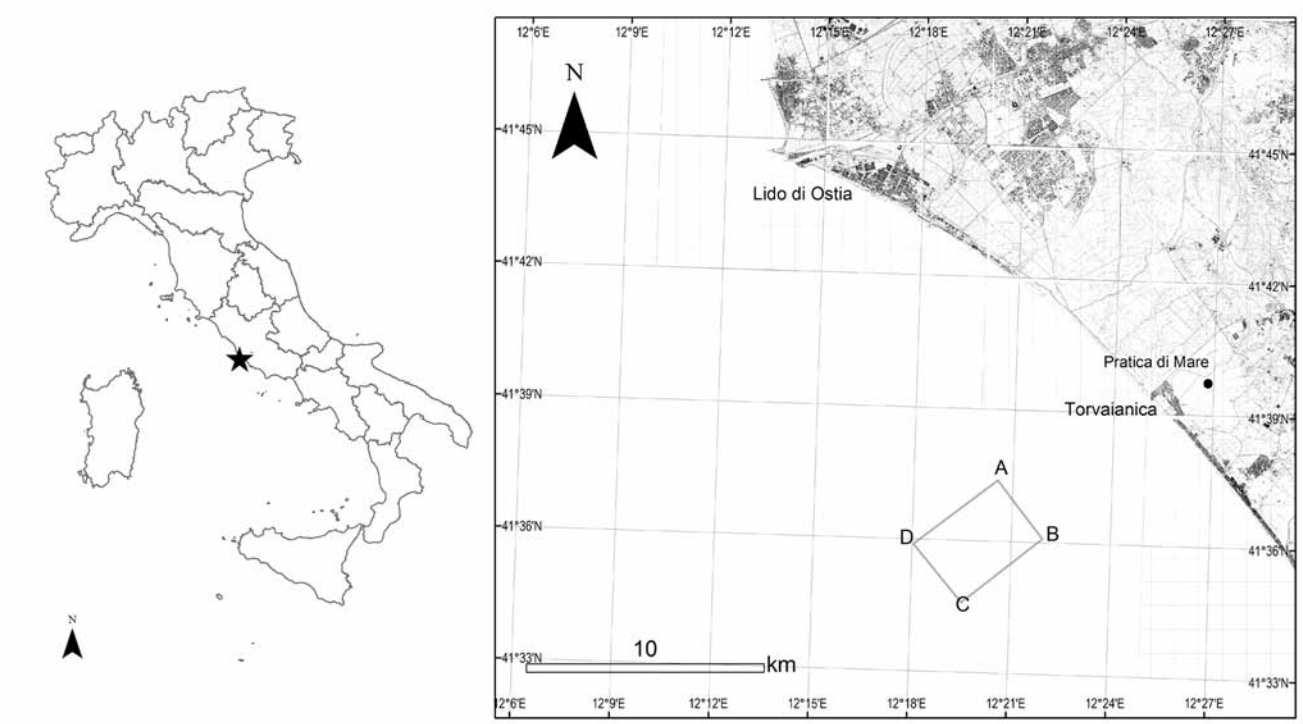

Figure 1. Location of the Marine Protected Area "Secche di Tor Paterno" (polygon A-B-C-D) in the Central Tyrrhenian Sea.
Figure 1. Localisation de l'aire marine protégée de "Secche di Tor Paterno" (polygone A-B-C-D), Mer Tyrrhénienne centrale.

Table 1. Station list, Marine Protected Area "Secche di Tor Paterno", Central Tyrrhenian Sea, Italy
Tableau 1. Liste des stations, Aire Marine Protégée de "Secche di Tor Paterno" Mer Tyrrhénienne centrale, Italie

Samples	Latitude	Longitude	Biocoenosis	Habitat details	Depth	Sampling method	Date [dd/mm/yyyy]
S1 S2 S3	41°36'21"N	12°20'28"E	Coralligenous	Horizontal hard substrate with *Eunicella* spp.	25 m	Suction sampler	21/05/2007
S4 S5 S6	41°36'18"N	12°20'30"E	Coralligenous	Vertical wall with *Eunicella* spp. and *Paramuricea clavata*	27 m	Suction sampler	25/05/2007
S7 S8 S9	41°36'18"N	12°20'30"E	Coralligenous	Horizontal hard substrate with *Eunicella* spp.	25 m	Suction sampler	25/05/2007
S10 S11 S12	41°36'15"N	12°20'29"E	Coralligenous	Horizontal hard substrate with *Eunicella* spp.	26 m	Suction sampler	07/06/2007
S13 S14 S15	41°36'15"N	12°20'29"E	Detritic	Detritic pools in coralligenous substrate	28 m	Suction sampler	07/06/2007
S16 S17 S22	41°36'13"N	12°20'30"E	Coralligenous	Horizontal hard substrate with rare *Eunicella* spp.	20 m	Suction sampler	20/06/2007
S18 S19 S20 S21	41°36'07"N	12°20'20"E	Coralligenous	Horizontal hard substrate with *Eunicella* spp.	25 m	Suction sampler	21/06/2007
SP1 SP2 SP3	41°36'21"N	12°20'28"E	*Posidonia oceanica*	*Posidonia* patches on hard substrate – rhizome layer	26 m	Suction sampler	08/06/2007
SP4 SP5 SP6	41°36'13"N	12°20'30"E	*Posidonia oceanica*	*Posidonia* field on soft substrate – rhizome layer	26 m	Suction sampler	20/06/2007
D1 Organogenous sediment	41°36'13"N	12°20'30"E	*Posidonia oceanica*	Organogenous sediment nearby small *Posidonia* meadow	25 m	Hand collected	20/06/2007
D2 Organogenous sediment	41°36'18"N	12°20'30"E	Coralligenous	Organogenous sediment at the base of a wall with *Eunicella* spp. and *Paramuricea clavata*	27m	Hand collected	07/06/2007

Sapienza, 1993) but it did not cover Brachiopoda at all. Other works on Mediterranean Brachiopoda have a wider view (Logan, 1979; Logan & Zibrowius, 1994; Logan et al., 2004) or cover different geographic areas (Brunton, 1988; Logan, 2003; Logan & Noble, 1983; Logan et al., 2002; Palazzi & Villari, 2001; Taddei Ruggiero, 1985, 1987, 1994 & 2001; Simon & Willems, 1999).

We feel that every component of the communities in a protected area should be properly studied and described as a coherent action with the conservation effort. The aim of this work is to give a first glance of the diversity of the brachiopod fauna of the Marine Protected Area "Secche di Tor Paterno".

Material and Methods

In May and June 2007 an intensive sampling effort on the benthic biocoenoses was carried out. Coralligenous, *Posidonia* meadows and patches (both foliar and rhizome strata) and detritic pools were investigated in a project to study the molluscan biodiversity of the Area. Several other phyla were collected in this way and here we present the results about Brachiopoda.

Samplings which collected Brachiopoda have been carried out by diver-operated airlift suction samplers. The airlift consisted of PVC tube of a minimum length of 120 cm and of 6.5 cm diameter, with a scuba cylinder supplying air, fitted 10 cm above the mouth of the tube. The other end of the tube was affixed to a 0.5 mm mesh nylon bag that could be removed, closed and replaced underwater.

Airlift suction sampling was used on coralligenous, on the rhizome layer of *Posidonia* and in detritic pools. These latter samples and sediment samples collected by hand offered a wealth of dead specimens, often in good condition, which helped us have a more complete view of the brachiopod fauna of the area. *Novocrania anomala* (Müller, 1776), for example, was found only in this way since the cemented ventral valve cannot be collected by suction sampling.

Samples have been sieved and the

coarsest part has been often discarded in the field. This means we may have missed some live specimens. However, the number of dead specimens found (almost 1,500 specimens and valves) make us confident we have a complete overview of the species living in the sampled biocoenoses. The few specimens collected live were preserved in ethanol 99%.

Specimens were measured using an ocular micrometer. Length, width and thickness were recorded for complete specimens as defined by Williams et al. (1997). In these cases dimensions are those of the ventral valve which is usually the biggest. Dead specimens were photographed with Scanning Electron Microscope after ultra-sound cleaning and gold coating. Live collected specimens were photographed with a digital camera mounted on a stereomicroscope.

A list of stations with details about location, habitat, depth and collecting method is given in Table 1. A quantitative list of the material studied is given in Table 2. All studied material is housed in the Zoological Museum of the University of Bologna, Italy.

Results

The taxonomy follows the check-list of Italian marine species (Emig, 2010). A detailed list of specimens found for each station with the indication of the biocoenosis is in Table 2.

Subphylum CRANIIFORMEA Popov, Bassett, Holmer & Laurie, 1993

Class CRANIATA Williams, Carlson, Brunton, Holmer & Popov, 1996

Order CRANIIDA Waagen, 1885
Family CRANIIDAE Menke, 1828
Genus *Novocrania* Lee & Brunton, 2001

Novocrania anomala (Müller, 1776)
(Fig. 2A-B)

Material examined

38 dorsal valves.

Size

The studied specimens range in length from 2.5 to 8.8 mm and in width from 2.9 to 9 mm.

Remarks

Novocrania anomala is little represented in the studied material, probably because the sampling method was not adequate for this species. This species and the very similar congeneric species *Novocrania turbinata* (Poli, 1795) are the only inarticulate brachiopods in the Mediterranean Sea (Logan et al., 2004). Externally these two species are very similar but they can be distinguished internally due to the morphology of the muscle scars on the inner surface of the dorsal valve. *N. turbinata* has generally darker brachial protractor muscle scars, more prominent and elevated anterior adductor muscle scars and, most important, brachial retractor muscle scars not separated from those of the adductor muscles. These differences, in particular the latter, made us assign all the dorsal valves to *N. anomala*, as all of them have the scars of the two retractor muscles completely separated from the ones of the two anterior adductor muscles. Specimens found in our study area tend to be generally smaller than reported in literature since Logan (1979) records specimens width up to 15 mm.

Table 2. Examined material. Abbreviations: **L**, living specimens; **D**, dead shells; **DV**, dorsal valve; **VV**, ventral valve.
Tableau 2. Répartition des spécimens récoltés par station. Abréviations : **L**, spécimens vivants ; **D**, coquilles mortes ; **DV**, valve dorsale ; **VV**, valve ventrale.

Samples	*Novocrania anomala* (Muller, 1776)				*Megathiris detruncata* (Gmelin, 1790)				*Joania cordata* (Risso, 1826)				*Argyrotheca cuneata* (Risso, 1826)			
	L	**D**	**DV**	**VV**	**L**	**D**	**DV**	**VV**	**L**	**D**	**DV**	**VV**	**L**	**D**	**DV**	**VV**
Coralligenous	0	0	33	0	0	2	0	1	1	103	29	30	3	90	22	16
***Posidonia* rhizomes**	0	0	0	0	0	1	0	0	7	73	17	30	0	20	5	6
Detritic bottoms	0	0	5	0	0	6	1	1	0	455	9	13	0	330	9	10
Organogenous	0	0	0	0	0	0	0	0	0	99	7	7	0	38	2	4
TOTAL			**38**			**9**	**1**	**2**	**8**	**730**	**62**	**80**	**3**	**478**	**38**	**36**
			38			**9**		**3**		**738**		**142**		**481**		**74**

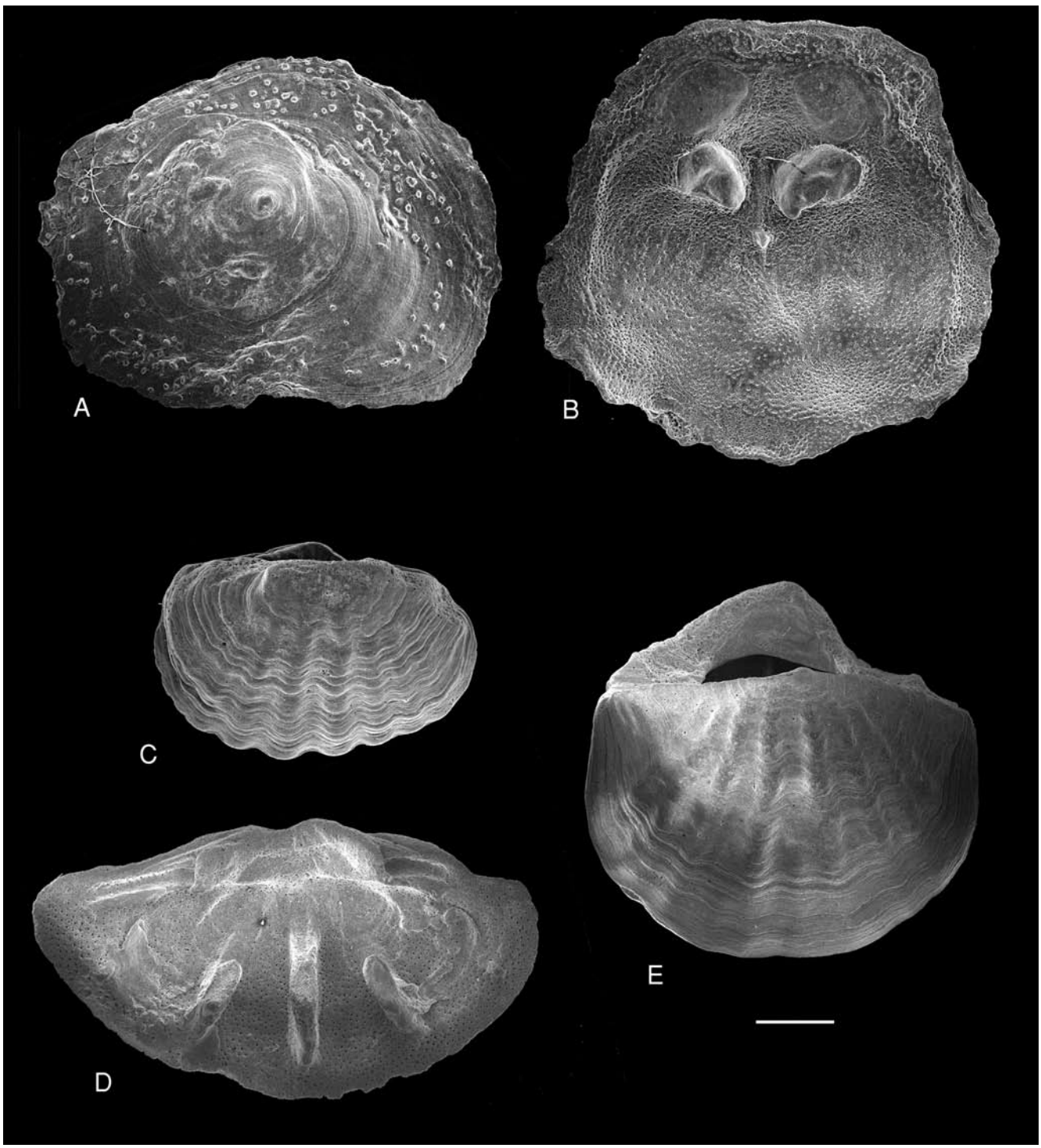

Figure 2. SEM photographs. **A & B.** Dorsal valve of *Novocrania anomala*. **C, D & E.** Complete specimens of *Megathiris detruncata*. Scale bar 1 mm.

Figure 2. Images MEB. **A & B.** Vues de la valve dorsale de *Novocrania anomala*. **C, D & E.** Spécimens complets de *Megathiris detruncata*. Barre d'échelle 1 mm.

Subphylum RHYNCHONELLIFORMEA Williams, Carlson, Brunton, Holmer & Popov, 1996

Class RHYNCHONELLATA Williams, Carlson, Brunton, Holmer & Popov, 1996
Order TEREBRATULIDA Waagen, 1883
Family MEGATHYRIDIDAE Dall, 1870
Genus *Megathiris* d'Orbigny, 1847

Megathiris detruncata (Gmelin, 1790)
(Fig. 2C-E)

Material examined

9 complete specimens and 3 valves.

Size

The studied specimens range in length from 1.8 to 6.7 mm and in width from 2.4 to 7.6 mm. Thickness ranges from 2.2 to 2.5 mm.

Remarks

Megathiris detruncata is widespread in the Mediterranean Sea and in the North-Eastern Atlantic (Logan, 1979). Nevertheless it is very rare in the examined material, as only 9 complete specimens and 3 valves were obtained from 6 stations.

Externally *M. detruncata* is closely related to the species of the genus *Argyrotheca* but it differs in having a larger maximum size, a thicker shell, greater convexity and more numerous and narrow costae. In particular *M. detruncata* is very similar to *Argyrotheca cuneata* (Risso, 1826) having the same outline, hinge line, foramen and profile. Nevertheless it differs, at first sight, from the latter species in lacking the red-pink intercostal coloration, typical of *A. cuneata*. Moreover, *M. detruncata* can be immediately distinguished from *A. cuneata* by its internal features, in particular the number of median septa on dorsal valve: while *A. cuneata* has only one median septum, *M. detruncata* has three median septa, one central and two lateral (Fig. 2 D). The studied specimens never have costae bifurcating near the anterior margin as occasionally reported by Logan (2003) for recent Adriatic Sea specimens.

Genus *Joania* Alvarez, Brunton & Long, 2008
Joania cordata (Risso, 1826)
(Figs 3 A-D & 4B-G)

Material examined

8 living specimens, 730 complete empty specimens and 142 valves.

Size

The studied specimens range in length from 1.0 to 3.5 mm and in width from 1 to 3.5 mm. Thickness ranges from 0.3 to 1.9 mm.

Remarks

Joania cordata is an articulate species which is widely distributed in the Mediterranean basin and in the North-Eastern Atlantic, where it is often associated with the species *Argyrotheca cuneata* (Risso, 1826) and *Argyrotheca cistellula* (Searles-Wood, 1841). *J. cordata* is easily recognizable for its translucent shell, a very shallow sulcus on each valve, a typical elongate to heart-shaped outline, and submarginal tubercles on the inner surface of both valves (Fig. 3B-D). *J. cordata* is one of the most common articulate brachiopods in the Mediterranean Sea (Logan, 1979) and it is the most common species in the studied material too. The species is variable in shape and ornamentation. The ribless variety cited by Logan (1979) occurs here in a few specimens which are usually larger and more elongate than the typical form.

Some live specimens have been found in our samples. One from coralligenous (sample S19) and 7 from *Posidonia* rhizomes. This relative abundance in the *Posidonia* rhizomes does not have much significance because it is probably caused by the efficiency of the air-lift suction sampler in the rhizomes where it manages to catch small shells or rhizome fibres where brachiopods settle (Fig. 4B). The species is probably abundant in the coralligenous too, but the vacuum pump does not easily collect hard objects bigger than a few centimeters where the species may settle too. However, the presence of brachiopods in the rhizome layer of *Posidonia oceanica* is poorly documented. They are generally reported attached to boulders and cave walls. The rhizome layer, however, represents a peculiar habitat which has some similarities with deeper water environments having low light conditions, numerous hard objects to settle and being a low energy environment which may facilitate larval settlement.

In the rhizomes of *Posidonia* we found a striking specimen attached to the suture of the last whorl of a live *Muricopsis aradasii* (Poirier, 1883) (Gastropoda, Muricidae), an active predator which is expected to be a rather mobile species wandering in its habitat looking for suitable prey (Fig. 4G). The specimen has settled in the concavity between the shoulder and the spine of the last whorl of the muricid. When the muricid finds a prey like a bivalve it is supposed to prey drilling a hole in the shell like other muricids. This specimen is not in the sessile conditions typical of brachiopods, but it is in a vagile state due to the vagility of its host and therefore represents an interesting case of phoresis. This peculiar situation should

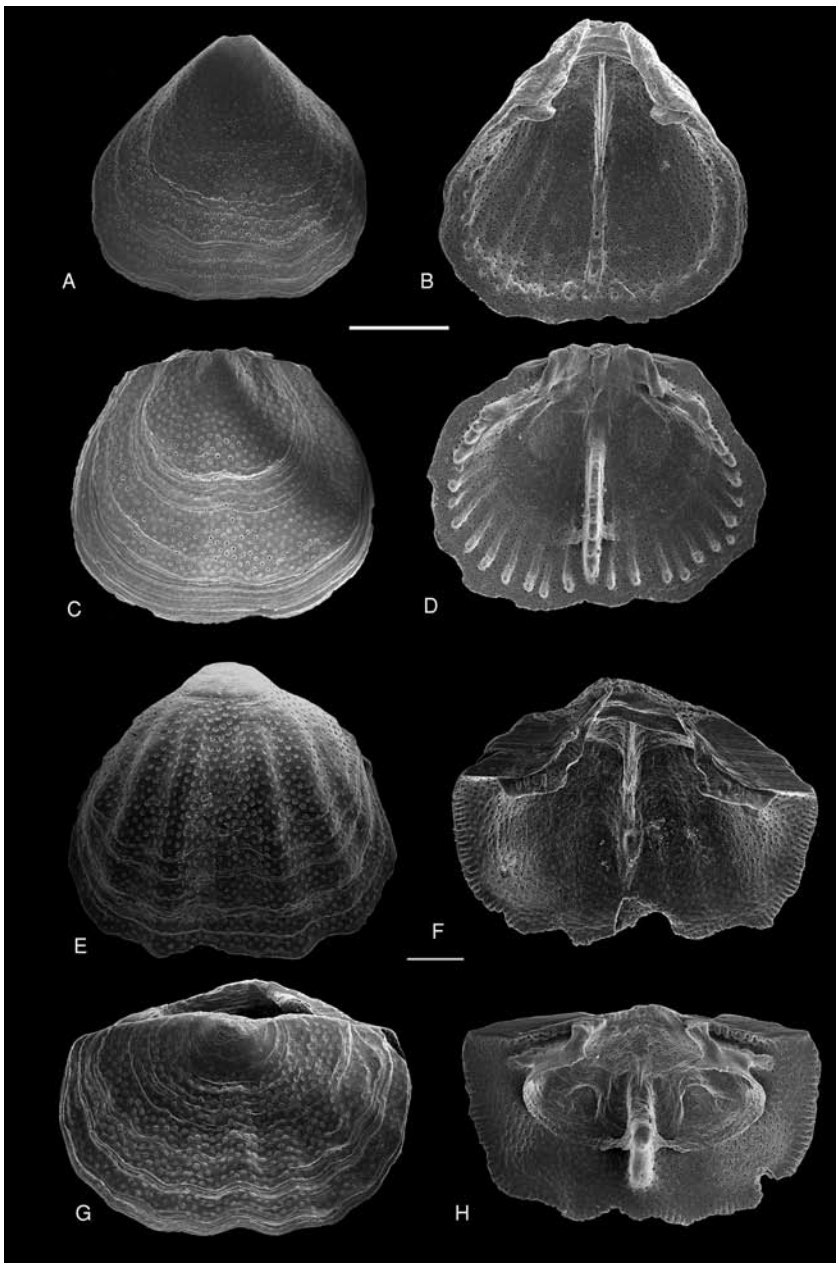

Figure 3. SEM photographs. **A, B, C & D.** *Joania cordata.* Scale bar 1 mm. **F, G, H & I.** *Argyrotheca cuneata*. Scale bar 0.5 mm.

Figure 3. Images MEB. **A, B, C & D.** *Joania cordata.* Barre d'échelle 1 mm. **F, G, H & I.** *Argyrotheca cuneata*. Barre d'échelle 0,5 mm.

affect the ability of *J. cordata* to supply food since the water current conditions are therefore independent from the place of settlement, but strictly dependent on the movements of the *Muricopsis*.

According to the frequence of dead specimens in the different biocoenoses sediments, the species is well represented both in the *Posidonia* rhizomes (104 specimens) and in the coralligenous (80 specimens).

Genus *Argyrotheca* Dall, 1900
Argyrotheca cuneata (Risso, 1826)
(Figs 3E-H & 4A)

Material examined

3 living specimens, 478 complete empty specimens and 74 valves.

Size

The studied specimens range in length from 1.0 to 3.7 mm and in width from 1.3 to 3.8 mm. Thickness ranges from 0.5 to 2.5 mm.

Remarks

Argyrotheca cuneata is very common in the Mediterranean Sea (Logan, 1979) and is well represented in the studied material too. *A. cuneata* is usually characterized by its typical red-pink wash between the costae which can run all the along the intercostal spaces or just near the anterior margin. A rare variation bears no red-pink coloration (Logan, 1979) which has been found in Secche di Tor Paterno.

Three live specimen have been found in coralligenous samples (S1, S8, S20) (Fig. 4A). According to the frequence of dead specimens in the different biocoenoses sediments, the species is poorly represented in the *Posidonia* rhizomes (20 specimens) while well represented in the coralligenous (93 specimens).

Discussion

Sampled fauna versus potential fauna

The Mediterranean brachiopod fauna is composed by 14 species living in different bio-depth zones (Logan et al., 2004). Eight species live in the infralittoral: *Novocrania anomala* (Müller, 1776), *Tethyrhynchia mediterranea* (Logan, 1994), *Argyrotheca cistellula* (Searles-Wood, 1841), *Argyrotheca cuneata* (Risso, 1826), *Joania cordata* (Risso, 1826), *Megathiris detruncata* (Gmelin, 1790), *Megerlia truncata* (Linnaeus, 1767) (which is more typical of the bathyal zone) and *Lacazella mediterranea* (Risso, 1826) and constitute the

Figure 4. Live collected or *in situ* specimens of *Argyrotheca cuneata* and *Joania cordata*. **A.** Live collected *A. cuneata* attached to a coralligenous concretion, length 2.9 mm. **B.** Live collected *J. cordata* on concretions found in the rhizome layer of *Posidonia oceanica* patches, length 2.3 mm. **C.** Live collected *J. cordata* on concretions found in the rhizome layer of *Posidonia oceanica* patches, length 2.3 mm. **D.** Dead *J. cordata* within a dead valve of *Nucula* sp. (Bivalvia, Nuculidae) collected in the rhizome layer of *Posidonia oceanica* patches, length 1.9 mm. **E.** Live collected *J. cordata* on a dead specimen of the same species, rhizome layer of *Posidonia oceanica* patches, length 2.9 mm. **F.** Live collected *J. cordata* found in the rhizome layer of *Posidonia oceanica* patches, length 2.2 mm, note the lophophore visible in transparency. **G.** Live collected *J. cordata* on *Muricopsis aradasii* (Gastropoda, Muricidae) found in the rhizome layer of *Posidonia oceanica* patches, height of *Muricopsis* 5 mm *circa*.

Figure 4. Spécimens vivants collectés *in situ* de *Argyrotheca cuneata* and *Joania cordata*. **A.** *A. cuneata* attaché à une concrétion coralligène, longueur 2,9 mm. **B.** *J. cordata* sur concrétion, trouvé dans les taches de rhizomes à *Posidonia oceanica,* longueur 2,3 mm. **C.** *J. cordata* sur concrétion, trouvé dans les taches de rhizomes à *Posidonia oceanica,* longueur 2,3 mm. **D.** *J. cordata* mort dans une valve isolée de *Nucula* sp. (Bivalvia, Nuculidae), récolté dans une tache de rhizomes à *Posidonia oceanica,* longueur 1,9 mm. **E.** *J. cordata* vivant, récolté sur un spécimen mort de la même espèce dans une tache de rhizomes à *Posidonia oceanica,* longueur 2,9 mm. **F.** *J. cordata* vivant, récolté dans une tache de rhizomes à *Posidonia oceanica,* longueur 2,2 mm, lophophore visible par transparence. **G.** *J. cordata* vivant sur *Muricopsis aradasii* (Gastropoda, Muricidae), trouvé dans une tache de rhizomes à *Posidonia oceanica,* hauteur du *Muricopsis*, environ 5 mm.

potential fauna of the central Tyrrhenian Sea, with the possible exception of the latter which is at present reported from the South-Western Mediterranean only.

Gwynia capsula (Jeffreys, 1859) is an infralittoral species but is reported from the Adriatic Sea only. *Novocrania turbinata* (Poli, 1776) is more typical of the Eastern Mediterranean. Therefore both are not considered part of the potential fauna. Four brachiopod species (one inarticulate and three articulated) belonging to four genera have been identified in our collection from the Marine Protected Area "Secche di Tor Paterno": *Novocrania anomala*, *Megathiris detruncata*, *Argyrotheca cuneata* and *Joania cordata.* Despite attention given to the very fine fraction of the samples, the micromorphic species *Argyrotheca cistellula* or *Tethyrhynchia mediterranea* have not been found.

The diversity of the fauna is lower than the potential number of infralittoral species. Further exploration of the reefs may increase the number of species, especially sampling at greater depths or where the reefs meet the surrounding muddy substrates and a few deep water caves are reported.

Argyrotheca cuneata and *Joania cordata* have been found alive and probably many more live specimens could be found if the sampling and sorting techniques were more effective for this *phylum* (e.g.: brushing of hard objects, sampling and later lab analysis of boulders, …). *Novocrania anomala* was not found alive, probably because the cemented ventral valve cannot be collected by suction sampling and rocks bigger than a few centimetres are not caught by this technique. The lack of live specimens of *Megathiris detruncata* may be due to its rarity in the reefs since only 9 complete specimens and 3 valves have been found. This is consistent with the depth distribution of the species, which begins its range at about 27 m, and with the hypothesis of competition with *Argyrotheca cuneata* and *Joania cordata* (Pajaud, 1974).

Ecology

Dead brachiopods were found in 21 of the 28 stations sampled by airlift suction sampler and in all the sediment samples. The high number of specimens found show the reefs are a suitable environment for this phylum, probably because of the many cryptic micro-habitats they host.

All the four species encountered in our survey are associated to the coralligenous and often live attached to boulders and rocks, especially in the interstices of this biocoenosis which constitutes a low energy habitat suitable for larval settlement. *Argyrotheca cuneata* and *Joania cordata* are strongly dominant in our sediment samples. They account for the 96.6% of specimens. *J. cordata* is the most abundant with the 59.3% while *A. cuneata* accounts for the 37.4%.

Joania cordata has been found alive in the rhizome layer of *Posidonia oceanica* patches and meadows. Here it probably finds a suitable low-energy habitat similar to the coralligenous with the exception it may be subject to greater sedimentation due to the reduced hydrodinamism effect of the foliar layer. Sediments may interfere with the functionality of the lophophore. In this habitat *J. cordata* was found attached to small concretions (Fig. 4B-C) of the rhizomes, to shells (Fig. 4D-G) and even to other brachiopod shells (Fig. 4E). The most striking finding is however the specimen found attached to a live *Muricopsis aradasii* (Gastropoda, Muricidae). Since this specimen lost its sessile habit and became a vagile specimen it may be considered a peculiar case of phoresis. *J. cordata* has been found alive in the more typical coralligenous biocenosis too. *Argyrotheca cuneata* has been found alive in the coralligenous attached to concretions (Fig. 4A) as expected for this species and it has not been found in the *Posidonia* rhizomes.

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