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MONOGRAPH

The long journey of *Fusinus rostratus* (Olivi, 1792) (Gastropoda Fasciolariidae) from Portugal coasts to Venice Lagoon

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ABSTRACT In the present paper the following morpha of *Fusinus rostratus* (Olivi, 1792) (Gastropoda Fasciolariidae) were investigated: Atlantic, Central and Southern Tyrrhenian Sea, Egadi Islands and the Sicilian Channel, Coasts of North Africa, the Central Adriatic Sea, Upper Adriatic Sea and the Venice Lagoon. Each of these morpha shows such morphological characteristics to be easily separated from the others. It is interesting to observe that the morphotype from the coast of Portugal is by far morphologically the closest to that from Northern Adriatic. A feature common to all the described morphotypes, is the presence of secondary cords, regularly spaced between the primary ones. The aim of this study is to split this species by geographical areas in order to facilitate further studies.

KEY WORDS *Fusinus rostratus*; Fasciolariidae; Mediterranean Sea; morphotipi.

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INTRODUCTION

The *Fusinus rostratus* (Olivi, 1792) (Gastropoda Fasciolariidae) is a species distributed all over the Mediterranean Sea.

It is more common in the Northern and Central Adriatic and in Tyrrhenian Sea. It is also reported for the Atlantic Coasts, Portugal (Hidalgo, 1917; Barash & Danin, 1992), the Canary Islands (Aradas & Benoit, 1870 Poppe & Goto, 1991; Barasch & Danin, 1992). There are also records from Morocco (Pasteur-Humbert, 1962; Barasch & Danin, 1988, 1992; Ardovini & Cossignani, 2004) and Mauritania (Lozet & Dejean-Arrecgros, 1977) but these latters should be investigated; rare in the Aegean Sea with records that require a careful study (personal observation). According to Mallard & Robin (2005), *F. rostratus* is endemic to the Mediterranean Sea.

F. rostratus is an eurybates species, found in a few centimeters of water in the Lagoon of Venice (Buzzurro & Russo, 2001; Russo, 2012) to a maximum of detected depth of 823 m (D'Amico, 1912).

This species is related to soft sediments (Vio & De Min, 1994, 1996), muddy (Monterosato, 1877), debris and muddy (Coen & Vatova, 1932), debris and muddy-sandy (Vatova, 1943), muddy-sandy (Vatova, 1940; Taviani, 1978).

F. rostratus also occurs in *Peyssonnelia polymorpha* facies and mäerl (Jacquotte, 1962; Ledoyer, 1969). It feeds on polychetes.

In the present paper the following morpha of *F. rostratus* were investigated: Atlantic, Central and Southern Tyrrhenian Sea, Egadi Islands and the Strait of Sicily, Coasts of North Africa, Central Adriatic Sea, Northern Adriatic Sea and the Venice Lagoon.

MATERIAL AND METHODS

Due to the considerable amount of available material, it was possible to select a typical range for all considered morpha. For the most part these are from residues of fishing. The following locations were selected: Atlantic: coasts of Portugal, Algarve from nets at 60 m; Central Thyrennian: Tuscan Archipelago from fishing vessels at 100/300 m; Southern Thyrennian, Pozzuoli from fishing vessels at 60 m; Strait of Sicily: Egadi Islands by fishing vessels at unknown depths; Coasts of North Africa: Algeria from creels at 60 m; Central Adriatic, Pescara from fishing vessels at 40–60 m; Northern Adriatic, Chioggia from nets for *Aequipecten opercularis* (Linnaeus, 1758) and *Pecten jacobaeus* (Linnaeus, 1758) at 25–30 m; Venice Lagoon, Pellestrina Island, harvested by hand during low tide.

SYSTEMATICS

Familia FASCIOLARIIDAE J.E. Gray, 1853
Subfamilia FUSININAE Wrigley, 1927
Genus *Fusinus* Rafinesque, 1815

Fusinus rostratus (Olivi, 1792)

Original description (Olivi, 1792): "*M. strombo di prima spezie di colore biondetto formato ad angoli, e tutto ricoperto di finissimi cordoncini, che gli girano pel traverso*. Gin. Adr. T. II. Pag. 8 tav. 7 fig. 56." (Fig.1).

A very brief description not easy to interpret. A more accurate description can be found in D'Ancona (1871): "*Conchiglia fusiforme allungata, acuminata all'apice e terminata alla base da un canale dritto, stretto, di poco più corto della spira. Questa consta di circa 9 giri convessi, carenati ad eccezione dei primi tre o quattro, divisi da una sutura molto profonda, i quali portano otto o nove coste longitudinali piuttosto grosse, rotondate, sporgenti, ristrette al loro principiare verso la sutura superiore e più larghe al loro terminare verso quella inferiore. Tutti gli anfratti sono divisi quasi nel mezzo in due porzioni pressoché uguali (la superiore sovente maggiore) da una carena rilevata, talora lamellosa e sfrangiata, producendo in tal caso in corrispondenza delle coste longitudinale delle punte molto ottuse e molto compresse dal basso all'alto, come apparisce dalla fig. 9 (a, b) della Tav. 14. Numerosi sono i solchi ed i cordoncini traversi, ravvicinati fra loro, rilevati, rugosi e leggermente ondulati, i quali gradatamente diminuendo di numero e di grossezza giungono fino alla estremità del canale. Tali cordoncini sogliono essere un poco meno grossi nella porzione superiore dei giri, e nella inferiore si osserva ordinariamente che nel solco che divide due di loro vi ha un sottile filetto. Tutta la superficie della conchiglia è resa scabra da numerosissime linee di accrescimento sottilissime che rendono quasi granulosi i cordoncini trasversali. L'apertura è piuttosto piccola, ovale; il labbro alquanto spesso, è acuto nel margine ed internamente solcato; la lamina columellare perfettamente liscia nella maggior parte dei casi si rialza sul penultimo anfratto prolungandosi in questo modo anche lungo il canale. Il quale è mediocremente lungo, stretto, dritto ed aperto.*"

In *F. rostratus* the protoconch, always paucispiral, cannot be considered a diagnostic element (Buzzurro & Russo, 2007) as highly variable depending on the population. For further clarity here are illustrated the protoconchs of all the considered morpha with the exception of specimens from Egadi Islands due to lack of intact specimens (Figs. 2–8 and Table 1). The presence of secondary cords, regularly spaced between the primary ones, is an element of diagnostic character (Fig. 9). Normally the shells are 50–60 mm up to 87 mm high (Donnarumma, 1968), reaching 95 mm (Kaicher, 1978, unverified). It counts 76 synonymies.

Algeria	914	364
Chioggia	907	392
Civitavecchia	892	478
Pescara	928	385
Portugal	735	321
Pozzuoli	714	521
Strait of Messina	642	228
Venice Lagoon	664	385

Table 1. Sizes of protoconchs and nuclei (expressed in μm) of the described morphotypes.

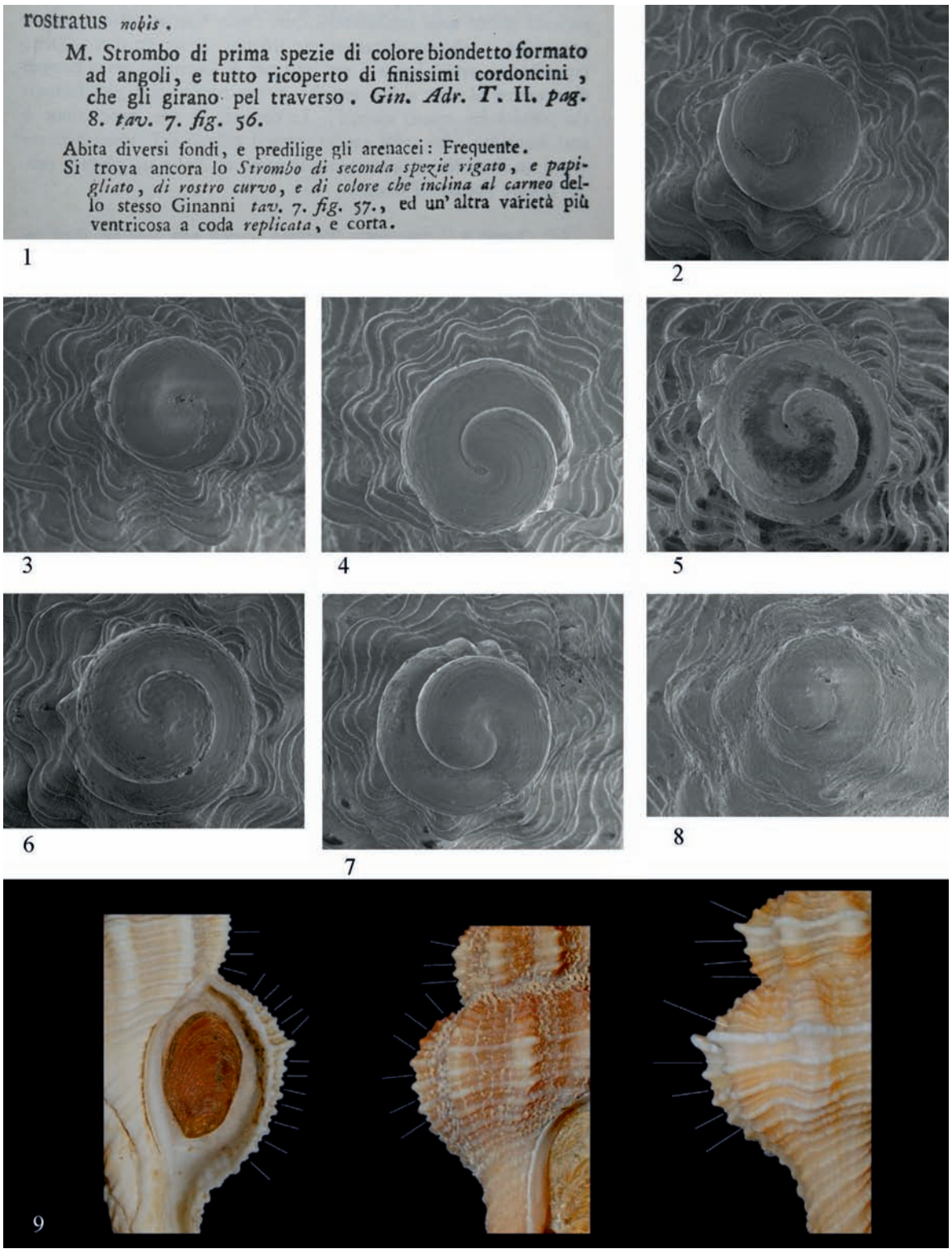


Figure 1. Original description of *Fusinus rostratus* Olivi, 1792. Figures 2–8. Protoconchs. Fig. 2: morphotype from Portugal. Fig. 3: morphotype from Southern Tyrrhenian. Fig. 4: morphotype from Central Tyrrhenian. Fig. 5: morphotype from North Africa. Fig. 6: morphotype from Central Adriatic. Fig. 7: morphotype from Northern Adriatic. Fig. 8: morphotype from Venice Lagoon. Figure 9. Secondary cords in *F. rostratus*.

Following is a summary of the main populations of the Mediterranean Sea.

COAST OF PORTUGAL (Figs. 10–12)

Medium sized
Shell rather thick and solid
Siphonal canal of medium length and slightly deviated
Teleoconch consisting of 7–7.5 whorls
Light brown or yellowish in color
Axial ribs not very prominent
Usually acarinate, sometimes the supramediane cord of the body whorl is slightly raised
Protoconch diameter 735 µm, nucleus 321µm

CENTRAL TYRRHENIAN (Figs. 13–14)

Medium sized
Shell rather light
Siphonal canal long and straight
Teleoconch consisting of 7–7.5 whorls
Milk white, sometimes with pale yellow shades
Axial ribs not very prominent, sometimes barely hinted
Spiral cords rather thin and raised
Always acarinate
Protoconch diameter 892 µm, nucleus 478 µm

SOUTHERN TYRRHENIAN (Figs. 15–17)

Small and medium sized
Shell rather light
Siphonal canal long and straight
Teleoconch consisting of 7–7.5 whorls
Reddish brown
Axial ribs not very prominent
Spiral cords rather thin and raised
Always acarinate
Protoconch diameter 714 µm, nucleus 521 µm

EGADI AND STRAIT OF SICILY (Figs. 18–19)

Medium sized
Shell rather thick
Siphonal canal long and straight
Teleoconch consisting of 6–7 whorls
Whitish with pale yellow shades
Axial ribs little prominent, barely visible in the adapical area of the body whorl
Spiral cords irregular and of discontinuous thickness
Keel very raised
It was not possible to detect the protoconch for lack of intact specimens

NORTH COAST OF AFRICA (Figs. 20–22)

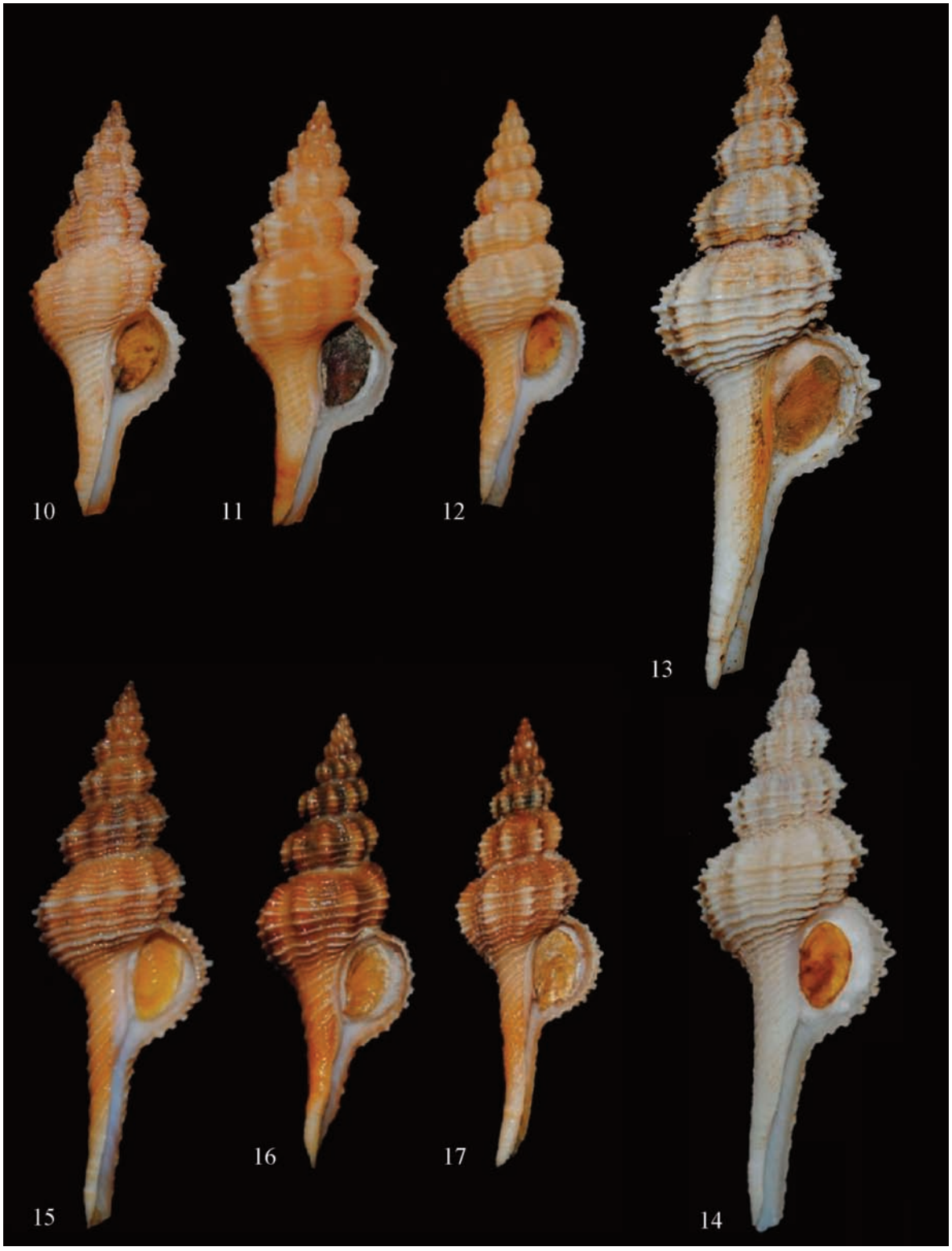
Medium sized
Shell rather thick and solid
Siphonal canal of medium length and slightly deviated to the left
Teleoconch consisting of 7 whorls
Pale yellow to light brown
Axial ribs normally rised
Spiral cords particularly evident and spaced
Generally has a rather evident keel
Presence of a rather evident columellar callus
Protoconch diameter 914 µm, nucleus 364 µm

CENTRAL ADRIATIC (Figs. 23–25)

Medium to large sized for the species
Shell thick and solid
Siphonal canal of medium length and often twisted
Teleoconch consisting of 7–7.5 whorls
Whitish in colour
Axial ribs not very raised
Spirals cords thin and of medium height
Whorls particularly inflated
Seldom a slight keel is present
Aperture particularly wide
Protoconch diameter 925 µm, nucleus 385 µm

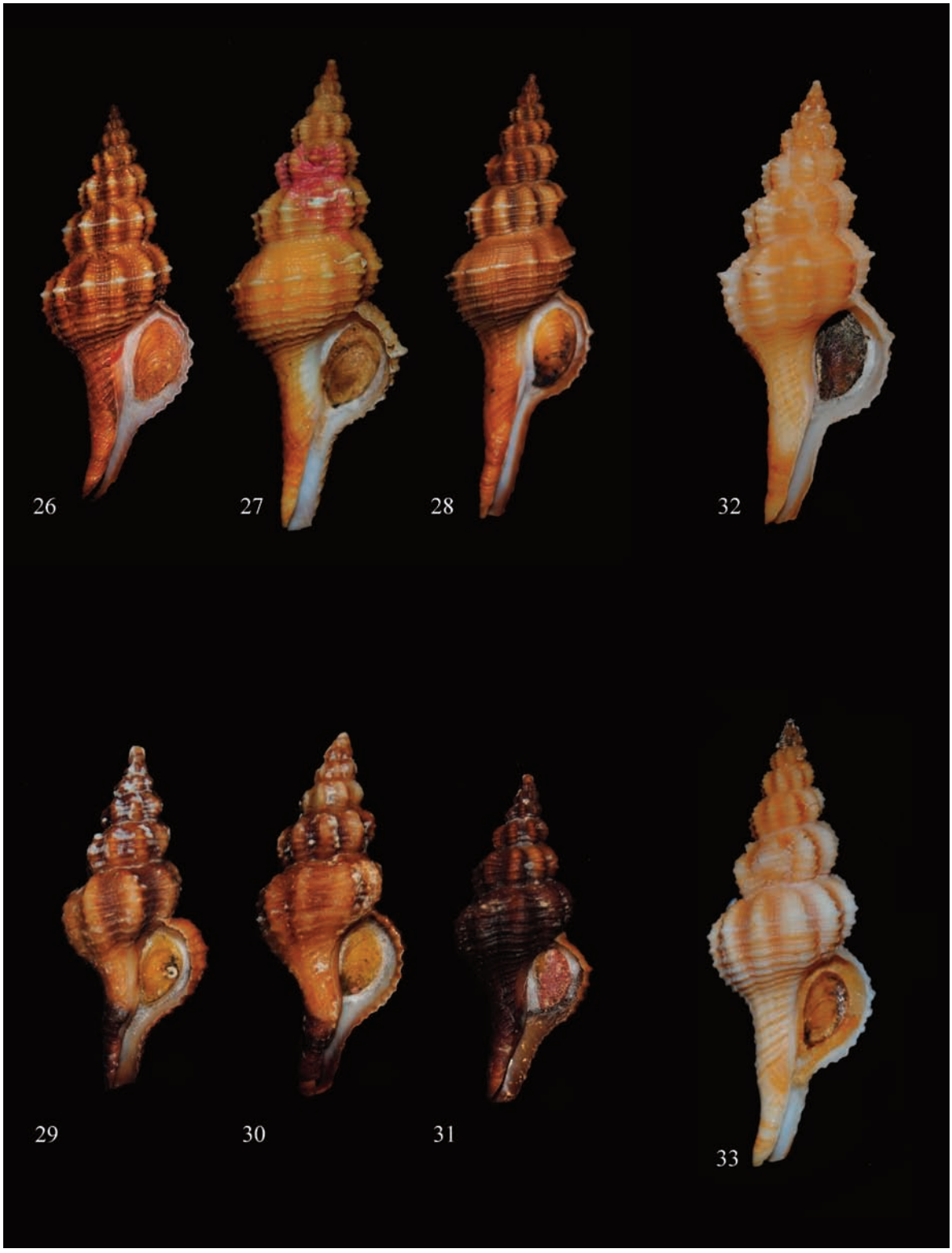
NORTHERN ADRIATIC (Figs. 26–28)

Medium sized
Shell rather thick
Siphonal canal of medium length and slightly deviated
Teleoconch consisting of 7–7.5 whorls
Deep reddish brown to pale yellow and straw-coloured
Axial ribs not very raised, sometimes lacking on the last whorl
Spirals cords thin and of medium height
Often acarinate, sometimes the supramediane cord of the last whorl slightly raised
Protoconch diameter 907 µm, nucleus 392 µm



Figures 10–12. Morphotype from Coast of Portugal. Fig. 10. h: 39.3 mm, D: 14.5 mm. Fig. 11. h: 41.4 mm, D: 17.6 mm. Fig. 12. h: 35.3 mm, D: 12.2 mm. Figures 13, 14. Morphotype from Central Tyrrhenian. Fig. 13. h: 61.6 mm, D: 21.0 mm. Fig. 14. h: 47.5 mm, D: 20.4 mm. Figures 15–17. Morphotype from Southern Tyrrhenian. Fig. 15. h: 50.5 mm, D: 16.3 mm. Fig. 16. h: 36.4 mm, D: 12.7 mm. Fig. 17. h: 37.7 mm, D: 13.3 mm.

Figures 18, 19. Morphotype from Egadi and Strait of Sicily. Fig. 18. h: 46.0 mm, D: 24.7 mm. Fig. 19. h: 44.0 mm, D: 27.6 mm. Figures 20–22. Morphotype from North coast of Africa. Fig. 20. h: 40.5 mm, D: 14.6 mm. Fig. 21. h: 34.0 mm, D: 14.2 mm. Fig. 22. h: 40.6 mm, D: 15.4 mm. Figures 23–25. Morphotype from Central Adriatic. Fig. 23. h: 57.6 mm, D: 22.0 mm; Fig. 24. h: 59.0 mm, D: 22.2 mm; Fig. 25. h: 55.8 mm, D: 21.0 mm.



Figures 26–28. Morphotype from Northern Adriatic. Fig. 26. h: 40.0 mm, D: 15.2 mm; Fig. 27. h: 41.5 mm, D: 15.7 mm. Fig. 28. h: 61.0 mm, D: 21.4 mm. Figures 29–31. Morphotype from Venice Lagoon. Fig. 29. h: 27.4 mm , D: 12.0 mm; Fig. 30, h: 28.2 mm, D: 11.4 mm; Fig. 31. h: 25.2 mm, D: 11.0 mm. Figures 32–33. Comparison among the morphotype from Portugal Coasts (Fig. 32) and that from Northern Adriatic (Fig. 33).

VENICE LAGOON (Figs. 29–31)

Small sized
Shell rather thick and almost always eroded
Siphonal canal short
Teleoconch consisting of 5–6 whorls
From dark brown to almost black in colour
Axial ribs not very raised and often eroded
Spirals cords thin and of little raised
Always acarinate
In some areas of the Venice Lagoon, during the low tide, it lives in absence of water
Protoconch diameter 664 µm, nucleus 385 µm

RESULTS AND DISCUSSION

Each of these morpha shows such morphological characteristics to be easily separated from the others, therefore, despite being *F. rostratus* a polymorphic species, it is stable within the analyzed morpha.

It is interesting to observe that the morphotype from the coast of Portugal is by far morphologically the closest to that from the Northern Adriatic (Figs. 32, 33). This may not be surprising when one considers that the Northern Adriatic lagoon environments show, for concomitant geographical, climatic and environmental factors, sub-Atlantic rather than Mediterranean characteristics (Sacchi, 1977, 1983; Bianchi, 1983; Mizzan, 1999). Among the Northern Adriatic malacofauna we can include at least two other "cold" guests as *Littorina saxatilis* (Olivi, 1792) and *Calliostoma virescens* (Coen, 1933).

A feature common to all the described morphotypes, is the presence of secondary cords, regularly spaced between the primary ones. It is believed that this element is a diagnostic character (Merle, 2001, 2005; Crocetta et al., 2012; Russo, 2013) (Fig. 9).

It can therefore be said that the alternation of (primary cords, secondary cords) is a valuable character for the determination of *F. rostratus*, or rather, the presence of this sequence, excludes other species with the exception of *F. buzzurroi* Prkic et Russo,

Morphotipo	**1**		**2**		**3**		**4**		**5**		**6**		**7**		**8**			**parametro**
	h	d	h	d	h	d	h	d	h	d	h	d	h	d	h	d	somma	media h/d
Portogallo	44.4	17.7	41.0	16.0	42.5	17.0	29.6	12.0	31.0	11.7	30.3	11.8	29.4	11.6	39.4	15.3		
h/d	2.51		2.56		2.50		2.47		2.65		2.57		2.53		2.58		20.36	**2.55**
Medio Tirreno	61.4	21.2	60.0	19.4	60.0	19.6	57.0	20.0	57.0	20.0	53.0	20.0	53.0	19.0	57.0	17.2		
h/d	2.90		3.09		3.06		2.85		2.85		2.65		2.79		3.31		23.50	**2.94**
Basso Tirreno	53.0	27.6	50.3	16.6	36.4	12.0	37.6	13.3	36.3	12.4	41.3	13.8	33.4	12.8	28.0	10.7		
h/d	1.92		3.03		3.03		2.83		2.93		2.99		2.61		2.62		21.96	**2.74**
Nord Africa	40.6	15.8	40.3	14.0	34.0	14.0	32.0	12.8	34.0	12.5	40.0	14.0	39.0	15.0	34.5	13.0		
h/d	2.57		2.88		2.43		2.50		2.72		2.86		2.60		2.65		21.21	**2.65**
Medio Adriatico	57.8	23.0	57.8	21.6	54.0	20.0	53.2	19.0	42.7	18.3	55.0	21.0	44.5	18.0	44.7	19.0		
h/d	2.51		2.68		2.70		2.80		2.33		2.62		2.47		2.35		20.47	**2.56**
Alto Adriatico	43.6	18.4	46.2	16.8	40.0	15.0	46.0	17.8	37.4	13.0	45.0	18.0	48.0	18,0	49.0	19.0		
h/d	2.37		2.75		2.67		2.58		2.88		2.50		2.67		2.58		20.99	**2.62**
Laguna di Venezia	25.0	10.6	27.4	12.0	26.0	11.2	28.2	11.9	25.0	10.8	21.5	10.0	31.0	12.3	26.8	12.0		
h/d	2.36		2.28		2.32		2.37		2.31		2.15		2.52		2.23		18.55	**2.32**

Table 2. h/D ratio of the described morphotypes.

2008 but this latter is easily distinguishable. These observations were made on a large amount of specimens from the different localities.

To confute this thesis the observations were extended also to a number of tropical species of the genus *Fusinus*, not useful to list here, confirming that the presence of secondary cords is not occasional and cannot be attributed to the single specimen: some species possess them and others do not.

From the observation of several juveniles it can be seen that for a height of 8 mm there are not yet secondary cords for 3 whorls; for a height of 14 mm and 4 whorls they appear on the body whorl; in specimens with 5–5,5 whorls they appear also in the penultimate whorl and in the larger ones with 7 whorls the secondary cords are present from the third last whorl.

This preliminary study has not dealt with the problem of a possible specific division of the different morpha of *Fusinus rostratus*. The current state of the art considers them all belonging to the same species.

The aim of this study is to split this species by geographical areas in order to facilitate further studies.

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REFERENCES

Aradas A. & L. Benoit, 1870. Conchiologia vivente marina della Sicilia e delle Isole che la circondano. Tipografico di C. Galatola, Catania, 324 pp., 5 pls.

Ardovini R. & Cossignani T., 2004. Le conchiglie dell'Africa Occidentale. L'informatore Piceno Ed., Ancona, 320 pp.

Barasch A. & Danin Z., 1988. Marine Mollusca of Rhodes. Israel Journal of Zoology, 35: 1–74.

Barasch A. & Z. Danin Z., 1992. Fauna Palestina. Mollusca I. Annotated list of Mediterranean Molluscs of Israel and Sinai. The Israel Academy of Sciences and Humanities, Jerusalem, 405 pp., figs. 1–372.

Bianchi C.N., 1983. Ecologia e distribuzione dei Policheti serpuloidei nella Laguna veneta (Adriatico Settentrionale). Atti del Museo Civico di Storia naturale di Trieste, 35: 157–172.

Buzzurro G. & Russo P., 2001. *Fusinus dalpiazi* (Coen, 1918), a controversial species. Triton, 4: 1–3,5, figs. 8–12.

Buzzurro G. & Russo P., 2007. *Fusinus* del Mediterraneo/ Mediterranean *Fusinus*. Milano, 280 pp.

Coen G.S. & Vatova A., 1932. Malacofauna Arupinensis. Thalassia, 1: 1–53.

Crocetta F., Bonomolo G., Albano P.G., Barco A., Houart R. & Oliverio M., 2012. The status of the northeastern Atlantic and Mediterranean small mussel drills of the *Ocinebrina aciculate* complex (Mollusca, Gastropoda, Muricidae), with the description of a new species. Scientia Marina doi: 10.3989.02A.

D'Amico A., 1912. I Molluschi raccolti nel Mediterraneo dalla R.N. "Washington" durante le campagne talassografiche (1881–83). Archivio Zoologico Italiano, 5: 233–279.

D'Ancona C., 1871. Malacologia pliocenica italiana. Fascicolo I. Generi *Strombus*, *Murex*, *Typhis*. Memorie del Regio Comitato Geologivo d'Italia. Vol. 1. Tip. G. Barbera, Firenze, 141 pp., pls. 1–15.

Donnarumma V., 1968. Conchiglie del Medio Adriatico. Conchiglie, 4: 5–12.

Hidalgo J.G., 1917. Fauna Malacologica de Espana, Portugal y las Baleares. Tomo 1, Introducion. Imprenta de M. Ginesta, Madrid, I-CXVII, 184 pp.

Jacquotte R., 1962. Etude des fonds de Maerle de Mediterranée. Recuil desTravaux de le Station Marine d'Endoume, 26: 141–235.

Kaicher S.D., 1978. Cart Catalogue of Word-Wide Shells. Pack n. 18. Fasciolariidae I, St Petrsburg, Florida, Kaicher.

Ledoyer M., 1969. Ecologie de la faune vagile des biotopes méditerranées accessibles en scaphander autonome (Région de Marseille principalement). IV.- Synthèse de l'étudeécologique. RecuildesTravaux de le Station Marine d'Endoume, [1968], 44: 125–295.

Lozet J.B. & Dejan-Arrecgros J., 1977. Je decouvre le coquillages. Cotes européennes et méditerranéennes. A. Leson, 173 pp.

Mallard D. & Robin A., 2005. Fasciolaridae. Muséum du Coquillages, Las Sables d' Olonne, 27 pp., pls, 1–70.

Merle D., 2001. The spiral cords and the internal denticles of the outer lip in the Muricidae: terminology and methodological comments. Novapex, 2: 69–91.

Merle D., 2005. The spiral cords of the Muricidae (Gastropoda, Neogastropoda): importance of ontogenetic and topological correspondence for delineating structural homologies. Lethaia, 38: 367–379.

Mizzan L., 1999. Le specie alloctone del Macrozzobenthos della Laguna di Venezia: il punto della situazione. Bollettino del Museo civico di Storia naturale di Venezia, 49: 145–177.

Monterosato T., 1877. Notizie sulle conchiglie della rada di Civitavecchia. Annali Museo Civico di Genova, 9: 407–428.

Olivi G., 1792. Zoologia Adriatica ossia Catalogo ragionato degli animali del golfo e delle lagune di Venezia; preceduto da una dissertazione sulla storia fisica e naturale del golfo; e accompagnato da memorie, ed osservazioni di fisica storia naturale ed economica. Bassano, X+334+XXXII pp., 9 pls.

Pasteur-Humbert C., 1962. Les molluscques marins testacés du Maroc. I. Les Gasteropodés. Travaux de l'Institut scientifique Chérifien. Série Zoologie, n 23: 245 pp.

Poppe G.T. & Goto Y., 1991. European sea shells. Vol. I (Polyplacophora, Caudofoveta, Solenogastra, Gastropoda). Verlag Christa Hemmen, 352 pp.

Prkic J. & Russo P., 2008. *Fusinus buzzurroi* (Gastropoda, Fasciolariidae), a new specie from Croatian coasts. Iberus, 26: 177–183.

Russo P., 2012. Segnalazione di una grande colonia di *Pinna nobilis* (Linnaeus, 1768) nella Laguna di Venezia. Notiziario S.I.M, 30: 31–34.

Russo P., 2013. Tre nuove specie di *Fusinus* (Gastropoda, Fasciolariidae) per il Mare Mediterraneo. Bollettino Malacologico, 49: 1–11.

Sacchi C.F., 1977. Le symposium International sur le "Problem malacologiques del le Mer Adriatique e des lagunes" organisé par la Societa Malacologica Italiana. AAtti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano, 118: 115–117.

Sacchi C.F., 1983. Il Nord Adriatico: crocevia di faune, intreccio di popoli. Atti del Museo Civico di Storia nturale di Trieste, 35: 39–64.

Taviani M., 1978. Associazioni a Molluschi pleistoceniche-attuali dragate nell'Adriatico meridionale. Bollettino di Zoologia, 45: 297–306.

Vatova A., 1940. La fauna bentonica del bacino del Pomo (Medio Adriatico). Note dell'Istituto Italo-Germanico di Biologia Marina di Rovigno d'Istria, 15: 1–12.

Vatova A., 1943. Le zoocenosi dell'Alto Adriatico presso Rovigno e loro variazioni nello spazio e nel tempo. Thalassia, 5: 1–61.

Vio E. & De Min R., 1994. I molluschi conchiferi della riserva marina di Miramare (Trieste). Bollettino della Società Adriatica di Scienze, 75: 465–482.

Vio E. & De Min R., 1996. Contributo alla conoscenza dei molluschi marini del Golfo di Trieste. Atti Museo Civico di Storia Naturale di Trieste, 47: 173–233.