

Description of a new species of the genus *Trophonopsis* Bucquoy et Dautzenberg, 1882 (Gastropoda Muricidae Pagodulinae) from the Mediterranean Sea

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ABSTRACT

Based on shell characters, a new species of the gastropod family Muricidae, *Trophonopsis sparacioi* n. sp., from Mediterranean Sea is described. Shells of the new taxon were collected from bathyal bottoms, in the Tyrrhenian Sea. The new taxon is compared with others species of the genus *Trophonopsis* Bucquoy et Dautzenberg, 1882, occurring in northeastern Atlantic and Mediterranean Sea.

KEY WORDS

Trophonopsis sparacioi n. sp.; Muricidae; Pagodulinae; Mediterranean Sea.

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INTRODUCTION

The genus *Trophonopsis* Bucquoy et Dautzenberg, 1882 has been traditionally included in the subfamily Trophoninae (Muricidae), while recently Barco et al. (2012) have included this genus in their newly erected subfamily Pagodulinae, based on clear evidence from the radular morphology.

Five Recent species of the genus *Trophonopsis* were so far recognised in northeastern Atlantic and Mediterranean Sea according to Houart (2001) and CLEMAM (Gofas & Le Renard, 2014): *T. alboranensis* (Smriglio et al., 1997) (Figs. 1–5, 39, 40), *T. barvicensis* (Johnston, 1825) (Figs. 6–10, 41, 42), *T. breviatus* (Jeffreys, 1882) (Figs. 11–15, 43, 44), *T. droueti* (Dautzenberg, 1889) and *T. muricatus* (Montagu, 1803) (Figs. 16–20, 45, 46). These taxa have been reviewed by Houart (2001), who considered *T. alboranensis* in the original genus *Houartiella* Smriglio, Mariottini et Bonfitto, 1997,

later synonymized with *Trophonopsis* by Peñas et al. (2006). In particular, two *Trophonopsis* species have an Atlantic distribution, being *T. droueti* endemic to the bathyal bottoms of the Azores (Bouchet & Warén, 1985; Houart, 2001), while *T. barvicensis*, which occurs at 50–1.000 m depth, is distributed from Morocco and the Azores, to the British Isles and West Scandinavia (Houart, 2001; Segers et al., 2009). *Trophonopsis barvicensis* was recently reported in the Mediterranean Sea from El Garraf (Spain), as a Würmian fossil, by Giribet & Penas (1997) and from the Djibuti bank (Spain), which could represent the extreme limit of its distribution into the Mediterranean, by Gofas et al. (2011). Furthermore, *T. alboranensis* and *T. breviatus* are endemic to Alboran and Black Sea, respectively (Smriglio et al., 1997; Houart, 2001; Gofas et al., 2011). *Trophonopsis breviatus* has been also recorded from Çanakkale and Bozcaada Isle, Turkey (Panayotis Ovalis, pers. comm.). Only *T. muricatus*

displays both a wide distribution, occurring in the Mediterranean and in the northeastern Atlantic up to the northern Great Britain, and a wide bathymetric range (0.5–300 m) (Rolán, 1983; Houart, 2001; Gofas et al., 2011).

Recently, we had the chance to examine shells of *Trophonopsis* from a spot located in the Tyrrhenian Sea, inhabited by rich bathyal benthic invertebrate communities (molluscan assemblages have been partially characterized in the past by Smriglio et al., 1989; Smriglio & Mariottini, 1996, 2000, 2001; Smriglio et al., 1999). After morphological comparison with the species of *Trophonopsis* occurring in northeastern Atlantic and Mediterranean, the studied shells have been regarded as belonging to a distinct, unnamed species, which is here described as new to science: *Trophonopsis sparacoi* n. sp.

ABBREVIATIONS AND ACRONYMS. The materials used for this study are deposited in the following private and Museum collections, BA: Bruno Amati collection, Rome, Italy; CS-PM: Carlo Smriglio-Paolo Mariottini collection, Rome, Italy; H: height; MO: Marco Oliverio collection, Rome, Italy; MTC: Monterosato collection; MCZR: Museum of Zoology of Rome (section collections of Malacology); MNHN: Muséum National d'Histoire Naturelle, Paris, France; MZB: Museum of Zoology Bologna (collection of the Laboratory of Malacology, University of Bologna, Italy); sh: empty shell(s); W: width.

MATERIAL AND METHODS

Samples consisted mainly of empty shells, in a few cases with dried soft parts, from CS-PM private collection and material stored in the MTC at the MCZR.

Sediment sampling was collected by fishermen trawlers from muddy-bathyal bottoms located off the coasts of Latium (Central Tyrrhenian Sea). Sediment samples were sieved through a 1 mm mesh and sorted under a stereomicroscope. Scanning Electron Microscopy (SEM) observations were carried out by a Philips XL30 at the Interdepartmental Laboratory of Electron Microscopy (LIME, University of "Roma Tre", Rome, Italy). Current systematics is based on WoRMS (2013), that for *Trophonopsis* species treated in this work is in

accordance with CLEMAM (Gofas & Le Renard, 2014). Sculpture of the teleoconch was described according to the notation of Merle (2001, 2005).

SYSTEMATICS

Family MURICIDEA Rafinesque, 1815

Subfamily Pagodulinae Barco, Schiaparelli, Houart et Oliverio, 2012

type genus *Pagodula* Monterosato, 1884 (by original designation)

Genus *Trophonopsis* Bucquoy, Dautzenberg et Dollfus, 1882

type species *Murex muricatus* Montagu, 1803 (by original designation)

Trophonopsis sparacoi n. sp.

EXAMINED MATERIAL. The type material (Figs. 21–33, 47, 48) consists of 100 shells, 27 of them with dry soft parts, from the Central Tyrrhenian Sea, off coasts of Latium, 500/600 m (41°51'N 11°28'E). Holotype, MNHN IM-2000-27897; paratype 1, MNHN IM-2000-27898; paratypes 2, MZB60093 and 3, MZB60094; paratypes 4, MCZR00222a and 5, MCZR00222b; paratypes 6 and 7, MO; paratypes 8 and 9, BA; paratypes 10–99, CS-PM.

Other examined material. *Trophonopsis alboranensis*: from CS-PM collection (Rome): paratypes "A-B-D" and 13 sh, Alboran Sea (type locality), 80–150 m; 1 sh, Alboran Island, 180 m.

Trophonopsis barvicensis: from MTC collection: 2 sh, Bergen, Norway; 2 sh, Oban, Scotland, 25 fathoms; 4 sh, Shetland, England; 3 sh, England; 42 sh, North Atlantic Ocean, 226 m; 60 sh, Palermo, Italy. From CS-PM collection (Rome): 4 sh, Aberdeen Bank (57°13'N 01°05' W), Scotland, 59–68 m.

Trophonopsis breviatus: from CS-PM collection (Rome): 2 sh Bozcaada Island, Turkey 85 m; 4 sh from Marmara Island, Marmara Sea.

Trophonopsis muricatus: from MTC collection: 2 sh, Northumberland coast, Scotland; 5 sh, England; 10 sh, Le Croisic (Saint-Nazaire), France; 4 sh, Villefranche sur Mer (Niçe), France; 2 sh, Minorca, Balears, Spain; 3 sh, Corsica; 4 sh, Sardinia, Italy; 4 sh, Positano (Naples), Italy; 3 sh, Golfo di Napoli, Italy; 1 sh, Naples, Italy; 192 sh, Palermo, Italy 1 sh, Algeria; 15 sh, Ficcarazzi

(Palermo), Italy, fossil; 3 sh, Ficarazzi (Palermo), Italy, fossil; 3 sh, Giannettilla (Caltanissetta), Italy; 3 sh, Babbaurra (Caltanissetta), Italy; 1 sh, Magnisi (Siracusa), Italy; 3 sh, Sciacca (Agrigento), Italy; 1 sh, Morocco. From CS-PM collection (Rome): 3 sh, Algeciras, Spain, 20-35 m; 4 sh, Capo Corso, Corsica, France, 70 m; 8 sh, Capraia Island (Leghorn), Italy, 80-200 m; 1 sh, Capraia Island (Leghorn), Italy, 400 m; 14 sh, Elba Island, Tuscany, Italy, 300 m; 3 sh, Elba Island (Leghorn), Italy, 50 m; 2 sh, Civitavecchia (Rome), Italy, 40 m; 3 sh, Fiumicino (Rome), Italy, 160 m; 8 sh, Circeo (Latina), Italy, 90 m; 108 sh, Ponza Island (Latina), Italy, 125-165 m; 1 sh, Capo Portiere (Latina), Italy, unspecified depth; 3 sh, Golf of Carini (Palermo), Italy, 120 m; 48 sh, 60 miles offshore Sfax, Tunisia, 100 m; 11 sh, Libyan coasts, 110-150 m.

Pagodula echinata (Kiener, 1840): from CS-PM collection (Rome): about 600 sh, offshore Fiumicino (Rome), Central Tyrrhenian Sea (41°51'N 11°28'E), Italy, 500-600 m.

DESCRIPTION OF THE HOLOTYPE. Shell of small size for the genus, H = 5.6, W = 2.9 mm, fusiform, elongate, with high spire and siphonal canal open and moderately long, last whorl about three quarter of entire shell length. Protoconch paucispiral, with a diameter of 580 µm and 1.5 rounded whorls, ornamented with narrow, irregular spiral threads. Teleoconch with 3.5 whorls, axial sculpture consisting of 11 lamellate ribs, slightly spiny at the shoulder. Infrasutural ramp without cords (cords 1 and 2 absent), convex part of the last whorl with 6 primary cords (cords 3-8). Aperture small, ovate with a thin, knife-edge outer lip, to some extent undulate. Columellar lip narrow, smooth and adherent. Siphonal canal narrow, with evident growth ridges. Shell uniformly white or greyish-white, vitreous. Operculum corneous, ovoid, planispiral with lateral nucleus.

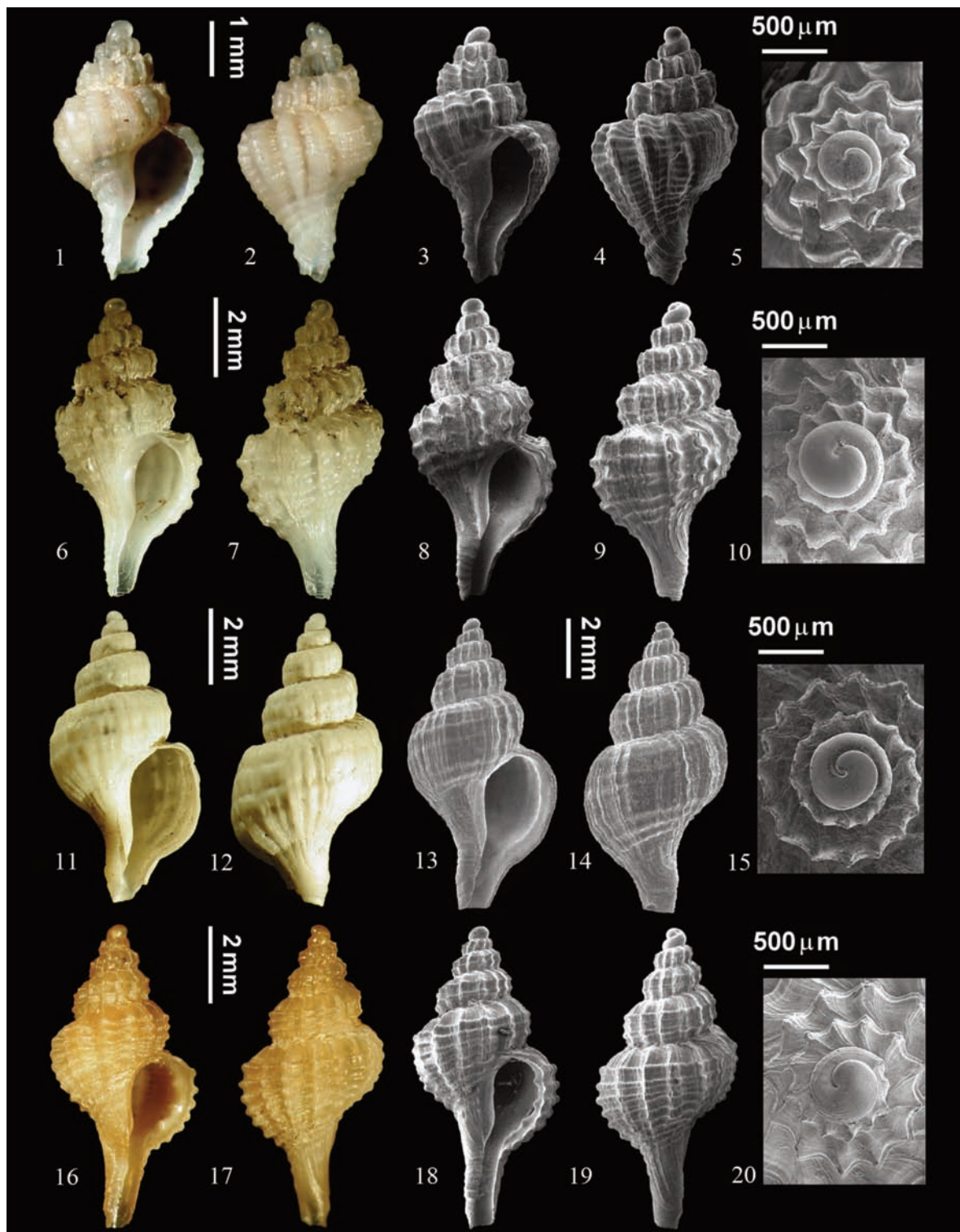
VARIABILITY. Shell height ranging from 5.8 to 6.3 mm with an average of 6.10 mm (50 sh measured), while the width is ranging from 2.9 to 3.1 mm (50 sh measured), with an average of 2.95 mm. Protoconch diameter from 550 to 650 µm, with an average of 589 mm (11 sh measured by SEM analyses). Teleoconch always comprising 3.5 whorls, which can be considered as a diagnostic character, and 6 (rarely 7) primary cords in the

convex part of the last whorl. Number of lamellate ribs of the axial sculpture ranging from 11 to 14, with an average of 12.24.

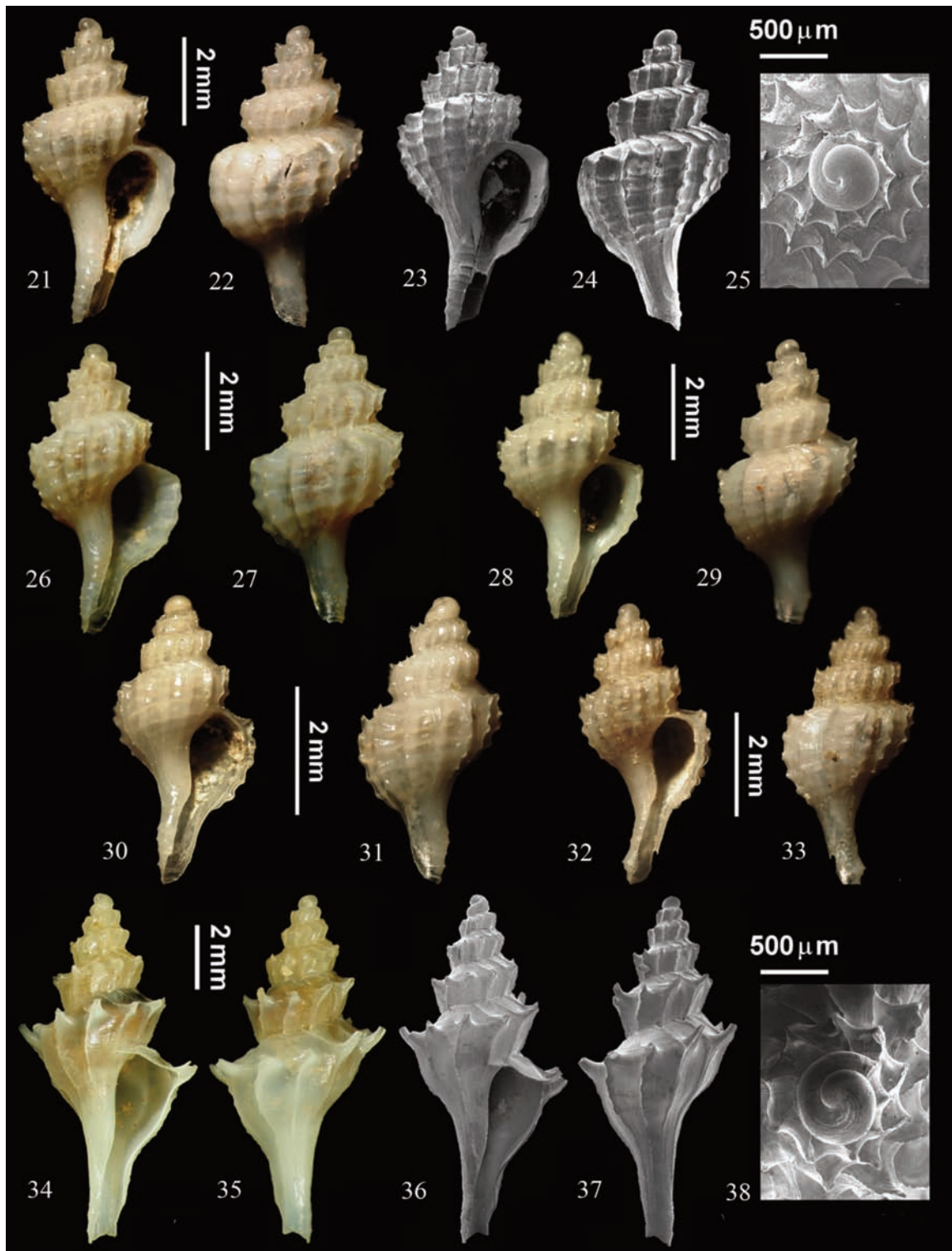
ETIMOLOGY. This species is dedicated to Ignazio Sparacio (Palermo, Italy), for his great contribution to scientific research and his editorial work for the biodiversity of the Mediterranean region.

DISTRIBUTION AND BIOLOGY. Locus typicus: Central Tyrrhenian Sea off the coasts of Latium (41°51'N 11°28'E). Habitat: Biocoenosis CB (sensu Pérès & Picard, 1964), 360-600 m depth.

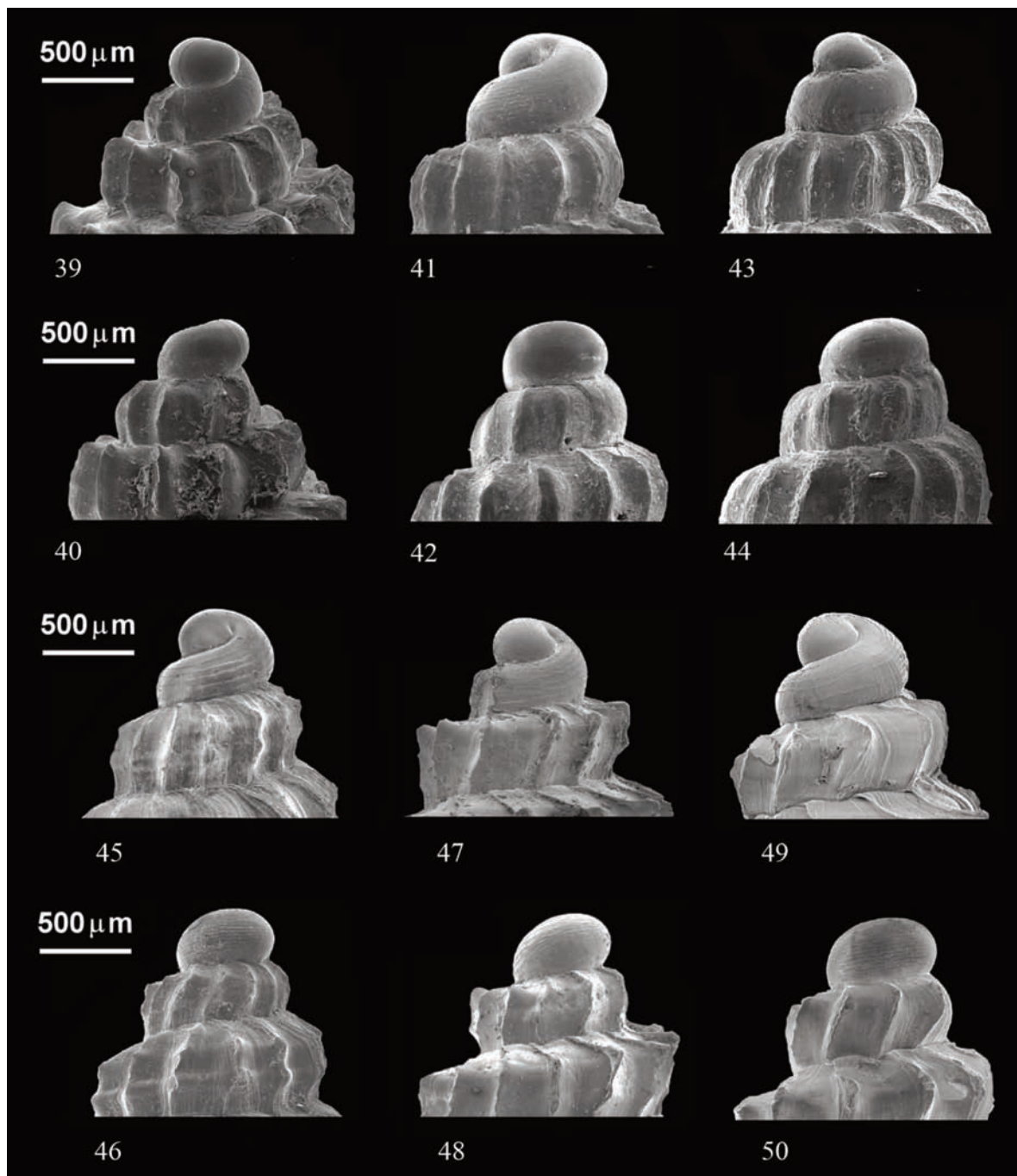
REMARKS. All shells of *T. sparacioi* n. sp. (Figs. 21-33, 47, 48), some of them with soft parts, were sorted out from sediment samples collected at bathyal depths. In particular, empty shells from muddy bottoms (biocoenosis VB, sensu Pérès & Picard, 1964), while shells with soft parts from deep-sea coral banks (biocoenosis CB, sensu Pérès & Picard, 1964). The benthic communities of this Tyrrhenian Sea area have been investigated since the late eighties, and have been partly characterized (Smriglio et al., 1989; Smriglio & Mariottini, 1996, 2000, 2001; Smriglio et al., 1999). The analysis of the accompanying dredged organogenic sediment revealed many fragments of alive azooxantellate corals like *Desmophyllum cristagalli* Milne Edwards et Haime, 1848 and *Madrepora oculata* (Linné, 1758), indicating that this species belongs to the biocoenosis CB. Furthermore, together with the empty shells of the new taxon, we collected another abundant pagoduline, *Pagodula echinata* (Kiener, 1840) (Figs. 34-38, 49, 50), which typically inhabits circalittoral/bathyal muddy bottoms (Smriglio et al., 1989; Houart, 2001; Gofas et al., 2011). For *P. echinata*, it is interesting to recall that the fossil *P. vaginata* (De Cristofori et Jan, 1832) differs by presenting "a distinct difference in the larval shell, which in the recent form consist of about 1.5 whorls while the Pliocene form has more than 2.5 whorls, and possibly planktotrophic larval development" (Bouchet & Waren, 1985 p. 138). Moreover, La Perna (1996) remarked "at that time, the two species lived in ecologically segregated populations, *P. vaginata* being linked to deep-shelf and upper-slope bottoms, and *P. echinata* to deeper bathyal bottoms". Possibly, this difference in habitat has enabled *P. echinata* to be protected during the Quaternary climatic cooling, which instead caused



Figures 1–5. *Trophonopsis alboranensis*. Paratype D, H 4.7 x W 2.8 mm. Alboran Sea, 80-150 m depth. CS-PM. Figures 6–10. *T. barvicensis*. H 7.4 x W 3.7 mm. Aberdeen Bank, E. Scotland, 59-68 m depth, 57°13'N-01°05'W. CS-PM. Figures 11, 12. *T. breviatus*. H 7.6 x W 4.2 mm. Marmara Island, Marmara Sea. CS-PM. Figures 13–15. *T. breviatus*. H 9.5 x W 5.2 mm. Bozcaada Island, Turkey, 85 m depth. CS-PM. Figures 16–20. *T. muricatus*. H 7.6 x W. 3.7 mm. Circeo, Italy, 90 m depth. CS-PM.



Figures 21–25. *Trophonopsis sparacoi* n. sp. Paratype 10, H 6.2 x W 3.3 mm. Central Tyrrhenian Sea. CS-PM. Figures 26, 27. *T. sparacoi* n. sp. Paratype 2, H 5.8 x W 2.9 mm. Central Tyrrhenian Sea. MZB60093. Figures 28, 29. *T. sparacoi* n. sp. Holotype, H 5.6 x W 2.9 mm. Central Tyrrhenian Sea. MNHN IM-2000-27897. Figures 30, 31. *T. sparacoi* n. sp. Paratype 4, H 4.5 x W 2.9 mm. Central Tyrrhenian Sea. MCZR00222a. Figures 32, 33. *T. sparacoi* n. sp. Paratype 11, H 6.1 x W 2.8 mm. Central Tyrrhenian Sea. CS-PM. Figures 34–38. *Pagodula echinata*. H 10.7 x W 5.4 mm; Central Tyrrhenian Sea. CS-PM.



Figures 39, 40. *T. alboranensis*. Same as Fig. 1. Figures 41, 42. *T. barvicensis*. Same as Fig. 6. Figures 43, 44. *T. breviatus*. Same as Fig. 11. Figures 45, 46. *T. muricatus*. Same as Fig. 16. Figures 47, 48. *T. sparacioi* n. sp. Same as Fig. 34. Figures 49, 50. *Pagodula echinata*. Same as Fig. 11.

the extinction of *P. vaginata*. We think that *P. vaginata* represents the sister species of *P. echinata* that has lost the planktotrophic larval stage showing a different successful adaptive strategy, as described for other Recent couples of sibling species (Pusateri

et al., 2012; Pusateri et al., 2013). *Trophonopsis sparacioi* n. sp. clearly differs from all other *Trophonopsis* occurring in Northeastern Atlantic and Mediterranean Sea mainly for its small size and shell sculpture. Only *T. alboranensis* has similar

dimensions, but this species shows a totally different shell sculpture consisting of nodulose axial ribs with a higher number of spiral cords (compare Figs. 1–5 and 39, 40 to Figs. 21–25 and 47, 48) (Smriglio et al., 1997; Houart, 2001; Gofas et al., 2011). *Trophonopsis barvicensis* possesses both protoconch and teleoconch of bigger size and its shell sculpture shows less axial ribs and spiral cords, also less spiny at intersections (compare Figs. 6–10 and 41, 42 to Figs. 21–25 and 47, 48). *Trophonopsis sparacoi* n. sp. clearly differs from *T. breviatus* in many respects, the latter having a more convex shell outline, being less sculptured, and having a bigger protoconch (compare Figs. 11–15 and 43, 44 to Figs. 21–25 and 47, 48). *Trophonopsis muricatus* is bigger in size, shows a more convex shell outline, a more reticulated sculpture, less spiny at the intersections, and a longer siphonal canal. The protoconch of this species is similar in size, but shows less spiral threads, coarser in the last part of the whorl (compare Figs. 16–20 and 45, 46 to Figs. 21–25 and 47, 48).

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REFERENCES

- Barco A, Schiaparelli S., Houart R. & Oliverio M. 2012. Cenozoic evolution of Muricidae (Mollusca, Neogastropoda) in the Southern Ocean, with the description of a new subfamily. *Zoologica Scripta* 41: 596–616.
- Bouchet P. & Warén A., 1985. Revision of the Northeast Atlantic bathyal and abyssal Neogastropoda excluding Turridae (Mollusca, Gastropoda). *Bollettino Malacologico*, Supplemento 1: 123–296 pp.
- Giribet G. & Penas A., 1997. Malacological marine fauna from Garraf coast (NE Iberian Peninsula). *Iberus*, 15: 41–93.
- Gofas S. & Le Renard J., 2014. CLEMAM: Check List of European Marine Mollusca. Available at <http://www.somali.asso.fr/clemam/index.clemam.html>. Accessed 2014-oct-01.
- Gofas S., Moreno D. & Salas C., 2011. *Moluscos marinos de Andalucía - I*. Universidad de Malaga, Junta de Andalucía, Consejería de medio ambiente, 342 pp.
- Houart R., 2001. A review of the Recent Mediterranean and Northeastern Atlantic Species of Muricidae. *Evolver*, Roma, 227 pp.
- La Perna R., 1996. Phyletic relationships and ecological implications between *Pagodula vaginata* (De Cristofori & Jan, 1832) and *Pagodula echinata* (Kiener, 1840) (Gastropoda, Muricidae). *Bollettino della Società Paleontologica Italiana*, 35: 81–92.
- 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 correspondences for delineating structural homologies. *Lethaia*, 38: 367–379.
- Pèrès J. M. & Picard J., 1964. *Nouveau Manuel de Bionomie Benthique de la Mer Méditerranée*. Recueil des Travaux de la Station Marine d'Endoume, 31: 1–137.
- Pusateri F., Giannuzzi-Savelli R. & Oliverio M., 2012. A revision of the Mediterranean Raphitomidae 1: on the sibling species *Raphitoma contigua* Monterosato, 1884 and *Raphitoma spadiana* n. sp. (Gastropoda, Conoidea). *Iberus*, 30: 41–52.
- Pusateri F., Giannuzzi-Savelli R. & Oliverio M., 2013. A revision of the Mediterranean Raphitomidae 2: on the sibling species *Raphitoma lineolata* (BDD, 1883) and *Raphitoma smriglioi* n. sp. (Gastropoda, Conoidea). *Iberus*, 31: 11–20.
- Peñas A., Rolán E., Luque A.A., Templado J., Moreno D., Rubio F., Salas C., Sierra A. & Gofas S., 2006. *Moluscos marinos de la isla de Alborán*. *Iberus*, 24: 23–151.
- Rolán E., 1983. *Moluscos de la Ria de Vigo, 1*. *Gastropodos*. Privately published, Vigo, 383 pp.
- Segers W., Swinnen F. & de Prins R., 2009. *Marine molluscs of Madeira*. Snoeck publishers, 612 pp.
- Smriglio C. & Mariottini P., 1996. *Molluschi del Mar Tirreno Centrale: Contributo XII*. Descrizione di una nuova specie di Cystiscidae Stimpson, 1865, per il Mar Mediterraneo: *Granulina gofasi* n. sp. *La Conchiglia*, 281: 54–56.
- Smriglio C. & Mariottini P., 2000. *Onoba oliverioi* n. sp. (Prosobranchia, Rissoidae), a new gastropod from the Mediterranean. *Iberus*, 18: 15–19.
- Smriglio C. & Mariottini P., 2001. *Emarginula bonfittoi* sp. nov. (Gastropoda, Prosobranchia, Fissurellidae),

- a new bathyal species from the Mediterranean Sea. *Basteria*, 65: 139–143.
- Smriglio C., Mariottini P. & Bonfitto A., 1997. Description of *Houartiella* n. gen., Trophoninae Cossmann, 1903, and *Houartiella alboranensis* n. sp. from the Mediterranean Sea. *Bollettino Malacologico*, 32: 27–34.
- Smriglio C., Mariottini P. & Calascibetta S., 1999. Description of a new species of Conidae Fleming, 1822 from the Mediterranean Sea: *Conopleura aliena* n. sp. *Bollettino Malacologico*, 34: 27–32.
- Smriglio C., Mariottini P. & Gravina F., 1989. Molluschi del Mar Tirreno Centrale: ritrovamento di *Putzeysia wiseri* (Calcara, 1842), *Ischnochiton vanbellei* Kaas, 1985 e *Neopilina zografi* (Dautzenberg & Fischer, 1896). Contributo VI. *Bollettino Malacologico*, 25: 125–132.
- WoRMS Editorial Board, 2013. World Register of Marine Species. Available from <http://www.marine-species.org> at VLIZ. Accessed 10 September 2014.