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BİLAL ÖZTÜRK

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Bathyal gastropod (Mollusca) species from the Turkish Levantine and Aegean Seas

Bilal ÖZTÜRK*
Department of Hydrobiology, Faculty of Fisheries, Ege University (retired academic), İzmir, Turkiye

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Abstract: This study assigns 35 gastropod specimens and 23 shells collected from two sites on the Turkish Levantine and Aegean coasts at depths of 432 and 702 m, respectively, to 13 species. Among the species identified, *Alvania subsoluta* (Aradas, 1847), *Protatlanta souleyeti* (Smith, 1888), *Pagodula echinata* (Kiener, 1839), *Pleurotomella gibbera* Bouchet & Warén, 1980, *Ringicula gianninii* Nordsieck, 1974 and *Diaphana marshalli* (Sykes, 1904) are new records for the Turkish molluscan fauna; *Anatoma aspera* (Philippi, 1844) and *Acteon monterosatoi* Dautzenberg, 1889 are new records for the Levantine coast of Türkiye; and *Crenilabium exile* (Jeffreys, 1870) is a new record for the Turkish Aegean coast. Of the 13 species identified, nine species were found at a depth of 432 m on the Levantine coast of Türkiye, while four species were found at a depth of 702 m on the Turkish Aegean coast. A fresh shell of the holoplanktonic species *Protatlanta souleyeti* was found in the sampled benthic material. This paper comments on the identified species and provides information on their nomenclature, ecology, and distribution.

Key words: Mollusca, bathyal gastropods, Levantine Sea, Aegean Sea, Türkiye, distribution

1. Introduction

The molluscan fauna of the Mediterranean Sea has been extensively studied in the last 50 years. More is known about molluscs at infralittoral depths (0–40 m), while little is known about the molluscs in bathyal habitats (Toma et al., 2022). This is particularly true for the Eastern Mediterranean that is characterised by a marked oligotrophy, as well as different relationships and ecological characteristics compared to the Western Mediterranean (Pérès and Picard, 1958; Por, 1989).

Scientific studies of the deep molluscan fauna of the Levantine and Aegean Seas began in the middle of the 19th century. The earliest studies were carried out by Forbes (1844) (Aegean Sea) and Sturany (1895) (Levantine Sea). The more recent studies carried out in these regions that have made important contributions to the knowledge of bathyal gastropods include Koutsoubas et al. (2000), Öztürk et al. (2003), Campani et al. (2011), Bogi and Galil (2004, 2013), Bitlis and Öztürk (2017), Manousis et al. (2018), and Di Bari et al. (2024). Koutsoubas et al. (2000) studied the molluscs in the southern part of the Cretan Sea (Aegean Sea) at 22 sampling stations at depths between 40 and 1570 m. Of the sampled stations, 16 were at bathyal depths (200–1570 m) and a total of 28 gastropod species were reported. Of the identified species, *Danilia otaviana* (Cantraine, 1835), *Putzeysia wiseri* (Calcara, 1842) and *Tiberia minuscula* (Monterosato, 1880) were found to have the deepest distributions. Another study in the same area investigated materials taken from the north and west of the island of Crete at depths between 677 and 2722 m and identified 57 mollusc species (Di Bari et al., 2024). Bitlis and Öztürk (2017), studied *Alvania* species distributed along the Turkish Aegean coast in materials of shallow and bathyal depths (680 and 875 m) sampled in Saros Bay and in a locality near Gökçeada. Among the recognised species, *Alvania cimicoides* (Forbes, 1844) and *Alvania testae* (Aradas & Maggiore, 1844) were cited as species distributed at bathyal depths. Furthermore, 45 gastropod species were identified in a study examining molluscs distributed along the Hellenic coasts of the Aegean Sea, of which more than 40% were found at depths of 200 m or more (Manousis et al., 2018).

The Levantine Sea is one of the most important basins in the Eastern Mediterranean, especially the northeastern part—a hotspot area for alien species. Öztürk et al. (2003) studied materials sampled from the northern coast of Cyprus at depths between 210 and 600 m and the bathyal gastropods *Alvania testae*, *Gymnobela subaraneosa* (Dautzenberg & Fischer, 1896), and *Teretia teres* (Reeve, 1844) were identified. Furthermore, studies on materials from the Israeli coasts identified numerous gastropod species from depths between 734 and 1558 m (Bogi and Galil, 2004; Campani et al., 2011; Bogi and Galil, 2013). Among the cited species, *Akritogyra conspicua*

* Correspondence: ozturkbilal1955@gmail.com

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(Monterosato, 1880), *Alvania electa* (Monterosato, 1874), *Turbonilla micans* (Monterosato, 1875), *Gleba cordata* Forsskål, 1776, *Diaphana marshalli* (Sykes, 1904), and *Odostomia silesui* Nofroni, 1988 were recorded for the first time in the Eastern Mediterranean. In a study on Rissoidea species distributed along the Turkish Levantine coast, the bathyal gastropods *Alvania beanii* (Hanley, 1844), *Alvania testae*, and *Obtusella macilenta* (Monterosato, 1880) were found in benthic materials collected at depths down to 1302 m (Bitlis Bakir and Öztürk, 2016).

The present study examines materials sampled from the Turkish Levantine and Aegean coasts and assesses the occurrence and distribution of bathyal gastropod species new to the Turkish molluscan fauna.

2. Materials and methods

The bathyal gastropod specimens examined in the present study were collected within the framework of the Integrated Marine Pollution Monitoring Programme (DEN-İZ) [Final Reports, Republic of Türkiye MoEUCC and TÜBİTAK MAM (The Scientific and Technological Research Council of Türkiye, Marmara Research Centre)], carried out on the Turkish Levantine and Aegean coasts in 2024 (Figure 1). At each site, three replicates were taken by using a box core, sampling an area of 0.1 m^2. On the Levantine coast, the samples of muddy material were collected from a site in Antalya Bay (36°37′44.4″N, 30°52′47.9″E) at a depth of 432 m in August 2024. On the Aegean coast, the samples of mud with shell fragments were taken in Gökova Bay (36°51′38.52″N, 27°39′23.76″E) at a depth of 702 m in September 2024. The first 30 cm of sediment from each box core sample was evaluated. Samples were sieved with a 0.5 mm mesh, and the retained material was placed in jars containing seawater with 4% formaldehyde solution. At the laboratory, the material was washed with tap water and specimens were sorted according to taxonomic groups under a stereomicroscope. The gastropod specimens were then identified to the species level and counted. The species identification was based on the relevant literature and the nomenclature followed MolluscaBase[1]. The identified material was deposited in the scientific collection of the Ege University Faculty of Fisheries (ESFM), İzmir (Türkiye).

3. Result and discussion

In total, 35 specimens and 23 shells (without soft parts) were recovered from the material sampled at the two sites on the Turkish Levantine and Aegean coasts, belonged to 13 species. Of the identified 13 species (Table), nine were found in the Levantine Sea and four were encountered in the Aegean Sea, of which *Alvania subsoluta* (Aradas, 1847), *Protatlanta souleyeti* (Smith, 1888), *Pagodula echinata* (Kiener, 1839), *Pleurotomella gibbera* Bouchet & Warén, 1980, *Ringicula gianninii* Nordsieck, 1974, and *Diaphana marshalli* (Sykes, 1904) are reported here for the first time in the Turkish molluscan fauna.

Anatoma aspera (Philippi, 1844) and *Acteon monterosatoi* Dautzenberg, 1889 are new records for the Turkish Levantine coast, and *Crenilabium exile* (Jeffreys, 1870) is a new record for the Turkish Aegean coast.

Of the species identified herein, the newly recorded taxa are briefly commented on and illustrated below. *Benthonella tenella* (Jeffreys, 1869) and *Tritia lima* (Dillwyn, 1817) recorded in Antalya Bay (station 1), and *Alvania cimicoides* (Forbes, 1844), *Atlanta peronii* Lesueur, 1817, *Cavolinia gibbosa* (d'Orbigny, 1835), and *Cavolinia inflexa* (Lesueur, 1813) collected in Gökova Bay (station 2) were previously reported from the relevant Turkish coasts (Öztürk et al., 2024). As the latter three species are holoplanktonic, only their shells were found in benthic materials.

[1] MolluscaBase (2025). MolluscaBase Search Page [online]. Website https://www.molluscabase.org/aphia.php?p=search [20 April 2025].

Figure 1. Map of the sampling stations.

Table. List of the species found in the present study with the number of specimens or shells of each taxon and the localities where they were found (* new record for the Turkish molluscan fauna, **new record for the Levantine coast of Türkiye, and ***new record for the Aegean coast of Türkiye, and registration number of each taxon with ESFM).

Species	L. Sea (station 1)	A. Sea (station 2)	Specimen	Shell	Registered with ESFM under number
Scissurellidae					
***Anatoma aspera* (Philippi, 1844)	+		2		ESFM-GAS/2024-18
Rissoidae					
Alvania cimicoides (Forbes, 1844)		+	1		ESFM-GAS/2024-32
**Alvania subsoluta* (Aradas, 1847)	+		2		ESFM-GAS/2024-07
Benthonella tenella (Jeffreys, 1869)	+		4	1	ESFM-GAS/2024-14
Atlantidae					
**Protatlanta souleyeti* (Smith, 1888)	+			1	ESFM-GAS/2024-04
Cavoliniidae					
Cavolinia gibbosa (d'Orbigny, 1835)		+		16	ESFM-GAS/2024-27
Muricidae					
**Pagodula echinata* (Kiener, 1839)	+		3	1	ESFM-GAS/2024-06
Nassariidae					
Tritia lima (Dillwyn, 1817)	+		8	3	ESFM-GAS/2024-02
Raphitomidae					
**Pleurotomella gibbera* Bouchet & Warén, 1980	+		6		ESFM-GAS/2024-08
Acteonidae					
***Acteon monterosatoi* Dautzenberg, 1889	+		1		ESFM-GAS/2024-05
****Crenilabium exile* (Jeffreys, 1870)		+	2	1	ESFM-GAS/2024-31
Ringiculidae					
**Ringicula gianninii* Nordsieck, 1974	+		5		ESFM-GAS/2024-03
Diaphanidae					
**Diaphana marshalli* (Sykes, 1904)		+	1		ESFM-GAS/2024-01

Anatoma aspera (Philippi, 1844)

(Figures 2A–2D)

Scissurella aspera Philippi, 1844: 160, plate 25, figure 17 (described from a Calabrian fossil of Pleistocene age). As the type material is unknown and presumably lost, a neotype of the species was designated (Høisæter and Geiger, 2011, figure 19).

Anatoma aspera is characterised by higher spire whorls, higher total shell height, less rapidly increasing whorl diameter, much coarser axial sculpture (especially on the shoulder) and larger size in adult specimens compared to *Anatoma crispata* (Fleming, 1828). The detailed distinguishing features of *A. aspera* from the other congeneric species were discussed in detail by Høisæter and Geiger (2011).

On the Turkish coasts, the earliest record of *A. aspera* (as *Scissurella aspera*) was that of Ostroumoff (1896) from the Sea of Marmara at depths between 73 and 77 m. Later, Demir (2003), assigned the *Anatoma* specimens recorded from the Aegean Sea and the Sea of Marmara to *A. crispata*. Based on this information, this taxon was listed under the same name in the inventory list of Turkish marine molluscs (Öztürk et al., 2014). However, in the present study, *Anatoma* specimens collected in the Aegean Sea and Sea of Marmara during various research projects in recent years were also examined and all were found to belong to *A. aspera*. Therefore, the species previously reported as *A. crispata* from the Turkish coasts may in fact be *A. aspera*. This confusion may be due to the fact that the subadult individuals of *A. aspera* (Figures 2C and 2D) also have a flatter shell closely resembling *A. crispata*.

Anatoma aspera lives at depths between 20 and 4400 m (Høisæter, 2009; Høisæter and Geiger, 2011).

Distribution: Atlantic Ocean and Mediterranean Sea (Høisæter and Geiger, 2011). The occurrence of *A. crispata* along the Turkish Aegean coast and in the Sea of Marmara (Demir, 2003) is probably a misidentification of *A. aspera*. This is the first time this species has been recorded from the Turkish Levantine coast.

Alvania subsoluta (Aradas, 1847)

(Figures 3A–3C)

Rissoa subsoluta Aradas, 1847: 77.

Among the *Alvania* species distributed along the Turkish coasts, *A. subsoluta* has some similarities with *A. testae*, but differs from the latter species in having a narrow conical shell, more convex teleoconch whorls, and a paucispiral protoconch. On the semicircular protoconch, there are about 5–7 fine spiral striae and very few tubercles in the interspaces. *A. subsoluta* is usually found at depths between 200 and 1200 m, rarely occurring outside this range (Bouchet and Warén, 1993).

Distribution: Atlantic Ocean and Mediterranean Sea (Bouchet and Warén, 1993; Bogi and Galil, 2013). This is the first time this species has been recorded from the Turkish coasts.

Protatlanta souleyeti (Smith, 1888)

(Figures 4A and 4B)

Atlanta souleyeti Smith, 1888: 43.

One shell of this holoplanktonic gastropod was found in the benthic material sampled in Antalya Bay and has been included for registration as the species has not been recorded from the Turkish coasts until now. The shell is characterised by small and convex early whorls and smooth protoconch and body whorl. A brief description of the species was given in Gofas et al. (2011).

The larval shell of this species is quite different in appearance from the adult, being almost trochiform and can be confused with that of *Atlanta peronii* Rang, 1817 (Janssen, 2012). *Protatlanta souleyeti* is found in the epipelagic zone down to 200 m depth and widely distributed due to its pelagic lifestyle.

Distribution: A cosmopolitan species in tropical to subtropical waters of the eastern Pacific, northern Atlantic and Mediterranean Sea (Öztürk et al., 2003; Gofas et al., 2011; Moreno-Alcántara, 2019).

Pagodula echinata (Kiener, 1839)

(Figures 5A–5C)

Fusus echinatus Kiener, 1839: 19, plate II, figure 2.

Pagodula echinata differs from the other congeneric species in having a paucispiral and smooth protoconch, strongly shouldered teleoconch whorls with delicate and foliate varices, and a slender, widely open siphonal canal. A detailed description of the species and some remarks on its nomenclature and variation can be found in Bouchet and Warén (1985) and Houart (2001).

According to Bouchet and Warén (1985), the shell variability of *P. echinata* is mainly related to bathymetry. The shallower specimens have a pronounced spiny sculpture, while the deeper specimens usually have less developed spines. The specimens recorded down to 1000 m depth are almost devoid of spines.

Distribution: Atlantic Ocean and Mediterranean Sea (Bouchet and Warén, 1985). In the Levantine Sea, it was previously recorded from the Northern Cyprus coast at a depth of 140 m (Öztürk, 2002). The present record is a new addition to the Turkish molluscan fauna.

Pleurotomella gibbera Bouchet & Warén, 1980

(Figures 6A–6D)

Pleurotomella gibbera Bouchet & Warén, 1980: 40–41, figures 93, 220.

The species was described by Bouchet and Warén (1980), and the type locality is Adventure Bank at 166 m depth. *P. gibbera* differs from the other species of the genus in having a multispiral protoconch consisting of four whorls, sculptured by oblique axial ribs in the upper part of the whorls and an oblique reticulation in the lower part.

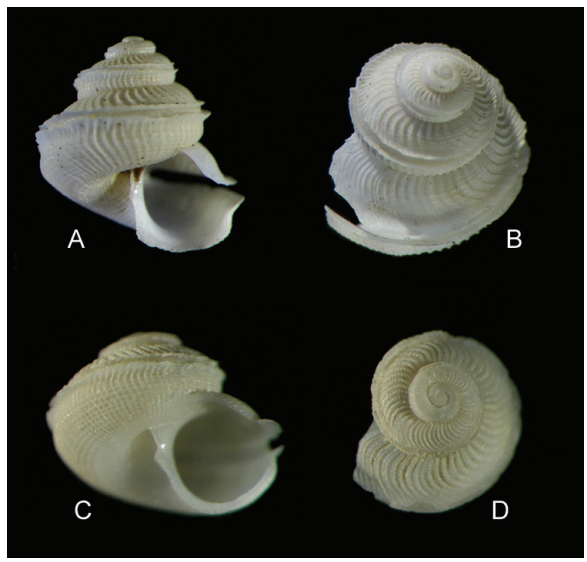

Figure 2. *Anatoma aspera*: different views of two specimens (A = B = 2.6 mm and C = D = 1.2 mm).

Figure 3. *Alvania subsoluta*: ventral views (A, B) of two specimens and the protoconch (C) of the specimen A (A = 2.1 mm, B = 2.5 mm).

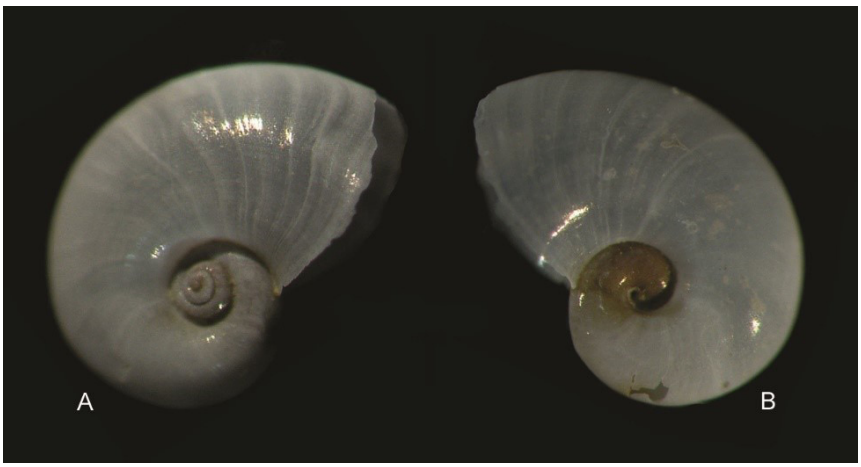

Figure 4. *Protatlanta souleyeti*: different views of the collected shell (A = B, d = 1.9 mm).

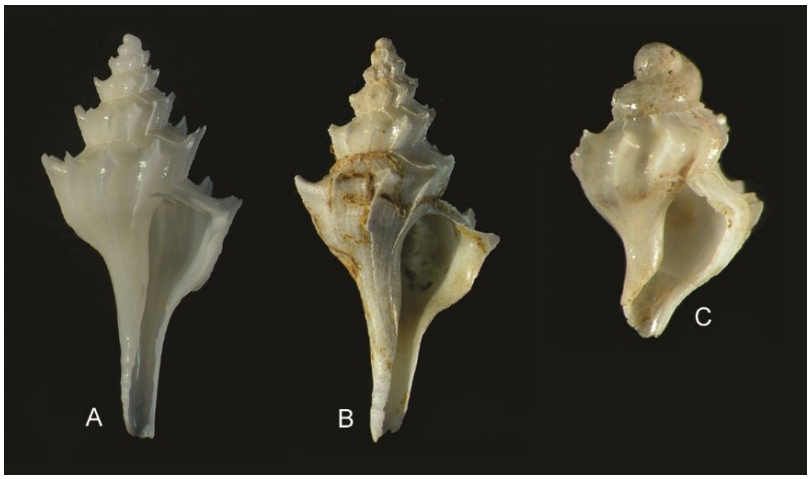

Figure 5. *Pagodula echinata*: ventral views of two adult (A, B) and one juvenile (C) specimens (A = 10.6 mm, B = 10.7 mm, and C = 2.1 mm).

Teleoconch whorls are angulated, with distant strong orthocline axial ribs and spirals on the penultimate and body whorls, and a well-defined concave subsutural zone. The distinguishing characteristics of the species were discussed by Bouchet and Warén (1980) and Landau et al. (2022).

Distribution: Eastern Atlantic (northwest Africa) and Mediterranean Sea (Bouchet and Warén, 1980; Gofas et al., 2011). In the Levantine Sea, *P. gibbera* was previously recorded from the northern Cypriot coast at a depth of 210 m (Öztürk, 2002). In the present study, it is reported for the first time from the Turkish coasts.

Acteon monterosatoi Dautzenberg, 1889

(Figures 7A and 7B)

Actaeon monterosatoi Dautzenberg, 1889: 20, plate 1, figures 2a–2d.

The shell of *A. monterosatoi* is globular and comprises about 3.5–4 teleoconch whorls, of which the body whorl accounts for three-quarters of the total shell height. The apex is blunt. On the teleoconch whorls, there is a sculpture of chain-like spiral cords narrower than the interspaces. There are fine growth lines, more visible at the interspaces between the spirals. The aperture is wider abapically and the columella is slightly opisthocline, with a less pronounced fold (Öztürk, 2014).

The genus *Acteon* Montfort, 1810 has two representatives in the Mediterranean: *Acteon tornatilis* (Linnaeus, 1758) and *A. monterosatoi*. The former species is commonly found on sandy-muddy bottoms of the infralittoral depths, whereas *A. monterosatoi* inhabits muddy bottoms of circalittoral and bathyal depths, and has a rare distribution compared to *A. tornatilis*.

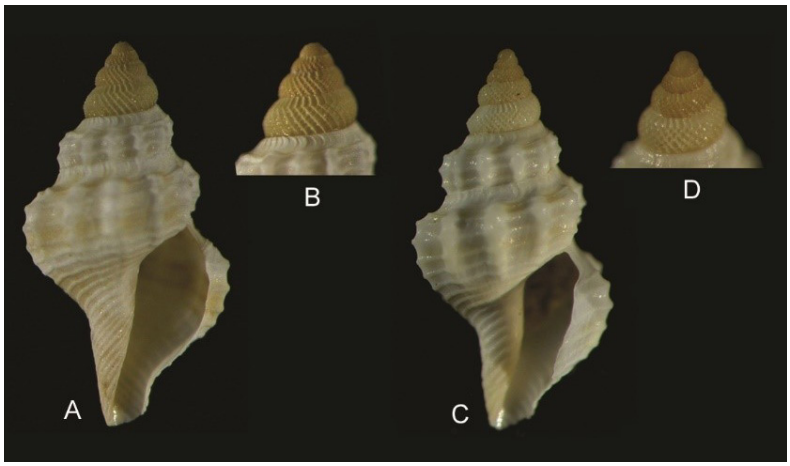

Figure 6. *Pleurotomella gibbera*: ventral views (A, C) of two specimens and their protoconchs (B, D) (A = 3.1 mm, C = 3.5 mm).

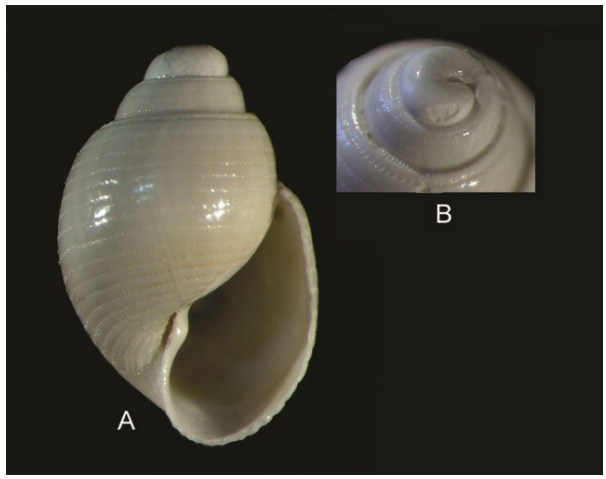

Figure 7. *Acteon monterosatoi*: ventral view (A) of the sampled specimen and its protoconch (B) (A = 3.2 mm).

Acteon monterosatoi also has some similarities with *Japonactaeon pusillus* (Forbes, 1844), but the latter species differs in having a conical shell shape, a longer spire, and larger shell size than *A. monterosatoi*.

Distribution: North Atlantic Ocean and Mediterranean Sea (Peñas et al., 2006; Öztürk, 2014; MolluscaBase[1]). Along the Turkish coasts, *A. monterosatoi* was previously recorded off the Turkish Aegean coast at a depth of 195 m (Öztürk, 2014). Here it is reported for the first time from the Turkish Levantine coast.

Crenilabium exile (Jeffreys, 1870)

(Figures 8A–8D)

Acteon exilis Jeffreys, 1870: 85.

The shell is bulloid, elongate, and consists of about 3.5–4 slightly convex teleoconch whorls. Body whorl about two-thirds of the total shell height. Protoconch mamillated. On the teleoconch whorls, there is a sculpture of equally spaced fine striae. Aperture rounded abapically and narrow adapically. Outer lip simple and there is no tooth or fold on the columella (Öztürk, 2014). *C. exile* is a deep-sea species, and along the Turkish coasts, it was recorded on muddy bottoms at depths ranging from 500 to 1300 m.

The specimens of *C. exile* can sometimes be confused with specimens of *Cecilioides acicula* (Müller, 1774), which are transferred in marine environments by freshwater inflows. *C. exile* differs by having a more broadly conical shell shape, equally spaced spiral striae on the teleoconch whorls, and with a truncated columellar base. For more information on this subject, see the work of Smriglio and Mariottini (1996).

Distribution: Central and North Atlantic Ocean and Mediterranean Sea (MolluscaBase[1]; Öztürk et al., 2003). On the Turkish coasts, *C. exile* was previously recorded in the Levantine Sea and Sea of Marmara (Öztürk et al., 2024). In the present study, it is reported from the Turkish Aegean coast for the first time.

Ringicula gianninii Nordsieck, 1974

(Figures 9A–9C)

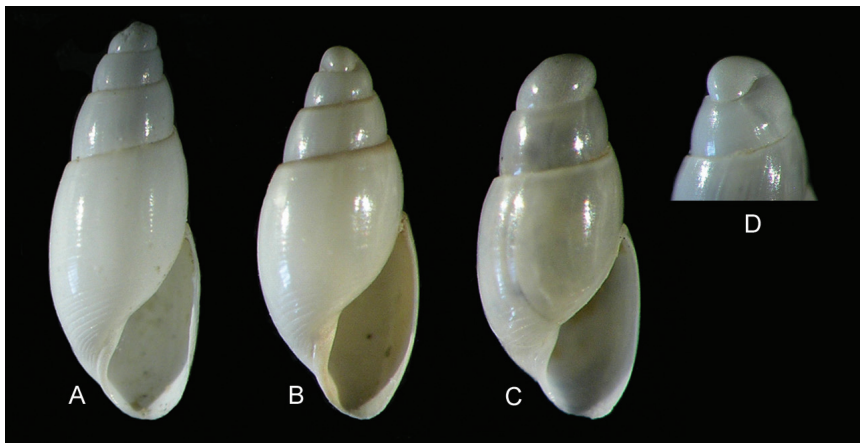

Figure 8. *Crenilabium exile*: ventral views (A, B, C) of three different specimens and protoconch (D) of the specimen C (A = 4.2 mm, B = 2.8 mm, C = 2.5 mm).

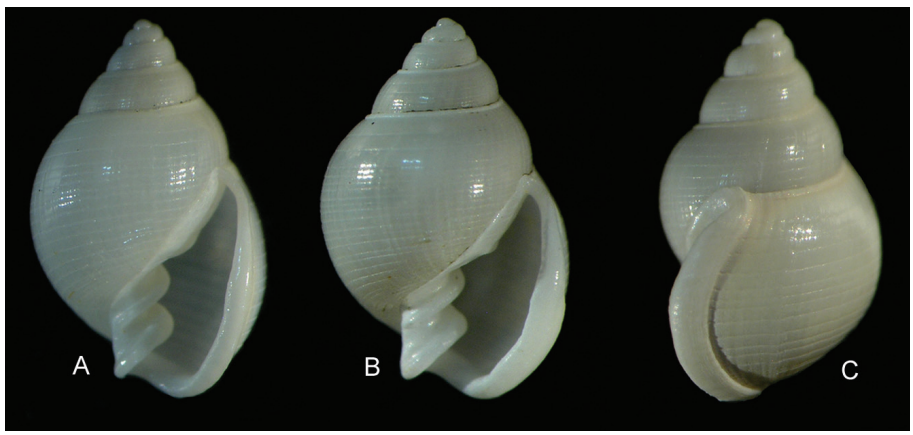

Figure 9. *Ringicula gianninii*: ventral (A, B) and lateral (C) views of three specimens (A = 4.1 mm, B = 4.2 mm, and C = 4.1 mm).

Ringicula gianninii Nordsieck, 1974: 13, figures 19–20.

This species is distinguishable from the other congeneric ones distributed on the Turkish coasts by a spiral sculpture consisting of about 18 equally spaced striae. Shell globular, conical, body whorl more than two-thirds of total height. Aperture half of body whorl, outer lip varicose. There is one parietal tooth and two columellar folds, of which the lower is a bit larger. Pale white in colour. It is distributed on muddy bottoms of circalittoral and bathyal depths (180–2006 m) (Mariottini et al., 2000).

R. gianninii has some similarities with *R. ciommeii* Mariottini, Smriglio and Oliverio, 2000, which is known to occur in the Western Mediterranean, but it differs from the latter species in having a conical shell shape as opposed to globular, and sparser spirals on the teleoconch whorls as opposed to more densely arranged ones (about 24 striae) in *R. ciommeii*.

Distribution: Atlantic Ocean and Mediterranean Sea (Mariottini et al., 2000; MolluscaBase[1]). This is the first time *R. gianninii* has been reported from the Turkish coasts.

Diaphana marshalli (Sykes, 1904)

(Figures 10A and 10B)

Retusa marshalli Sykes,1904: 31–32; plate 3, figures 5, 6a, and 6b.

Diaphana marshalli was described and illustrated by Sykes (1904) from specimens collected at station 17 on the "Porcupine" expedition of 1870 off Portugal, at depths between 1.100-2000 m. Later, Bouchet and Warén (1979) reported a holotype height of 2.45 mm that is larger than the 2 mm originally described by Sykes (1904). *D. marshalli* is known as an exceedingly rare species (Campani et al., 2011).

Among the *Diaphana* species distributed in the Mediterranean, *D. marshalli* more closely resembles *Diaphana lactea* (Jeffreys, 1877), from which it differs by having a completely visible protoconch, a whitish unsculptured shell, the widest part of the aperture in the lower third of the shell, and by being of smaller size. The differences between *D. marshalli* and *D. lactea* were discussed in detail by Bouchet and Warén (1979).

D. marshalli has been reported to inhabit depths of 1100–2000 m (Sykes, 1904), 2644 m (Schiøtte, 1999), and 1400–1500 m (Bouchet, 1975).

Distribution: Northern Atlantic and Eastern Mediterranean Sea (Campani et al., 2011; Bogi and Galil, 2013).

4. Conclusion

Mollusc diversity varies significantly between littoral and deep-sea environments due to differences in ecological conditions, habitat structure, and resource availability. Of the 1133 mollusc species distributed along the Turkish coasts, the highest number of taxa (752 species) were recorded at depths varying between 0 and 10 m (Öztürk et al., 2024). With increasing depth, there is a significant decrease in species diversity, with only 173 benthic and pelagic mollusc species recorded at depths of 201 m and more.

The bathyal fauna recorded at two sites on the Turkish Levantine and Aegean coasts accounted for 35 specimens and 23 shells identified as 13 species. Six of the recognised species (*A. subsoluta*, *P. souleyeti*, *P. echinata*, *P. gibbera*, *R. gianninii* and *D. marshalli*) are new additions to the Turkish molluscan fauna, although they were previously reported in the Mediterranean basin. The heterobranch species *R. gianninii* and *D. marshalli* are rarely distributed taxa in the Mediterranean, whereas *P. souleyeti* is a pelagic mollusc, for which only one fresh shell was found in the studied benthic material.

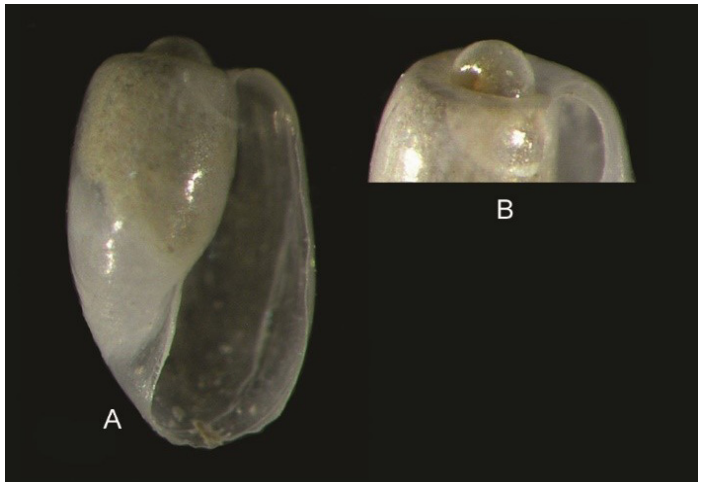

Figure 10. *Diaphana marshalli*: ventral view (A) of the sampled specimen and its apex (B) (A = 1.6 mm).

Compliance with ethical standards
Ethical approval was not needed for this study, as this study involved invertebrate organisms.

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