

Alien Marine Molluscs along the Turkish Coast, with a New Record of *Varicopeza pauxilla* (A. Adams, 1855) (Mollusca: Gastropoda) from the Mediterranean Sea

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Abstract: This study deals with the alien mollusc species recorded along the Turkish coast after the last checklist published in 2014. Six species (*Lodderia novemcarinata*, *Eratoena sulcifera*, *Zafra obesula*, *Z. pumilla*, *Retusa desgenetti*, and *Martesia striata*) were added to the alien mollusc fauna of the Levantine coast of Turkey, two species (*Leucotina natalensis* and *Pyrrunculus fourierii*) were recorded along the Aegean coast of Turkey and one species (*Arcuatula senhousia*) was found in the Sea of Marmara. The present study is also the first report of *Varicopeza pauxilla* (Gastropoda: Cerithiidae) from the Mediterranean Sea. This gastropod species, which originates from the Indo-West Pacific Ocean, was found in İskenderun Bay (Levantine coast of Turkey). With the above-mentioned species, the total number of alien molluscs along the Turkish coast amounts to 125 species.

Key words: Alien molluscs, Mediterranean Sea, Turkish coast, *Varicopeza pauxilla*, new record

Introduction

The introduction of non-native species to the Mediterranean Sea has continued since the second half of the 19th century via various pathways, such as: commercial shipping, canals, aquaculture, drilling platforms, and aquarium industry (ZENETOS et al. 2012). The first recorded alien species in the Mediterranean Sea was *Littorina saxatilis* (Olivier, 1792) sampled along the Italian coast (CROSETTA et al. 2013). Two other species, *Pinctada radiata* (Leach, 1814) and *Cerithium scabridum* Philippi, 1848, were the earliest reported alien molluscs in the Mediterranean, recorded in Alexandria and Port Said in 1874 and 1883, respectively (GALIL 2008). Since then, numerous studies have been conducted on alien species in the Mediterranean Sea, and by 2016 their number increased to 821 species, of which 613 species were considered as established (ZENETOS et al. 2017). With regard to the diversity of alien species, the Mediterranean Sea (especially its

eastern part) appears to be one of the hot-spot areas for the aliens due to its proximity to the Suez Canal and intensive maritime traffic.

The Turkish coast, with its high number of recorded alien species, could be regarded as a centre of introductions (ZENETOS et al. 2008). A total of 277 species were reported for that coast in the list of the aliens compiled by ÇINAR et al. (2005). Several years later, this number increased to 400 species, which belonged to 14 taxonomic groups, with the domination of molluscs, with 105 species (ÇINAR et al. 2011). The reasons for the high increase in the number of alien species for that period are mainly related to the increase in scientific studies dealing with the subject. According to the latter study, the highest number of alien species was recorded along the Turkish Levantine coast (330 species), followed by the Aegean Sea (165 species), the Sea of Marmara (69 species) and the Black Sea (20 species).

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Most recently, ÖZTÜRK et al. (2014) reported 1065 mollusc species along the Turkish coast, of which 118 species were aliens. Of those species, 111 were recorded for the Levantine coast of Turkey, 37 species for the Aegean Sea, nine species for the Sea of Marmara and four species for the Black Sea.

The present study deals with the alien mollusc species recorded along the Turkish coast after 2014. The aims are to compile a list of alien mollusc species based on new records and published data, and to present more detailed information on newly recorded species, including *Varicopeza pauxilla* found on the Levantine coast of Turkey, which is a new record for the Mediterranean Sea.

Materials and Methods

The samples were collected along the Turkish Levantine coast between Samandağ and Manavgat, in İzmir Bay, Aegean Sea, and in the Sea of Marmara (Fig. 1). The samplings were conducted in September-October 2012, in the Sea of Marmara, in September 2015, in the Aegean Sea, and in August 2016, in the Levantine Sea (Table 1). The materials were sampled by using a van Veen grab, except in the Sea of Marmara, where the sampling gear was a box corer. The data concerning other alien mollusc species along the Turkish coast are based on the studies by ÇINAR et al. (2005, 2011) and ÖZTÜRK et al. (2014, 2015).

Results and Discussion

As a result of the field study, *Varicopeza pauxilla* was found in muddy sediments, at depths between 18 and 55 m, at five localities along the Turkish Levantine coast between Samandağ and Manavgat (Table 1, Fig. 1). *Leucotina natalensis* and *Pyrunculus fourierii* were found in İzmir Bay, Aegean Sea, while *Arcuatula senhousia* was recorded in the Sea of Marmara (Table 1, Fig. 1).

Our study documented a total of 125 alien mollusc species for the Turkish coast (Table 2). They belong to 59 families, with the domination of Gastropoda with 40 families (Fig. 2). The family richest in species is Pyramidellidae (13 aliens), followed by Veneridae with 8 alien species (Fig. 3).

The origin of *Alvania dorbignyi*, one of the species in Table 2, is debated. According to MIENIS (1985, 2005) the species is native to the Mediterranean Sea. At the same time, ZENETOS et al. (2005) referred the species to the established aliens. Since there are no representatives of the genus *Alvania* in the Red Sea and neighbouring regions, MIENIS' opinion is probably correct. However, in order to avoid the possible confusion, we retained *Alvania dorbignyi* in Table 2.

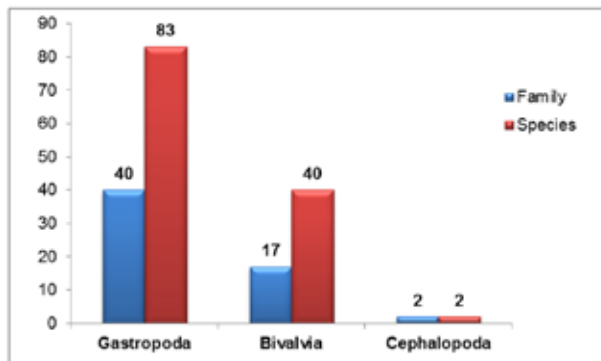
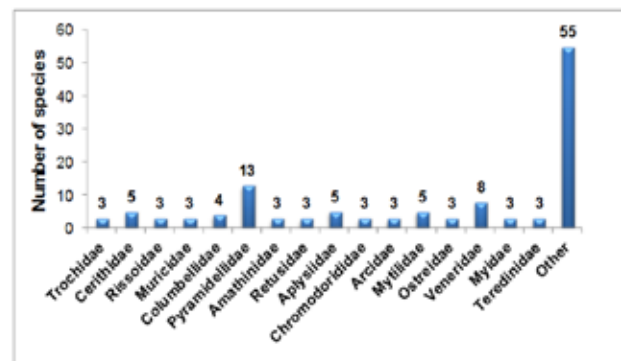
Based on the literature review, six new species (*Lodderia novemcarinata*, *Eratoena sulcifera*, *Zafra obesula*, *Z. pumilla*, *Retusa desgenetti*, and *Martesia striata*) were added to the alien mollusc fauna of the



Fig. 1. Sampling stations of *Arcuatula senhousia* (1, 2), *Leucotina natalensis* (3), *Pyrunculus fourierii* (3), and *Varicopeza pauxilla* (4, 5, 6, 7, 8)

Table 1. Newly recorded species and some characteristics of the sampling stations

Station	Species	Sea	Sampling date	Depth (m)	Geographic coordinates		Substrate	Number of individuals
1	<i>A. senhousia</i>	Sea of Marmara	29.09.2012	0.5	40°24'10"N	27°54'35"E	Facies of <i>M. galloprovincialis</i>	36
2	<i>A. senhousia</i>	Sea of Marmara	05.10.2012	0.5	40°36'30"N	27°05'49"E	Facies of <i>M. galloprovincialis</i>	3
3	<i>L. natalensis</i>	Aegean Sea	01.09.2015	8	38°25'16"N	27°03'45"E	Mud	2
3	<i>P. fourierii</i>	Aegean Sea	01.09.2015	8	38°25'16"N	27°03'45"E	Mud	3
4	<i>V. pauxilla</i>	Levantine Sea	22.08.2016	18	36°44'07"N	31°27'36"E	Detritic mud with many shell fragments and <i>Caulerpa</i> sp.	2
5	<i>V. pauxilla</i>	Levantine Sea	20.08.2016	33	36°16'08"N	33°52'45"E	Mud with shell fragments	1
6	<i>V. pauxilla</i>	Levantine Sea	20.08.2016	25	36°24'58"N	34°20'01"E	Mud with some shell fragments and detritus	5
7	<i>V. pauxilla</i>	Levantine Sea	20.08.2016	32	36°35'23"N	34°19'00"E	Mud with many shell fragments	1
8	<i>V. pauxilla</i>	Levantine Sea	18.08.2016	55	36°02'56"N	35°56'09"E	Mud	2


Fig. 2. Number of alien species and families reported for the Turkish coast, sorted by classes

Fig. 3. Number of alien species reported for the Turkish coast sorted by families

Levantine coast of Turkey, and one species (*Septifer cumingii*) to this of the Aegean Sea (Table 2).

Varicopeza pauxilla, which was encountered along the Turkish Levantine coast during our study, is a new record for the Mediterranean Sea (Tables 1 and 2). *Leucotina natalensis* and *Pyrrunculus fourierii* are new records for the Aegean Sea, whereas *A. senhousia* is a new record for the Sea of Marmara.

Some traits of the newly recorded species are provided below:

Class GASTROPODA

Family Cerithiidae

Varicopeza pauxilla (A. Adams, 1855)
(Fig. 4)

Cerithidea (Pirenella) pauxilla A. Adams, 1855: 86 (Holotype description).

Cerithium pauxillum Tryon, 1887: 141, pl. 34, fig. 95.

Cerithium bicanaliferum Brazier, 1877: 317.

Cerithium trigonostomum Melville, 1910: 10, pl. 1, fig. 15.

Argyropeza involuta Thiele, 1918: 120, pl. 21, figs 20, 20a.

Varicopeza varicopeza Gründel, 1976: 46-48, figs 8, 11-13.

Shell small, slender and turreted, and consists of about 10-11 straight-sided teleoconch whorls in adult specimens, with deeply channeled sutures. There are evident spiral cords and less distinct axial ribs on the whorls. On the teleoconch whorls of

young specimens and on the early whorls of adult ones, there are two spiral cords only (Fig. 4 A, E), whereas on the body whorl, between the suture and the beginning of the aperture, they number 5-6 spirals (Fig. 4 A, B). Protoconch consists of nearly 3.5 concave and smooth whorls, with no sculpture at x 50 magnification (Fig. 4 D). The nucleus of the protoconch in all investigated specimens is broken. Body whorl with wide and prominent varix opposite outer lip (Fig. 4 B-1). Outer lip crenulate and a lip varix on the outside (Fig. 4 C). At the aperture an anterior and a prominent posterior siphonal canals (Fig. 4 B-2). Operculum corneous and paucispiral with subcentral nucleus. The shell is of whitish or yellowish colour. 11 specimens of the species were found in İskenderun Bay (Levantine coast of Turkey), with shell heights varying between 2.8 and 9.1 mm (mean height=5.6 mm).

Remarks: *Varicopeza pauxilla* is highly similar to *Argyropeza divina* Melvill & Standen, 1901, which is distributed in the same area, but distinguishes from the latter species by its smooth protoconch, while the protoconch of *A. divina* has two spiral cords and many minute subsutural folds (HOUBRICK 1993: 304). The last author discusses in detail distinction between this species and the similar gastropods.

Distribution: The type locality of the species is Buriyas (Philippines). It has large distribution in the Indo-West Pacific region and is also known from Gulf of Aqaba of the Red Sea. In this study the specimens were sampled from muddy substrates at depths between 18 and 55 m in İskenderun Bay of the Levantine coast of Turkey (Fig. 1). According to HOUBRICK (1980), *Varicopeza pauxilla* is distributed at different depths up to 686 m.

Family Amathinidae

Leucotina natalensis E. A. Smith, 1910

(Fig. 5 E)

Leucotina natalensis E. A. Smith, 1910: 183, pl. 7, fig. 1 (Holotype description), AARTSEN & HORI (2006): 5, figs 7-9.

Monotygmata amoena (A. Adams, 1851): MICALI & PALAZZI (1992): 86, 89, fig. 1; BUZZURRO & GREPPI (1996): 8.

Distribution: The type locality of the species is Isezela, Natal, South Africa (SMITH 1910). In the Mediterranean, the first record of the species was from the Israeli coast in 1978 as *Kleinella amoena* (AARTSEN & HORI 2006). Along the Turkish coast, it was reported from İskenderun Bay and Taşucu (Levantine coast of Turkey) by MICALI & PALAZZI (1992) and BUZZURRO & GREPPI (1996). The species originates from the

Indo-Pacific region and has large distribution in the eastern Mediterranean and Red Sea (CECALUPO & QUADRI 1996, GOFAS & ZENETOS 2003). In the present study, two specimens were found in muddy material sampled at a depth of 8 m in İzmir Bay (Aegean coast of Turkey) in 2015 (Table 1, Fig. 1).

Family Retusidae

Pyrunculus fourierii (Audouin, 1826)

(Fig. 5, F1, F2)

Bulla fourierii Audouin, 1826: 39, BOUCHET & DANRIGAL (1982): 13, 20, fig. 54.

Retusa fourierii (Audouin, 1826): ENGL (1992): 8, CECALUPO & QUADRI (1996): 110, AARTSEN et al. (1989): 71.

Distribution: The type locality of the species is Egypt (AUDOUIN 1826). The species has been known in the Mediterranean since 1989 and the first localities where it was recorded are Haifa Bay (Israel) and Mersin Bay (Levantine coast of Turkey) (AARTSEN et al. 1989). Later the species spread further in the eastern Mediterranean Sea (ENGL 1992, CECALUPO & QUADRI 1996). *P. fourierii* is also distributed in the Indo-Pacific region and the Red Sea (GOFAS & ZENETOS 2003). We investigated 3 specimens of this species found in muddy material sampled at a depth of 8 m in İzmir Bay of the Aegean coast of Turkey.

Class BIVALVIA

Family Mytilidae

Arcuatula senhousia (Benson in Cantor, 1842)

(Fig. 5, G)

Modiola arcuatula (Hanley, 1844): BARASH & DANIN (1971): 99.

Musculista senhousia (Benson, 1842): POUTIERS (1998): 166, 171, fig. 6.

Distribution: The type locality of *A. senhousia* is Zhoushan Island (China). In the Mediterranean Sea, it was first recorded on the Tel Aviv coast (Israel) in 1964 as *Modiola arcuatula* (BARASH & DANIN 1971). Later on, the species spread further to the Turkish Levantine coast (UYŞAL et al. 2008) and Turkish Aegean coast (DOĞAN et al. 2014). In the present study, totally 39 specimens of *A. senhousia* were recorded in 20 x 20 cm quadrat samplings taken of *M. galloprovincialis* facies, at two stations in the Sea of Marmara (Table 1, Fig. 1).

Most of the alien molluscs recorded along the Turkish coast are considered as established. They are distributed mainly on soft substrata at shallow depths (ÇINAR et al. 2011). The majority of alien species use the Suez Canal as a gateway for entering the

Table 2. List of alien marine mollusc species from the Turkish coast. **BS:** Black Sea; **SM:** Sea of Marmara; **AS:** Aegean Sea; **LS:** Levantine Sea; **PS:** Present study; *: New record for the Mediterranean Sea; **: New record for the Turkish coast. Literature (L): ÖZTÜRK et al. (2015) (**L1**), CROCETTA & TRINGALI (2015) (**L2**), ÇEVİK et al. (2015) (**L3**), and BİTLİS et al. (2017) (**L4**)

Taxon	BS	SM	AS	LS
GASTROPODA				
Fissurellidae				
<i>Diodora ruppellii</i> (Sowerby G. B. I, 1835)				+
Trochidae				
<i>Trochus erithreus</i> Brocchi, 1821				+
<i>Pseudominolia nedyma</i> (Melvill, 1897)				+
<i>Stomatella impertusa</i> (Burrow, 1815)				+
Skeneidae				
<i>Parviturbo dibellai</i> Buzzurro & Cecalupo, 2007				+
** <i>Lodderia novemcarinata</i> (Melvill, 1906)				L1
Neritidae				
<i>Nerita sanguinolenta</i> Menke, 1829				+
<i>Smaragdia souverbiana</i> (Montrouzier, 1863)				+
Cerithidae				
* <i>Varicopeza pauxilla</i> (A. Adams, 1855)				PS
<i>Cerithidium diplax</i> (Watson, 1886)				+
<i>Cerithidium perparvulum</i> (Watson, 1886)				+
<i>Cerithium scabridum</i> Philippi, 1848			+	+
<i>Rhinoclavis kochi</i> (Philippi, 1848)				+
Dialidae				
<i>Diala semistriata</i> (Philippi, 1849)				+
Litiopidae				
<i>Gibborissoia virgata</i> (Philippi, 1849)				+
Scaliolidae				
<i>Finella pupoides</i> A. Adams, 1860			+	+
Triphoridae				
<i>Metaxia bacillum</i> (Issel, 1869)				+
Cerithiopsidae				
<i>Cerithiopsis pulvis</i> (Issel, 1869)				+
<i>Cerithiopsis tenthrenois</i> (Melvill, 1896)				+
Epitoniidae				
<i>Cycloscala hyalina</i> (G. B. Sowerby II, 1844)				+
Eulimidae				
<i>Sticteulima lentiginosa</i> (A. Adams, 1861)				+
Rissoidae				
<i>Alvania dorbignyi</i> (Audouin, 1826)			+	+
<i>Rissoina ambigua</i> (Gould, 1849)				+
<i>Rissoina bertholleti</i> Issel, 1869			+	+
Caecidae				
<i>Caecum sepimentum</i> de Folin, 1868				+
Strombidae				
<i>Conomurex persicus</i> (Swainson, 1821)			+	+
Calyptraeidae				
<i>Crepidula fornicata</i> (Linnaeus, 1758)			+	
Triviidae				
Taxon	BS	SM	AS	LS
** <i>Eratoena sulcifera</i> (Gray in Sowerby GBI, 1832)				L1
Cypraeidae				
<i>Purpuradusta gracilis notata</i> (Gill, 1858)				+
Naticidae				
<i>Eunaticina papilla</i> Gmelin, 1791				+
Muricidae				
<i>Ergalatax junionae</i> Houart, 2008			+	+
<i>Rapana venosa</i> (Valenciennes, 1846)	+	+	+	
<i>Thaisella lacera</i> (Born, 1778)				+
Columbellidae				
<i>Zafra savignyi</i> (Moazzo, 1939)				+
<i>Zafra selasphora</i> (Melvil & Standen, 1901)				+
** <i>Zafra obesula</i> (Hervier, 1899)				L1
** <i>Zafra pumilla</i> (Dunker, 1858)				L1
Clathurellidae				
<i>Lienardia mighelsi</i> Iredale & Tomlin, 1917			+	
Mangeliidae				
<i>Pseudoraphitoma iodolabiata</i> (Hornung & Mermod, 1928)				+
Pyramidellidae				
<i>Chrysallida fischeri</i> (Hornung & Mermod, 1925)				+
<i>Chrysallida maiae</i> (Hornung & Mermod, 1924)				+
<i>Pyrgulina nana</i> (Hornung & Mermod, 1924)			+	+
<i>Chrysallida pirinthella</i> (Melvill, 1910)				+
<i>Cingulina isseli</i> (Tryon, 1886)				+
<i>Iolaea neofelixoides</i> (Nomura, 1936)				+
<i>Monotyga fulva</i> (A. Adams, 1853)			+	
<i>Monotyga lauta</i> (A. Adams, 1853)			+	+
<i>Odostomia lorioli</i> (Hornung & Mermod, 1924)			+	+
<i>Syrnola cincitella</i> A. Adams, 1863				+
<i>Syrnola fasciata</i> Jickeli, 1882			+	+
<i>Syrnola lendix</i> (A. Adams, 1863)				+
<i>Turbonilla edgarii</i> (Melvill, 1896)				+
Amathinidae				
<i>Amathina tricarinata</i> (Linnaeus, 1767)				+
<i>Leucotina cf. eva</i> Thiele, 1925			+	+
* <i>Leucotina natalensis</i> E.A. Smith, 1910			PS	+
Bullidae				
<i>Bulla arabica</i> Malaquias & Reid, 2008				+
Haminoeidae				
<i>Atys macandrewi</i> E. A. Smith, 1872				+
<i>Haminoea cyanomarginata</i> Heller & Thompson, 1983			+	+
Aglajidae				

Table 2. Continued

Taxon	BS	SM	AS	LS
<i>Chelidonura fulvipunctata</i> Baba, 1938			+	+
Cylichnidae				
<i>Acteocina crithodes</i> Melvill & Standen, 1907				+
<i>Acteocina mucronata</i> (Philippi, 1849)				+
Retusidae				
<i>Cylichnina girardi</i> (Audouin, 1826)			+	+
* <i>Pyrunculus fourierii</i> (Audouin, 1826)			PS	+
** <i>Retusa desgenetti</i> (Audouin, 1826)				L2
Oxynoidae				
<i>Oxynoe viridis</i> (Pease, 1861)				+
Plakobranhidae				
<i>Elysia grandifolia</i> Kelaart, 1857				+
<i>Elysia tomentosa</i> Jensen, 1997			+	+
Aplysiidae				
<i>Aplysia dactylomela</i> Rang, 1828				+
<i>Aplysia parvula</i> Mörch, 1863		+	+	+
<i>Bursatella leachii</i> de Blainville, 1817			+	+
<i>Notarchus punctatus</i> Philippi, 1836			+	+
<i>Syphonota geographica</i> (Adams & Reeve, 1850)				+
Chromodorididae				
<i>Chromodoris quadricolor</i> (Rüppell & Leuckart, 1830)				+
<i>Goniobranchus annulatus</i> (Eliot, 1904)				+
<i>Hypselodoris infucata</i> (Rüppell & Leuckart, 1830)				+
Dendrodorididae				
<i>Dendrodoris fumata</i> (Rüppell and Leuckart, 1830)				+
Polyceridae				
<i>Plocamopherus ocellatus</i> Rüppell & Leuckart, 1828				+
<i>Placomopherus tilesii</i> Bergh, 1877				+
Tethydidae				
<i>Melibe viridis</i> (Kelaart, 1858)				+
Aeolidiidae				
<i>Baeolidia moebii</i> Bergh, 1888				+
Flabellinidae				
<i>Flabellina rubrolineata</i> (O'Donoghue, 1929)			+	+
Siphonariidae				
<i>Siphonaria belcheri</i> Hanley, 1858				+
<i>Siphonaria crenata</i> de Blainville, 1827				+
BIVALVIA				
Arcidae				
<i>Anadara kagoshimensis</i> (Tokunaga, 1906)	+	+	+	
<i>Anadara natalensis</i> (Krauss, 1848)				+
<i>Anadara transversa</i> (Say, 1822)			+	+
Mytilidae				
<i>Arcuatula perfragilis</i> (Dunker, 1857)				+

Taxon	BS	SM	AS	LS
* <i>Arcuatula senhousia</i> (Benson in Cantor, 1842)		PS	+	+
<i>Brachidontes pharaonis</i> (Fischer, 1870)			+	+
<i>Septifer bilocularis</i> (Linnaeus, 1758)				+
* <i>Septifer cumingii</i> Recluz, 1849			L4	+
Pteriidae				
<i>Electroma vexillum</i> (Reeve, 1857)				+
<i>Pinctada radiata</i> (Leach, 1814)			+	+
Malleidae				
<i>Malleus regula</i> (Forskall in Niebuhr, 1775)			+	+
Spondylidae				
<i>Spondylus spinosus</i> Schreibers, 1793			+	+
Ostreidae				
<i>Crassostrea gigas</i> (Thunberg, 1793)		+	+	+
<i>Dendostrea frons</i> (Linnaeus, 1758)				+
<i>Saccostrea cucullata</i> (Born, 1778)				+
Carditidae				
<i>Centrocardia akabana</i> (Sturany, 1899)				+
Chamidae				
<i>Chama asperella</i> Lamarck, 1819		+	+	+
<i>Chama pacifica</i> Broderip, 1835				+
Galeommatidae				
<i>Nudiscintilla cf. glabra</i> Lützen & Nielsen, 2005				+
Cardiidae				
<i>Afrocardium richardi</i> (Audouin, 1826)				+
<i>Fulvia fragilis</i> (Forsskal in Niebuhr, 1775)			+	+
Tellinidae				
<i>Psammotreta praeurupta</i> (Salisbury, 1934)		+		+
<i>Tellina valtonis</i> Hanley, 1844				+
Semelidae				
<i>Ervilia scaliola</i> Issel, 1869				+
Veneridae				
<i>Antigona lamellaris</i> Schumacher, 1817				+
<i>Clementia papyracea</i> (Gray, 1825)				+
<i>Gafrarium pectinatum</i> (Linnaeus, 1758)				+
<i>Gouldiopa consternans</i> (Oliver & Zuschin, 2001)				+
<i>Paphia textile</i> (Gmelin, 1791)				+
<i>Petricola fabagella</i> Lamarck, 1818				+
<i>Ruditapes philippinarum</i> (Adams & Reeve, 1850)		+	+	
<i>Timoclea roemeriana</i> (Issel, 1869)				+
Myidae				
<i>Mya arenaria</i> Linnaeus, 1758	+	+	+	
<i>Sphenia rueppellii</i> A. Adams, 1850				+
** <i>Martesia striata</i> (Linnaeus, 1758)				L3
Teredinidae				

Table 2. Continued

Taxon	BS	SM	AS	LS
<i>Teredo bartschi</i> Clapp, 1923				+
<i>Teredo navalis</i> Linnaeus, 1758	+	+	+	+
<i>Teredothyra dominicensis</i> (Bartsch, 1921)				+
Gastrochaenidae				
<i>Cucurbitula cymbium</i> (Spengler, 1783)				+
Laternulidae				

Taxon	BS	SM	AS	LS
<i>Laternula anatina</i> (Linnaeus, 1758)				+
CEPHALOPODA				
Loliginidae				
<i>Sepioteuthis lessoniana</i> Lesson, 1830				+
Octopodidae				
<i>Amphioctopus aegina</i> (Gray, 1849)				+

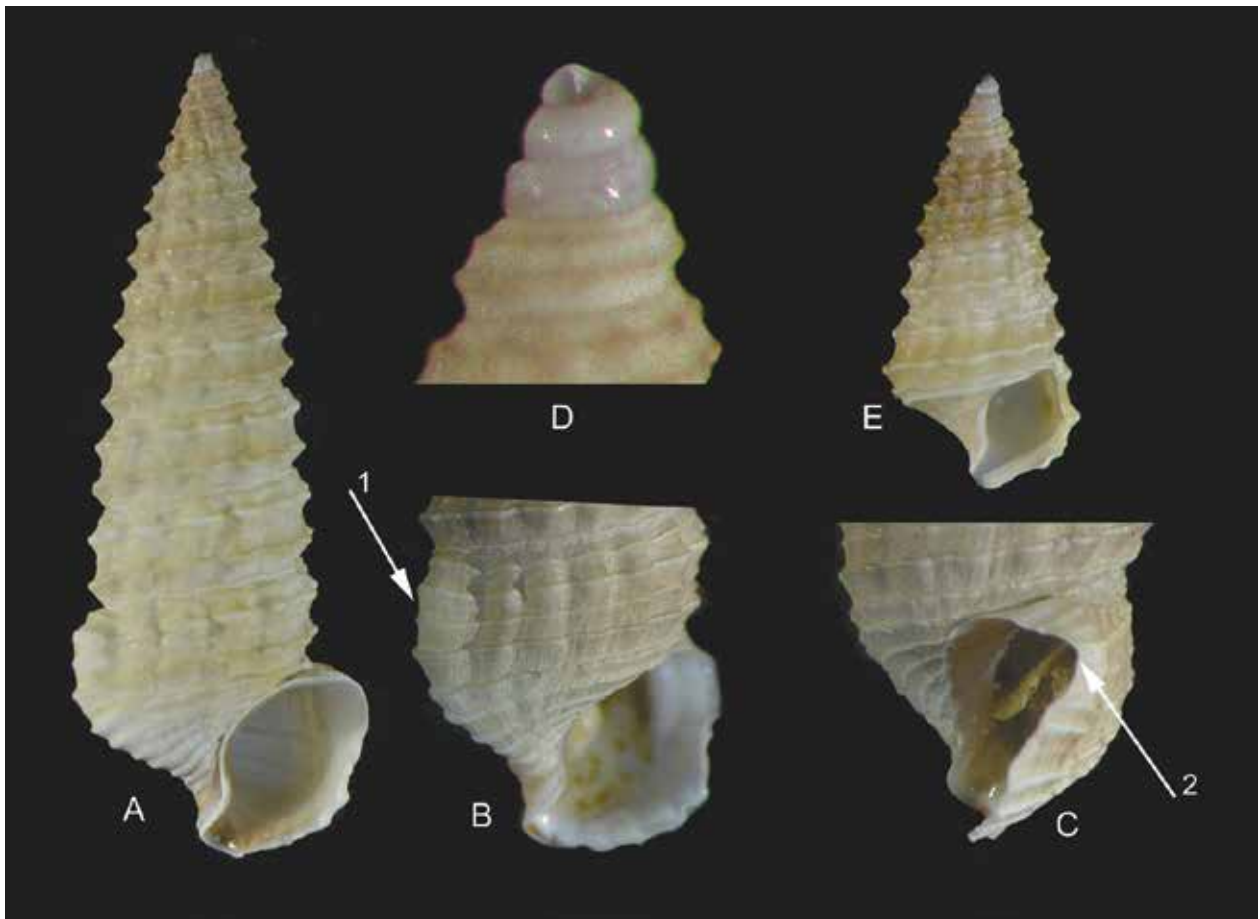


Fig. 4. *Varicopeza pauxilla* (A. Adams, 1855): Ventral view of a specimen (A, h=9.1 mm), body whorl (B and C), protoconch (D), and a young specimen (E, h=3.9 mm)

region. The importance of the Suez Canal as a vector of introduction is most evident in the Levantine Sea and gradually diminishes from the Levantine Sea to the Black Sea (ÇINAR et al. 2011). *Varicopeza pauxilla*, which was encountered at five stations along the Levantine Sea (Table 1, Fig. 1), seems to be an established species. The other gastropods, *L. natalensis* and *P. fourierii*, are also established molluscs recorded in the past from many localities in the Turkish part of the Levantine Sea.

The bivalve *A. senhousia* is a small fragile filter feeder, being considered an opportunistic species with a high reproductive capacity and a fast growth rate. It

may form large populations with more than 25,000 ind./m² and thus alter the structure of the sediment where it settled. This could lead to changes in the pre-established macrobenthic communities (MISTRI 2003, MUNARI 2008, KATSANEVAKIS et al. 2014). It is possible that the intensive shipping activities are one of the important pathways that facilitate the spread of *A. senhousia* into the Sea of Marmara.

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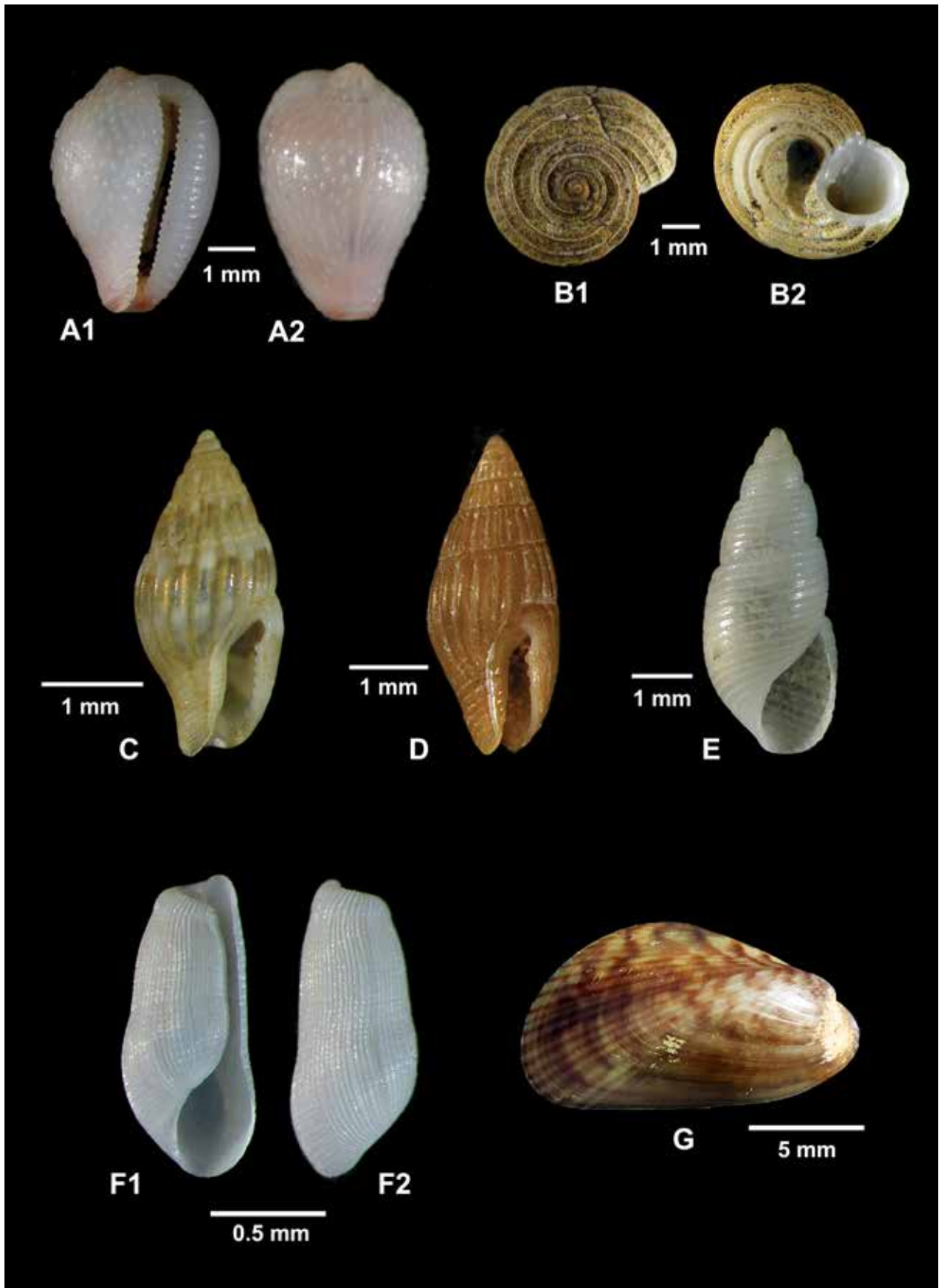


Fig. 5. Some of the alien mollusc species newly reported for the Turkish Sea coastal waters after 2014 (A1, A2: *Era-toena sulcifera*; B1, B2: *Lodderia novemcarinata*; C: *Zafra obesula*; D: *Zafra pumilla*; E: *Leucotina natalensis*; F1, F2: *Pyrrunculus fourierii*; G: *Arcuatula senhousia*)

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