

NON-MARINE MOLLUSCS OF THE ISLAND OF BRAČ (CROATIA) –WHEN CAN THE ISLAND BE CONSIDERED EXPLORED?

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Seventy-nine species of terrestrial, freshwater and brackish water molluscs were found on the island of Brač during our long-term field survey and literature review. The species diversity on Brač is the highest among the Croatian islands surveyed. The current occurrence of rare species and species with small ranges is commented on in more detail. Twenty-two taxa are newly recorded for the island, and two of them (*Lucilla scintilla* (T.R. Lowe, 1852) and *Limax wohlberedti* Simroth, 1900) are the first confirmed records in Croatia. Only four historically published taxa from the island were not confirmed by our fieldwork, three of them living in caves we did not visit. Most of the recorded species have small ranges in the Mediterranean; according to current knowledge, two species are endemic to Brač, *Medora hiltrudae* Nordsieck, 1970 and *Tandonia bolensis* De Mattia & Nardi, 2014. As there is a lot of confusion in the identification of Mediterranean fauna, we created ample photographic documentation of the species found. Although we found most of the species in the first three years of our research, new species were added almost every year during the thirteen years of fieldwork.

Key words: Gastropoda, Bivalvia, Croatia, Dalmatia, Brač Island, Adriatic, faunistics

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Tijekom naših dugotrajnih terenskih i literaturnih istraživanja otoka Brača zabilježili smo 79 vrsta kopnenih, slatkovodnih i boćatih vrsta mekušaca. Raznolikost vrsta na Braču najveća je od svih istraživanih hrvatskih otoka. U radu se detaljno komentiraju nalazi rijetkih vrsta te vrsta s malim arealom. Za otok su novozabilježene 22 svojte, a dvije od njih (*Lucilla scintilla* (T.R. Lowe, 1852) i *Limax wohlberedti* Simroth, 1900) su prvi potvrđeni nalazi za Hrvatsku. Četiri prethodno za otok zabilježene svojte nisu potvrđene našim terenskim istraživanjem, od toga tri u špiljama koje nismo obišli. Većina zabilježenih vrsta zauzima manje areale na području Sredozemlja; prema dosadašnjim spoznajama dvije vrste su endemične za Brač: *Medora hiltrudae* Nordsieck, 1970 i *Tandonia bolensis* De Mattia & Nardi, 2014. Budući da postoji dosta zbrke u identifikaciji faune Sredozemlja, donosimo obilnu fotodokumentaciju pronađenih vrsta. Iako smo većinu vrsta pronašli u prve tri godine našeg istraživanja, skoro svake godine u naših trinaest godina terenskog rada pronašli bismo neku novu vrstu.

Ključne riječi: Gastropoda, Bivalvia, Hrvatska, Dalmacija, otok Brač, Jadran, faunistika

INTRODUCTION

Although research on the mollusc fauna of the Croatian islands has been going on for decades, mainly thanks to Vesna Štamol, we are still very far from having exhausted their interest. In the coastal Adriatic Sea area of Croatia, there are 79 islands and 525 islets covered with vegetation (DUPLANČIĆ LEDER *et al.*, 2004). To date 18 large islands have been explored: – Krk (BOLE, 1958; BERAN, 2018 – only freshwater and brackish species), Cres, Lošinj (ŠTAMOL & VELKOVRH, 1995), Susak (ŠTAMOL & POJE, 1998), Pag (FISCHER *et al.*, 2000; REISCHÜTZ & REISCHÜTZ, 2005; BERAN, 2014 – only freshwater and brackish species), Dugi otok (ŠTAMOL, 2004; ŠTAMOL & KLETEČKI, 2005), Rab (BERAN, 2015 – only freshwater and brackish species), Brač (ŠTAMOL, 1986; KITTEL, 2002), Vis (REISCHÜTZ & REISCHÜTZ, 1999), Korčula (REISCHÜTZ & REISCHÜTZ, 2002), Mljet (ŠTAMOL, 1995; REISCHÜTZ & REISCHÜTZ, 2000), Kornat (ŠTAMOL *et al.*, 2012; 2014), Šolta, Drvenik Veliki, Drvenik Mali (ŠTAMOL *et al.*, 2017), Žirje, Kaprije, Prvić (ŠTAMOL *et al.*, 2018), and the 83 islets that make up the Kornati archipelago (ŠTAMOL *et al.*, 2012; 2014). However, repeated research on the same island almost always leads to the discovery of new species (e.g. ŠTAMOL, 1986; 1987; KITTEL, 2002; this study), which is due to both the high beta diversity and the small distribution areas of local species, including the often island-like occurrences of mainly rock dwelling species (see WELTER-SCHULTES, 2012) in the extremely complex karstic terrain (RAĐA *et al.*, 2020).

The only study summarising research on the malacofauna of Croatian islands concluded that island area and altitude are proportionate while there is no evidence that either island size or isolation is responsible for the impoverishment of the snail fauna (ŠTAMOL *et al.*, 2014).

In this study, we followed up on previous research on the island of Brač. We have significantly increased the number of localities studied and completed the list of species living here.

Study area

The island of Brač is the largest of the central Dalmatian islands and the third largest in the Adriatic. The total area is 394 km², the length is 36 km, and the maximum width is 12 km. The minimum distance between the island and the Dalmatian coast is 5 km, while Hvar and Šolta Islands are 3.3 km and 0.7 km away, respectively. The highest point, Vidova Gora Mt. (778 m a.s.l.), is also the highest peak of all the Croatian islands (Fig. 1A). The island is built of limestone and dolomite, mostly of Cretaceous age, forming cliffs and crags, especially on the shores. The landscape is dominated by a karst relief with numerous grikes, abysses (Fig. 1H), caves, and sinkholes (Fig. 1C) (RAĐA *et al.*, 2020). The famous Brač limestone quarries, known already since Roman times, are important sources of high-quality limestone. Brown Primorje soils are found on the inland plateau, so-called terra rossa is a widespread soil type, and terra fusca occurs sporadically on slopes.

The climate of the area is Mediterranean with long hot and dry summers and mild winters. The average January/July temperatures range from 4.9°/22.9°C in the inland (Pražnice) to 7.2°/24.7°C on the coast (Sutivan). Precipitation is higher inland (Pražnice, 1450 mm) than on the coast, especially in the northwest (Sutivan, 830 mm). Most of the precipitation falls in winter. The island climate is mostly moderated by winds (Vruljska bora from the mainland and the jugo or sirocco from the sea). There are no permanent surface water streams. The few small freshwater ponds, called lokve, are mostly

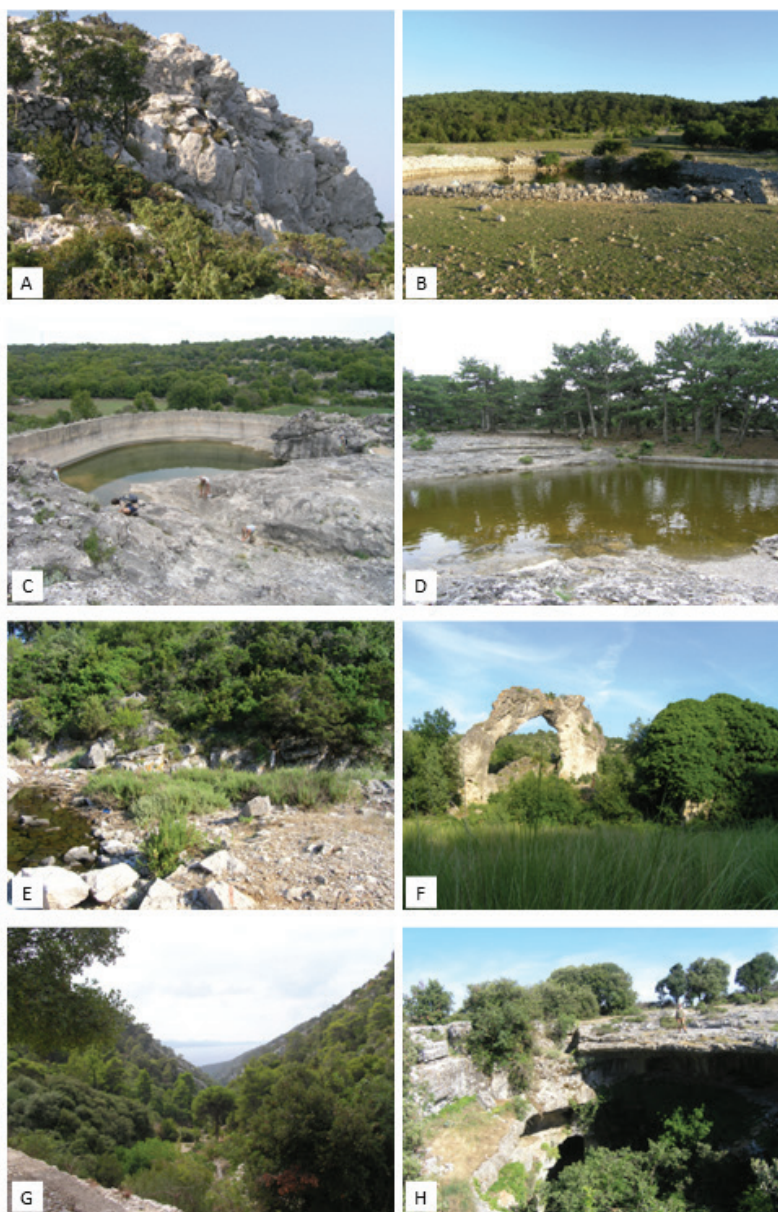


Fig. 1. Important localities of Brač: A – the limestone cliffs at the highest peak of all Croatian islands Vidova Gora host the abundant population of *Medora contracta*. This site is the *locus typicus* of this species; B – water reservoir near Gažul is surrounded by old pasture Black pine forest; C – maquis is the dominant vegetation type of the island. The doline near Pražnice is the greatest sinkhole on the island; D – the natural depression adapted to the water reservoir near the road to Vidova Gora is surrounded by Black pine forest; E – the salt marsh in Rasotica Bay is patterned with the occurrence of halophilic species *Ovatella myosotis* and *Truncatella subcylindracea*; F – the striking Koloč rock formation is partly overgrown with *Hedera helix* and surrounded by maquis and field; G – fragments of *Quercus ilex* forests originally covering the majority of island area are still preserved in Blaca Valley; H – Jama Plišćivica abyss, an example of karst phenomena on the island, is surrounded by maquis (*Quercus ilex*, *Fraxinus ornus*, *Hedera helix*).

natural depressions that have been adapted by man to increase their capacity, and some of them are completely artificial (Fig. 1B, C, D) (DERADO 1984, RADA *et al.* 2020).

The vegetation of Brač belongs to the central area of the eastern Adriatic Mediterranean zone, while the area around Vidova Gora belongs to the alpine-high northern zone (HORVATÍĆ 1963). The vegetation is adapted to the terrain. Most of the island was originally covered with *Quercus ilex* forests (*Orno-Quercetum ilicus*). Fragments of these forests are still preserved in some steep valleys (Fig. 1G). Recently, the lower parts of the island have been covered with plantations of Aleppo pine (*Pinus halepensis*), especially around the villages. The higher parts of the interior (above 400 m a.s.l.) are covered by black pine (*Pinus nigra*) forests (Fig. 1B, D). At present, forests cover about 25% of the island's area. The dominant type of vegetation is evergreen scrub (maquis) (Fig. 1C, E, F), often growing on abandoned agricultural land. Other parts of the island are covered by pastures, olive, fig, and almond orchards and vineyards. The rare salt marshes with halophilic vegetation are situated in some of the many bays (Fig. 1B).

Human settlement on Brač began in the Neolithic period, mainly on the coast. The inland area was settled later, due to raids by pirates that devastated the coast from the Middle Ages until the 18th century. The construction of dust-free roads and the connection to the water supply from the mainland in the 1970s accelerated the development of tourism, the abandonment of traditional agricultural methods, and the movement of people from hamlets to larger villages.

The history of malacological research

Malacological research on Brač was first reviewed by ŠTAMOL (1986), who summarized the scattered old records and added her own. Further references have been reviewed by KITTEL (2002). Among the historical records, the following should be mentioned. ROSSMÄSSLER (1842) described the species *Medora contracta* (Rossmässler, 1842) from Vidova Gora Mt. WAGNER (1914) in his study of cave snails, based mostly on material collected by K. Absolon, described *Spelaeoconcha paganettii polymorpha* (Wagner, 1914) from the caves Studenski Ratac, Ješkalovica, and Činjadra in Brač, and Belušica cave in Hercegovina (Trebinje area), and *Cecilioides acicula jeskalovicensis* Wagner, 1914, based on a single shell from Ješkalovica cave. ABSOLON & KSENNEMANN (1942) published an extensive paper on biospeleological research in Brač, including detailed descriptions of all examined caves accompanied with enumerations of collected invertebrates, as well as photos of *Cecilioides acicula jeskalovicensis* and *Spelaeoconcha paganettii polymorpha*; they also listed another endemic species from Ješkalovica cave – *Cecilioides incognita* sp. nov., which however remains an unavailable name (see Discussion).

More recently, two endemic species of the family Clausiliidae – *Delima hiltrudis* Nordsieck, 1969 and *Medora hiltrudae* Nordsieck, 1970 – were described by NORDSIECK (1969, 1970). However, as ŠTAMOL *et al.* (2017) showed, *D. hiltrudis* is not endemic to Brač but it is also found on the neighboring Šolta Island. GROSSU (1972) included specimens from Brač in the type series of *Deroceras bosniensis* Grossu, 1972, which is currently a junior synonym of *D. turcicum* (Simroth, 1894). The last new species described from the island is *Tandonia bolensis* De Mattia & Nardi, 2014, known only from the type locality near Bol (DE MATTIA & NARDI, 2014).

The subterranean fauna of Brač has so far been insufficiently surveyed. RADOMAN (1983, 1985) found the underground *Litthabittella chilodia* (Westerlund, 1886) in the Stu-

denac spring near Škrip; and RAĐA *et al.* (2020) mentioned three subterranean freshwater species of the genus *Eupaludestrina* (Mabille, 1877) (under the name *Semisalsa* Radoman, 1974 of unclear taxonomic position in Minjera Cave.

ŠTAMOL (1986) conducted the first systematic research on the island (26 visited sites) resulting in the finding of 44 species. Together with the old data she cited 53 species from Brač. Later, ŠTAMOL (1987) added the record of *Medora almissana* (Küster, 1847) from a single site in Dol village. KITTEL (2002) revisited some of Štamol's collecting sites, completed unpublished records, and examined a few new localities. He found five more species previously unknown from the island: *Ancylus fluviatilis* O. F. Müller, 1774, *Trochoidea trochoides* (Poiret, 1789), *Xerotricha conspurcata* (Draparnaud, 1801), *Liburnica denudata* (Rossmässler, 1836), and *Cantareus apertus* (Born, 1778) (Tab.1).

MATERIALS AND METHODS

One hundred and five sites were studied in June 2001, 2008, 2009, 2014, July 2010, 2012, and end of August–September 2002–2007, 2010, and 2011 to complete the representative network of sites (see below). Shells were collected through repeated visual searches at most sites, with several people taking part. Freshwater shells were collected with the use of a kitchen strainer. Combined standard 3-liter samples of litter and topsoil were collected from several sites. The samples were dried, and washed, and organic material was – after repeated drying – sorted into separate size categories. Molluscs were sorted and identified under a stereomicroscope. The shells of land and freshwater snails found on the coast in drifts were omitted from the results. The material examined is mostly deposited in the collection of the first author.

List of recently researched localities

In the locality list below, the data are given in the following order: locality number, the nearest village, locality name, characteristic of the site, geographical coordinates, altitude (in m a.s.l.), date of investigation, and the names of collectors (LJ – Lucie Juříčková, PK – Petr Kment, AM – Alena Míkovcová, AJ – Anna Jansová, DŘ – Dagmar B. Říhová, JČH – Jaroslav Č. Hlaváč, JH – Jitka Horáčková, JP – Jan Procházka, JŠ – Jana Škodová, LB – Luboš Beran, MD – Magda Drvotová, MH – Michal Horsák, VH – Vilém Hrdlička).

1. Milna area – cape Ražanj, near lighthouse, 43.3199N, 16.4090E, 3 m, 15.6.2014, lgt. LJ, PK
2. Milna area – Osibova bay, church garden and salt marsh on the beach, 43.3157N, 16.4346E, 1 m, 15.6.2014, lgt. LJ, PK
3. Milna area – Osibova bay, rock on the east site of the bay, *Pinus halepensis*, 43.3101N, 16.4350E, 10 m, 15.6.2014, lgt. LJ, PK
4. Milna area – Slavinjina bay, sparse growth of *Pinus halepensis*, 43.3121N, 16.4505E, 30 m, 15.6.2014, lgt. LJ, PK
5. Milna area – *Pinus halepensis* forest between the village and the lighthouse, stone walls, 43.3197N, 16.4239E, 5–30 m, 12.9.2003, lgt. LJ, JP
6. Milna – cliffs in the port, 43.3245N, 16.4500E, 5 m, 12.9.2003, lgt. LJ

7. Milna area – Podhume, small rocks around the village, after the fire, 43.3208N, 16.5006E, 270 m, 25.7.2012, lgt. LJ, PK
8. Bobovišća area – Luka Bobovišća bay, salt marsh and walls around, 43.3636N, 16.4493E, 0 m, 3.9.2004, lgt. LJ, PK
9. Bobovišća area – Luka Bobovišća, limestone cliffs, 43.3630N, 16.4508E, 40 m, 3.9.2004, lgt. LJ, PK
10. Bobovišća – park in the village, 43.3494N, 16.4644E, 1 m, 12.9.2003, lgt. LJ
11. Bobovišća area – valley of limestone cliffs S of the village, 43.3502N, 16.4677E, 40 m, 12.9.2003, lgt. LJ
12. Dračevica area – valley between Čelo and V. Hum, 43.3277N, 16.5169E, 300 m, 16.6.2008, lgt. LJ, PK
13. Nerežišća area – Koloč, stone gate with *Hedera helix* and surroundings, 43.3246N, 16.5580E, 350 m, 8.6.2009, lgt. LJ, PK
14. Donji Humac area – the mouth of Kopačina Cave and the surrounding maquis, 43.3528N, 16.5526E, 340 m, 13.6.2009, lgt. LJ, PK
15. Donji Humac – village, 43.3413N, 16.5591E, 310 m, 13.6.2009, lgt. LJ, PK
16. Ložišća area – St. Martin's chapel, 43.3468N, 16.4780E, 180 m, 12.9.2003, lgt. LJ, PK
17. Sutivan area – valley N of Hum Hill, cliffs, olive orchard, 43.3697N, 16.4752E, 120 m, 19.9.2005, lgt. LJ, PK
18. Sutivan – ruins and surrounding of the church, 43.3861N, 16.4773E, 5 m, 17.7.2012, lgt. LJ, PK
19. Mirca area – valley of the dry brook Murvica 1 km S of Mirca, humid bush, 43.3657N, 16.5185E, 160–180 m, 19.9.2005, lgt. LJ, PK
20. Mirca area – watering place 1 km S of Mirca, vineyard, 43.3500N, 16.5166E, 180 m, 19.9.2005, lgt. LJ, PK
21. Mirca area – rocky maquis 1 km SE of Mirca, 200 m, 43.3679N, 16.5310E, 19.9.2005, lgt. LJ, PK
22. Supetar – park in the city, 43.3837N, 16.5538E, 15 m, 26.6.2008, lgt. LJ
23. Supetar area – Trolokve E of the city, 43.3775N, 16.5695E, 50 m, 30.8.2010, lgt. LJ, PK
24. Splitska – water reservoir and surrounding maquis, 43.3756N, 16.6083E, 50 m, 10.6.2009, lgt. LJ, LB
25. Škrip area – water reservoir with *Chara* sp. on Humčac hill, rich open vegetation in surrounding, 43.3594N, 16.6029E, 250 m, 30.8.2010, lgt. LJ, PK
26. Škrip area –Hercules Roman quarry, *Quercus ilex*, *Arbutus unedo*, *Viburnum tinus*, 43.3683N, 16.6046E, 90 m, 30.8.2010, lgt. LJ, PK
27. Škrip – historical center, museum, cemetery, viewpoint, 43.3553N, 16.6124E, 240 m, 4.9.2007, 10.6.2009, lgt. LJ, PK
28. Dol – valley upon the village, limestone agglomerate rocks, 43.3473N, 16.6215E, 130–250 m, 10.9.2003, lgt. LJ
29. Dol area – Hladna voda valley, limestone agglomerate rocks, stream with cascades – flood deposits, 43.3455N, 16.6108E, 110 m, 10.6.2009, lgt. LJ, PK
30. Dol area – Hladna voda valley, the upper part of the valley, mostly *Quercus ilex*, 43.3328N, 16.6020E – 43.3402N, 16.6113E, 150–330m, 18.6.2009, lgt. LJ, PK

31. Nerežišća area – dried up stream bed, *Pinus halepensis*, *Quercus ilex*, 43.3225N, 16.5956E, 500 m, 18.6.2009, lgt. LJ, PK
32. Dol area – limestone cliffs E of the village, the church garden, 43.3516N, 16.6230E, 100–120 m, 10.9.2003, 30.8.2004, lgt. LJ, PK
33. Dol – small isolated rock inside the village, 43.3484N, 16.6223E, 100 m, 12.9.2005, 21.6.2014, lgt. LJ, PK
34. Postira area – limestone cliffs NW of Oklade, 43.3616N, 16.6794E, 50 m, 14.9.2003, lgt. LJ, JČH
35. Postira – around the church, lime trees, 43.3761N, 16.6290E, 5 m, 31.8.2011, lgt. LJ, PK
36. Postira area – Lovrečina bay, ruins of St. Lovro church, *Hedera helix*, 43.3687N, 16.6648E, 15 m, 31.8.2011, lgt. LJ, PK
37. Blaca area – Smrka valley, wide valley, limestone cliffs, orchards, 43.2997N, 16.5111E, 370 m, 6.9.2007, lgt. LJ, PK
38. Blaca area – valley between Blaca valley and Smrka valley W of Humac hill, small limestone rocks, 43.3008N, 16.5277E, 70–250 m, 6.9.2007, lgt. LJ, PK
39. Blaca valley – bay, *Pinus halepensis* forest, limestone rocks, 43.2783N, 16.5169E, 0–50 m, 9.9.2003, lgt. LJ
40. Blaca area – forest valley above the Blaca hermitage, cliffs, 43.2950N, 16.5300E, 100–360 m, 19.6.2001, 6.9.2002, 18.9.2005, lgt. LJ, PK, MH, JH, MD, JČH, AM, DŘ, VH
41. Bol area – branch of the road to Vidova Gora in the direction of Blaca, 43.3155N, 16.5916E, 570 m, 1.9.2004, lgt. LJ
42. Bol area – Vidova Gora, cliffs on the mountain top, 780 m, 43.2788N, 16.6197E, 7.9.2002, 14.9.2003, 4.9.2004, 26.8.2011, 23.7.2012, 16.6.2014, lgt. LJ, PK, MH, MD
43. Bol area – Vidova Gora, patch of *Ostrya carpinifolia*, 43.2832N, 16.6239E, 750 m, 19.6.2014, lgt. LJ, PK
44. Bol area – Vidova Gora, east from the top, steep rock with niches, 43.2849N, 16.6391E, 711 m, 19.6.2014, lgt. LJ, PK
45. Bol area – Vidova Gora, grikes between top and airport, *Juniperus oxycedrus*, 43.2823N, 16.6509E, 650 m, 19.6.2014, lgt. LJ, PK
46. Bol area – Vidova Gora – the rocks near the parking place, 43.2819N, 16.6225E, 700 m, 10.9.2002, lgt. LJ
47. Bol area – Vidova Gora, *Pinus nigra* forest and pastures N of the road, 690–700 m, 43.2908N, 16.6119E, 10.9.2002, 14.9.2003, 23.7.2012, 16.6.2014, lgt. LJ, PK
48. Bol area – Vidova Gora, pond, ca. 0.5 km from the top, the mouth of the cave, 43.2869N, 16.6171E, 720 m, 17.9.2005, 24.6.2008, 28.8.2011, 23.7.2012, 16.6.2014, lgt. LJ, PK
49. Bol area – way from Bol to Murvica, dump, 43.2636N, 16.6141E, 16.9.2005, 70 m, lgt. JH
50. Bol area – Veliko Koštilo valley, way from Bol to Vidova Gora, 43.2800N, 16.6405E, 17.9.2005, 8.9.2006, 355 m, lgt. LJ, PK, MD, JH
51. Bol – walls and gardens in the city, 43.26167N, 16.6425E, 10 m, 8.9.2006, lgt. LJ, PK

52. Bol – Dominican monastery, garden with palm trees, 43.2606N, 16.6664E, 5 m, 26.8.2010, lgt. LJ, PK
53. Murvica area – SW orientated limestone rocks upon the village and Zmajeva Cave, 43.2672N, 16.5938E – 43.2691N, 16.5991E, 100 -190 m, 7.9.2003, 9.9.2007, 21.6.2008, lgt. LJ, JP, PK
55. Pražnice area – Gažul, pastures around the farmhouse, 43.3025N, 16.6336E, 590 m, 12.9.2003, lgt. LJ
56. Pražnice area – Trolokve pools near Gažul, pastures, 43.2920N, 16.6275E, 670 m, 7.9.2002, 9.6.2009, 29.8.2011, 23.7.2012, 16.6.2014, lgt. LJ, PK, MH, JČH, LB
57. Pražnice area – maquis 1 km N of the airport towards the main road, the spring, 43.3072N, 16.6708E, 530 m, 5.9.2006, lgt. LJ, PK, MD
58. Pražnice area – doline on the way from the airport to the main road, 43.3133N, 16.6783E, 482 m, 7.9.2006, lgt. LJ, PK, MD
59. Pražnice area – pasture at Brač airport, 43.2770N, 16.6710E, 550 m, 19.6.2014, lgt. LJ, PK
60. Pražnice area – great doline NW of Pražnice, water reservoir and surrounding, 43.3186N, 16.6836E, 371 m, 9.9.2006, 11.9.2007, 15.6.2008, 17.6.2009, 16.7.2012, lgt. LJ, PK, MD, AJ, JŠ
61. Pražnice area – great doline NW of Pražnice, grikes in *Quercus ilex* wood, 43.3182N, 16.6793E, 380 m, 16.7.2012, lgt. LJ, PK, LB, AJ, JŠ
62. Pražnice area – doline near the main road to Supetar, limestone cliffs, 43.3105N, 16.6352E, 444 m, 9.9.2006, 16.6.2008, lgt. LJ, PK, MD
63. Gornji Humac – quarry W of the village, 43.2879N, 16.7168E, 410 m, 16.6.2008, lgt. LJ, PK
64. Gornji Humac area – Gradišće hill, 43.2906N, 16.7154E, 430–487 m, 13.9.2003, lgt. LJ
65. Gornji Humac area – Ravnice, new vineyard, 43.2755N, 16.7066E, 450 m, 19.6.2014, lgt. LJ, PK
66. Gornji Humac area – jama Plišćivica abyss and surrounding maquis (*Quercus ilex*, *Fraxinus ornus*, *Hedera helix*), 43.3115N, 16.7166E, 390 m, 15.6.2009, 29.8.2010, lgt. LJ, PK
67. Gornji Humac area – maquis near St. George's chapel, 43.3086N, 16.7227E, 400 m, 29.8.2010, lgt. LJ, PK
68. Gornji Humac area – doline Oskorušica and surrounding maquis (*Quercus ilex*, *Paliurus spina-christi*), 43.2958N, 16.7566E, 370 m, 22.8.2010, lgt. LJ, PK
69. Gornji Humac area – water reservoir Lokva SE of the village with *Chara* sp. and *Juncus* sp., stony walls, steps, 43.2806N, 16.7405E, 400 m, 1.9.2010, 26.8.2011, lgt. LJ, PK
70. Gornji Humac area – cliff above the Hrvatska bay, rocky grassland, *Ostrya carpinifolia*, *Quercus ilex*, 43.2683N, 16.7575E, 5–250 m, 23.8.2010, 28.8.2010, lgt. LJ, PK
71. Gornji Humac area –Konjska bay, 43.2652N, 16.7531E, 20–210 m, rocky steppes, *Pistacia lentiscus*, *Spartium junceum*, 25.8.2010, 28.8.2010, lgt. LJ, PK
72. Selca area – surrounding of St. John's chapel, ca. 5 km W of Selca, 43.3063N, 16.7965E, 360 m, pastures, maquis, pines, walls, the well, 3.9.2005, 3.9.2006, lgt. LJ, PK

73. Pučišća – dolomite cliffs around water reservoir, *Pinus halepensis*, 43.3533N, 16.7372E, 10 m, 17.6.2009, lgt. LJ
74. Pučišća area – Široki Dolac, agricultural landscape, olive orchards, 43.3302N, 16.7669E, 190 m, 2.9.2010, 18.6.2014, lgt. LJ, PK
75. Pučišća – walls and gardens in the city, 43.3475N, 16.7330E, 5 m, 18.6.2014, lgt. LJ, PK
76. Pučišća area – valley with grikes, 43.3380N, 16.7491E, 60 m, 18.6.2014, lgt. LJ, PK
77. Povelja area – Luka bay N of town, maquis, 43.3392N, 16.7911E, 20 m, 5.9.2002, lgt. LJ
78. Povelja area – NE of Šćirova glava, stony walls and scraps, olive orchards, 43.3290N, 16.8189E, 140 m, 17.6.2014, lgt. LJ, PK
79. Povelja area – stony walls and grikes, olive orchards, 43.3270N, 16.8124E, 160 m, 17.6.2014, lgt. LJ, PK
80. Povelja area – maquis SW of Povelja, 43.3200N, 16.8167E, 130 m, 19.9.2008, lgt. LJ, PK
81. Povelja – cliffs and bushes near the sea, 43.3366N, 16.8358E, 10 m, 15.9.2005, 25.8.2011, 26.6.2014, lgt. LJ, PK
82. Povelja area – St. Anthony's chapel 1 km SW of the village, maquis, 43.3217N, 16.8386E, 150 m, 15.9.2005, lgt. LJ, PK
83. Selca area – Vošćica bay, limestone cliffs, maquis, 43.3250N, 16.8630E, 0–50 m, 13.9.2003, lgt. LJ
84. Selca area – Polsmrčevik, maquis, 43.2827N, 16.7952E, 340 m, 12.9.2005, lgt. LJ, PK, MH
85. Selca area – Mala Hrvatska bay, seashore cliffs, 43.2633N, 16.7847E, 0–100 m, 12.9.2005, lgt. LJ, PK, MH
86. Selca area – the valley between Vela Studena bay and Nazor, *Pinus halepensis* forest, 43.2802N, 16.8294E, 170 m, 18.9.2008, lgt. LJ, PK
87. Selca area – NE of Nadselo, maquis with solitary *Quercus ilex*, 43.3008N, 16.8011E, 320 m, 7.6.2009, lgt. LJ, PK
88. Selca – park in the village, 43.2969N, 16.8487E, 110 m, 10.9.2007, 26.6.2014, lgt. LJ, PK
89. Selca area – surrounding of the church of St. John and St. Paul, 43.3063N, 16.7971E, 320 m, 19.7.2012, lgt. LJ, PK
90. Selca area – quarry near St. Nicholas', 43.2958N, 16.8627E, 150 m, 18.9.2008, lgt. VH
91. Novo Selo near Selca – village, 43.3075N, 16.8441E, 190 m, 27.8.2011, lgt. LJ, PK
92. Selca area – Vela Studena bay W of Sumartin, maquis, small cliffs on the NW side of the bay, 43.2751N, 16.8347E, 160 m, 8.9.2002, lgt. LJ, PK, MH, JČH
93. Selca area – Vela Studena bay W of Sumartin, maquis, small cliffs in the SE side of the bay, 43.2755N, 16.8411E, 120 m, 16.9.2003, lgt. LJ
94. Selca area – Vela Zvirje bay, limestone cliffs, orchards, 43.2713N, 16.8133E, 50–150 m, 9.9.2002, 16.9.2003, 2.9.2004, lgt. LJ, PK, MH
95. Selca area – unnamed bay between Vela Studena and Vela Zvirje bays, maquis, rocks, 43.2697N, 16.8333E, 70 m, 9.9.2002, lgt. LJ, PK, MH, JČH
96. Sumartin area – lighthouse at Rt Lašćatna, rocky maquis, 43.3133N, 16.8938E, 5–10 m, 16.9.2005, lgt. LJ, PK

97. Sumartin area – Rasotica bay, salt marsh, 43.3075N, 16.8854E, 0 m, 11.9.2005, 4.9.2006, 5.9.2007, 22.6.2008, 14.6.2009, 20.6.2014. lgt. LJ, PK, LB
98. Sumartin area – Rasotica, cliffs between the bay and the village, 43.3079N, 16.8850E, 10–50 m, 18.6.2001, 3.9.2002, 4.9.2006, 5.9.2007, 22.6.2008, 14.6.2009, lgt. LJ, PK, MH, MD, JČH
99. Sumartin area – Put Rasotice, way from Sumartin (from the former Manjana camp) to Rasotica, maquis, limestone cliffs, 80 m, 43.2988N, 16.8795E, 18.6.2001, 5.9.2007, lgt. LJ, PK
100. Sumartin – town (gardens, walls, dumps, etc.), 43.2861N, 16.8694E, 16.–22.6.2001, 31.8.–11.9.2002, 7.–17.9.2003, 28.8.–8.9.2004, 8.–19.9.2005, 2.–12.9.2006, 3.–12.9.2007, 3.10.2010, lgt. LJ, PK, MH, MD, JH, VH, JČH, AM, DŘ
101. Sumartin – limestone quarry near the village, 43.2853N, 16.8619E, 5–20 m, 5.9.2004, 24.9.2008, lgt. LJ, PK
102. Sumartin area – former Manjana camp and surrounding olive orchards, 43.2878N, 16.8762E, 40–80 m, 16.–22.6.2001, 31.8.–11.9.2002, 7.–17.9.2003, 28.8.–8.9.2004, 8.–19.9.2005, 2.–12.9.2006, 3.–12.9.2007, 6.6.2009, lgt. LJ, PK, MH, MD, JH, VH, JČH, AM, DŘ
103. Sumartin area – Lučica bay under the former Manjana camp, 43.2888N, 16.8783E, 10–30 m, 17.6.2001, 15.6.2009, lgt. LJ, LB
104. Sumartin area – hill upon the town, *Pinus halepensis* forest, 43.2897N, 16.8700E, 88 m, 1.9.2002, lgt. LJ
105. Sumartin area – Manjajama II, cave with brackish water, 43.3112N, 16.8974E, 15 m, 19.6.2009, LB

RESULTS

During thirteen years of malacological research on the Croatian island of Brač, we found 75 species of non-marine molluscs in 105 localities (Tab. 1 and the list below). When previously published observations are added there are 79 species (70 terrestrial snails, 5 freshwater snails, 3 brackish water snails, and 1 freshwater bivalve) on on this island (Tab. 1). 45% of the species recorded have a small distribution range and 31% of the species are southern European. Only 6% of the species are widespread, Holarctic or Palaearctic. The majority (56%) of the species recorded are epigean, 27% of the species live on calcareous rocks and cliffs, 10% of the molluscs are subterranean or terricolous, six are freshwater and three species are halophilic. Most species are snails, and only 6 (8%) are slugs.

Tab. 1. The list of all taxa recorded from the Brač Island. Older published records were summarized by ŠTAMOL (1986).

	older published records	Štamol (1986, 1987)	Kittel (2002)	this paper
<i>Cochlostoma cinerascens</i> (Rossmässler, 1837)	–	+	+	+
<i>Cochlostoma gracile</i> (L.Pfeiffer, 1849)	–	+	+	+
<i>Cochlostoma scalarinum</i> (Villa, 1841)	+	+	+	+

	older published records	Štamol (1986, 1987)	Kittel (2002)	this paper
<i>Pomatias elegans</i> (O.F.Müller, 1774)	+	+	+	+
<i>Eupaludestrina stagnorum</i> (Gmelin, 1791)	–	–	–	+
<i>Litthabitella</i> cf. <i>chilodia</i> (Westerlund, 1886)	+	–	–	–
cf. <i>Paladilhopsis</i> sp.	–	–	–	+
<i>Truncatella subcylindrica</i> (Linnaeus, 1767)	–	+	–	+
<i>Ancylus fluviatilis</i> O.F.Müller, 1774	–	–	+	+
<i>Holandriana holandrii</i> (C. Pfeiffer, 1828)	–	–	–	+
<i>Myosotella myosotis</i> (Draparnaud, 1805)	–	–	–	+
<i>Ovatella firminii</i> (Payraudeau, 1827)	–	–	–	+
<i>Zospeum amoneum</i> (Frauenfeld, 1856)	+	–	–	–
<i>Hypnophila pupaeformis</i> (Cantraine, 1836)	+	+	+	+
<i>Lauria cylindracea</i> (Da Costa, 1778)	–	+	+	+
<i>Odontocyclas kokeilii</i> (Rossmässler, 1837)	–	+	–	+
<i>Vallonia pulchella</i> (O.F.Müller, 1774)	–	–	–	+
<i>Vallonia costata</i> (O.F.Müller, 1774)	–	–	–	+
<i>Acanthinula aculeata</i> (O.F.Müller, 1774)	–	+	–	+
<i>Pyramidula cephalonica</i> (Westerlund, 1898)	–	+	–	+
<i>Pyramidula pusilla</i> (Vallot, 1801)	–	–	–	+
<i>Granaria frumentum illyrica</i> (Rossmässler, 1835)	+	+	+	+
<i>Chondrina spelta spelta</i> (Beck, 1837)	–	–	–	+
<i>Chondrina spelta ventilatoris</i> (Westerlund, 1875)	+	+	+	+
<i>Rupestrella philippii</i> (Cantraine, 1840)	–	+	–	+
<i>Rupestrella rhodia</i> (Roth, 1839)	–	+	+	+
<i>Truncatellina callicratis</i> (Scacchi, 1833)	+	+	+	+
<i>Truncatellina claustralis</i> (Gredler, 1856)	–	+	–	+
<i>Spelaeoconcha paganettii</i> A.J. Wagner, 1914	+	+	–	+
<i>Ena subtilis</i> (Rossmässler, 1835)	–	–	–	+
<i>Pseudojaminia seductilis</i> (Rossmässler, 1837)	–	+	+	+
<i>Chondrula quinquedentata</i> (Rossmässler, 1837)	–	+	+	+
<i>Agathyla biloba</i> (Wagner, 1914)	–	–	–	+
<i>Medora almissana</i> (Küster, 1847)	–	+	–	+
<i>Medora contracta contracta</i> (Rossmässler, 1842)	+	+	+	+
<i>Medora hiltrudae</i> H.Nordsieck, 1970	+	+	+	+
<i>Delima blanda conspurcata</i> (Rossmässler, 1836)	+	+	+	+
<i>Delima hiltrudis</i> H.Nordsieck, 1969	+	+	–	+
<i>Delima semirugata semirugata</i> (Rossmässler, 1836)	+	+	+	+
<i>Papillifera papillaris</i> (O.F.Müller, 1774)	–	–	–	+

	older published records	Štamol (1986, 1987)	Kittel (2002)	this paper
<i>Cecilioides acicula jeskalovicensis</i> A.J.Wagner, 1914	+	–	–	–
<i>Cecilioides acicula acicula</i> (O.F.Müller, 1774)	+	+	+	+
<i>Cecilioides veneta</i> (Strobel, 1855)	+	+	+	+
<i>Rumina decollata</i> (Linnaeus, 1758)	–	–	–	+
<i>Poiretia cornea</i> (Brumati, 1838)	+	+	+	+
<i>Punctum pygmaeum</i> (Draparnaud, 1801)	–	+	+	+
<i>Lucilla scintilla</i> (T.R.Lowe, 1852)	–	–	–	+
<i>Vitrea botterii</i> (L.Pfeiffer, 1853)	+	+	+	+
<i>Vitrea subrimata</i> (Reinhardt, 1871)	+	+	+	+
<i>Oxychilus cellarius</i> (O.F.Müller, 1774)	–	+	–	+
<i>Oxychilus draparnaudi</i> (H.Beck, 1837)	–	+	+	+
<i>Mediterranea planorbis</i> (Möllendorff, 1899)	–	–	–	+
<i>Mediterranea hydatina</i> (Rossmässler, 1838)	–	+	–	+
<i>Limax wohlberedti</i> Simroth, 1900	–	–	–	+
<i>Limacus cf. flavus</i> (Linnaeus, 1758)	–	–	–	+
<i>Tandonia bolensis</i> De Mattia et Nardi 2014	–	–	–	+
<i>Tandonia fejevaryi</i> (Wagner, 1929)	–	–	–	+
<i>Tandonia reuleauxi</i> (Clessin, 1887)	+	–	–	+
<i>Tandonia sowerbyi</i> (A.Férussac, 1823)	+	–	–	–
<i>Aegopis acies</i> (A.Férussac, 1832)	+	+	+	+
<i>Deroceras turcicum</i> (Simroth, 1894)	+	–	–	+
<i>Monacha cartusiana</i> (O.F.Müller, 1774)	–	+	–	+
<i>Monacha parumcincta</i> (Menke, 1828)	–	+	+	+
<i>Trochoidea trochoides</i> (Poiret, 1789)	–	–	+	+
<i>Trochoidea pyramidata</i> (Draparnaud, 1805)	–	–	–	+
<i>Xerotricha conspurcata</i> (Draparnaud, 1801)	–	–	+	+
<i>Cernuella jonica</i> (Mousson 1854)	–	+	–	+
<i>Cernuella virgata</i> (Da Costa, 1778)	–	+	–	+
<i>Cochlicella acuta</i> (O.F.Müller, 1774)	–	+	–	+
<i>Hiltrudia mathildae</i> (Westerlund, 1875)	+	+	+	+
<i>Liburnica denudata</i> (Rossmässler, 1836)	–	–	+	+
<i>Liburnica setosa</i> (Rossmässler, 1836)	–	+	+	+
<i>Eobania vermiculata</i> (O.F.Müller, 1774)	+	+	+	+
<i>Cantareus apertus</i> (Born, 1778)	–	–	+	+
<i>Cornu aspersum</i> (O.F.Müller, 1774)	–	+	+	+
<i>Helix secernenda</i> Rossmässler, 1847	+	+	+	+
<i>Sphaerium lacustre</i> (O.F.Müller, 1774)	–	–	–	+

We found 22 species and one subspecies for the first time on Brač: *Agathylla sulcosa*, *Ena subtilis*, *Eupaludestrina stagnorum*, *Holandriana holandrii*, *Chondrina spelta spelta*, *Limax wohlberedti*, *Limacus* cf. *flavus*, *Lucilla scintilla*, *Myosotella myosotis*, *Ovatella firminii*, *Papillifera papillaris*, *Pyramidula pusilla*, *Rumina decolata*, *Sphaerium lacustre*, *Mediterranea planorbis*, *Tandonia fejevaryi*, *Trochoidea pyramidata*, *Vallonia pulchella*, *V. costata*. One of them is an unspecified freshwater cave species probably of a new genus conchologically resembling the genus *Paladilhiopsis* Pavlović, 1913 and one unspecified species of the family Oxychilidae.

The most abundant species on the island is *Delima semirugata*, which was found in 87% of all sampled sites, including the plantations of *Pinus halepensis*. The shells of this species show considerable intraspecific variation within the island – at lower altitudes it creates forms up to twice as large as those on the plateau around Vidova Gora (see Fig. 3F). Another very abundant species on the island is *Cochlostoma scalarinum*, found on rocks as well as on stony walls almost everywhere on the island except the highest elevations around Vidova Gora. The epigeic prosobranch *Pomatias elegans* has a similar distribution. *Monacha parumcincta* and the predatory *Poiretia cornea* were also very abundant.

Two pairs of related epilithic (rock-dwelling) taxa have a completely uneven distribution on the island. *Pyramidula cephalonica* is a relatively common species on shaded rocks or stony walls, while *P. pusilla* was found only at two sites in the central part of the island near Nerežišća. The larger subspecies *Chondrina spelta ventilatoris* is quite common on natural rocks, while the nominotypical subspecies *Ch. s. spelta* was found only on a single rock in the harbor of Sumartin.

Three localities with relatively small natural coastal salt marshes were found on the island, with *Myosotella myosotis* and *Truncatella subcylindrica* as typical inhabitants of these habitats. *Ovatella firminii* inhabits the rocky seacoast and *Eupaludestrina stagnorum* was found in brackish water of Manjajama II cave. These four species were not previously known to occur on the island.

There are no permanent surface freshwater streams on the island, which is why open, often natural, but man-modified, or completely artificial rainwater reservoirs have been used as freshwater sources in many places. Two species of freshwater snails (*Ancylus fluviatilis* and *Holandriana holandrii*) and a single species of freshwater bivalve (*Sphaerium lacustre*) have been found in some of them.

Although most of the species were found in the first three years of the survey, new species were discovered on the island almost every year until the end of the survey (Fig. 2).

As the publications on Croatian land snails are generally poor in photo documentation, which makes the identification of the local fauna difficult, as well as the verification of possible identification errors, we have prepared plates with figures of almost all species shells found, supplemented with living specimens where possible (Figs. 3–9).

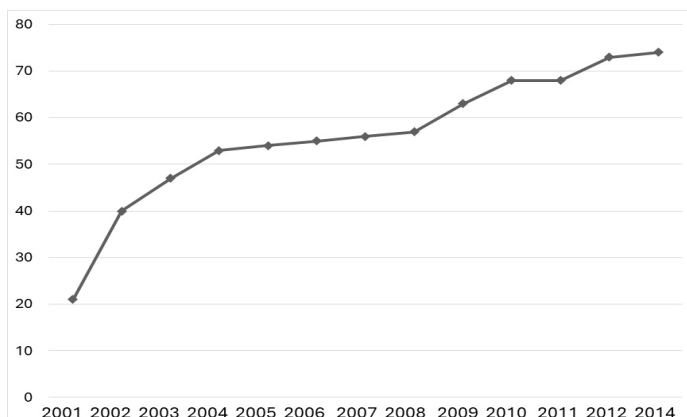


Fig. 2. Cumulative curve of the number of species found on Brač in the years 2001–2014.

List of species with finding sites

The site numbers correspond to the site list above.

1. *Cochlostoma cinerascens* (Rossmässler, 1837): 42, 43, 44, 46, 47, 50 (Fig. 4A)
2. *Cochlostoma gracile* (L. Pfeiffer, 1849): 3, 4, 8, 12, 25, 28, 37, 38, 39, 40, 44, 45, 57, 58, 61, 62, 64, 65, 68, 69, 79, 91 (Fig. 4C)
3. *Cochlostoma scalarinum* (Villa, 1841): 3, 4, 5, 6, 7, 8, 9, 11, 12, 16, 17, 20, 25, 26, 29, 30, 31, 34, 39, 40, 57, 62, 63, 67, 68, 69, 70, 71, 72, 73, 74, 76, 77, 79, 80, 81, 82, 83, 85, 86, 87, 90, 92, 93, 94, 95, 96, 98, 99, 101, 102, 104 (Fig. 4B)
4. *Pomatias elegans* (O. F. Müller, 1774): 1, 2, 3, 5, 6, 7, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 25, 27, 29, 30, 31, 35, 36, 38, 39, 40, 49, 50, 52, 53, 54, 58, 69, 70, 71, 73, 74, 77, 78, 79, 81, 83, 85, 86, 88, 90, 91, 92, 93, 94, 95, 96, 98, 100, 101, 102, 104 (Fig. 5E)
5. *Eupaludestrina stagnorum* (Gmelin, 1791): 105
6. *Litthabitella cf. chilodia* (Westerlund, 1866): 29, 52 (Fig. 7G)
7. cf. *Paladilhopsis* sp.: 29 (Fig. 7H)
8. *Truncatella subcylindrica* (Linnaeus, 1767): 13, 97 (Fig. 7F)
9. *Ancylus fluviatilis* O. F. Müller, 1774: 29, 56, 60, 69, 97
10. *Holandriana holandrii* (C. Pfeiffer, 1828): 23, 25
11. *Myosotella myosotis* (Draparnaud, 1805): 8, 97 (Fig. 7E)
12. *Ovatella firminii* (Payraudeau, 1827): 103
13. *Hypnophila pupaeformis* (Cantraine, 1836): 3, 8, 9, 11, 12, 18, 19, 22, 25, 27, 29, 30, 32, 34, 38, 40, 42, 53, 60, 71, 73, 79, 81, 83, 85, 88, 91, 92, 93, 94, 98, 102 (Fig. 5N)
14. *Lauria cylindracea* (Da Costa, 1778): 5, 11, 13, 15, 17, 22, 27, 40, 52, 60, 63, 64, 81, 82, 98, 100, 101, 102 (Fig. 5M)
15. *Spelaeoconcha paganettii* A. J. Wagner, 1914: 14, 29, 31, 60 (Fig. 7J)
16. *Odontocyclas kokeilii* (Rossmässler, 1837): 11, 60 (Fig. 7I)

17. *Vallonia pulchella* (O. F. Müller, 1774): 22, 52 (Fig. 5H)
18. *Vallonia costata* (O. F. Müller, 1774): 52 (Fig. 5G)
19. *Acanthinula aculeata* (O. F. Müller, 1774): 11, 12, 19, 25, 26, 29, 37, 40, 57, 58, 60, 77, 98 (Fig. 5F)
20. *Pyramidula cephalonica* (Westerlund, 1898): 25, 26, 67, 69, 72, 74, 82, 89, 98, 101, 102 (Fig. 4I)
21. *Pyramidula pusilla* (Vallot, 1801): 13, 17 (Fig. 4J)
22. *Granaria frumentum illyrica* (Rossmässler, 1835): 2, 3, 4, 6, 9, 12, 20, 27, 29, 31, 32, 38, 39, 40, 42, 44, 45, 49, 50, 53, 56, 58, 64, 67, 73, 74, 76, 70, 79, 81, 83, 93, 94, 95 (Fig. 5B)
23. *Chondrina spelta spelta* (Beck, 1837): 101 (Fig. 4D)
24. *Chondrina spelta ventilatoris* (Westerlund, 1875): 29, 30, 31, 37, 38, 39, 40, 42, 43, 44, 46, 53, 54, 58, 61, 62, 64, 70, 71, 94, 101 (Fig. 4E)
25. *Rupestrella philippii* (Cantraine, 1840): 3, 6, 9, 11, 17, 39, 40, 53, 71, 83, 92, 93, 94, 98, 101 (Fig. 4G)
26. *Rupestrella rhodia* (Roth, 1839): 5, 11, 12, 16, 26, 29, 31, 32, 37, 39, 40, 68, 71, 76, 79, 81, 83, 94, 98 (Fig. 4H)
27. *Truncatellina callicratis* (Scacchi, 1833): 9, 11, 12, 19, 26, 27, 31, 40, 43, 53, 69, 77, 79, 98 (Fig. 5I)
28. *Truncatellina claustralis* (Gredler, 1856): 29, 52 (Fig. 5J)
29. *Ena subtilis* (Rossmässler, 1835): 29, 32, 34, 40, 60, 61, 67 (Fig. 4F)
30. *Pseudojaminia seductilis* (Rossmässler, 1837): 45, 47, 50, 55, 56, 58, 67, 69 (Fig. 5C)
31. *Chondrula quinquedentata* (Rossmässler, 1837): 2, 3, 6, 9, 40, 47, 49, 50, 53, 56, 72, 78, 83, 93, 94, 95, 98 (Fig. 5D)
32. *Agathylla sulcosa* (J.A. Wagner, 1829): 61 (Fig. 3D)
33. *Medora almissana* (Küster, 1847): 29, 33 (Fig. 3A)
34. *Medora contracta contracta* (Rossmässler, 1842): 42, 43, 44, 46, 50, 54 (Fig. 3B)
35. *Medora hiltrudae* H. Nordsieck, 1970: 91, 94, 101 (Fig. 3C)
36. *Delima blanda conspurcata* (Rossmässler, 1836): 101 (Fig. 3G)
37. *Delima hiltrudis* H. Nordsieck, 1969: 5, 7, 9, 11, 17, 18 (Fig. 3H)
38. *Delima semirugata semirugata* (Rossmässler, 1836): 1, 2, 3, 4, 5, 6, 8, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 36, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 52, 54, 55, 56, 57, 58, 60, 61, 62, 63, 64, 65, 67, 68, 69, 70, 71, 72, 73, 74, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 90, 91, 92, 94, 95, 96, 98, 101, 102, 103, 104 (Fig. 3F)
39. *Papillifera papillaris* (O. F. Müller, 1774): 2, 18, 22, 32, 35, 75 (Fig. 3E)
40. *Ceciloides acicula acicula* (O. F. Müller, 1774): 14, 29, 31, 40, 65, 71 (Fig. 7K)
41. *Ceciloides veneta* (Strobel, 1855): 6, 19, 29, 37, 60, 63, 70, 71, 79, 85 (Fig. 7L)
42. *Rumina decollata* (Linnaeus, 1758): 1, 18, 35, 49, 51, 98, 100 (Fig. 5O)
43. *Poiretia cornea* (Brumati, 1838): 2, 4, 5, 6, 7, 9, 11, 12, 13, 16, 17, 18, 24, 25, 26, 27, 28, 30, 31, 35, 38, 39, 40, 42, 43, 44, 47, 48, 49, 50, 52, 53, 54, 57, 60, 61, 62, 65, 67, 68, 69, 70, 71, 72, 73, 74, 77, 78, 79, 81, 82, 83, 85, 87, 89, 90, 91, 92, 93, 96, 98, 101, 102, 104 (Fig. 5A)
44. *Punctum pygmaeum* (Draparnaud, 1801): 11, 12, 25, 26, 29, 31, 40, 43, 60, 68, 77, 98 (Fig. 5K)
45. *Lucilla scintilla* (T. R. Lowe, 1852): 52 (Fig. 5L)
46. *Vitrea botterii* (L. Pfeiffer, 1853): 11, 12, 13, 15, 19, 20, 21, 23, 24, 25, 26, 27, 29, 31, 34, 35, 37, 38, 39, 40, 43, 53, 57, 58, 60, 64, 67, 68, 70, 71, 72, 73, 74, 76, 79, 81, 92, 94, 96 (Fig. 6H)

47. *Vitrea subrimata* (Reinhardt, 1871): 12, 26, 29, 40, 43, 60, 74, 77, 79, 82, 98, 101, 103 (Fig. 6G)
48. *Oxychilus cellarius* (O.F.Müller, 1774): 17, 18, 19, 21, 24, 26, 30, 32, 36, 40, 52, 56, 60, 67, 69, 73, 86, 94, 102 (Fig. 6C)
49. *Oxychilus draparnaudi* (H. Beck, 1837): 18, 28, 29, 35, 81, 86, 92 (Fig. 6B)
50. *Oxychilus* sp.: 52 (Fig. 6E)
51. *Mediterranea hydatina* (Rossmässler, 1838): 13, 14, 27, 29, 36, 70 (Fig. 6F)
52. *Mediterranea planorbis* (Möllendorff, 1899): 83, 94, 102 (Fig. 6D)
53. *Limax wohlberedti* Simroth, 1900: 62 (Fig. 7C)
54. *Limacus* cf. *flavus* (Linnaeus, 1758): 100 (Fig. 7D)
55. *Tandonia bolensis* De Mattia et Nardi 2014: 66
56. *Tandonia fejevaryi* (Wagner, 1929): 47, 56, 60, 86, 88, 98, 102 (Fig. 7A)
57. *Tandonia reuleauxi* (Clessin, 1887): 42, 48, 56, 60, 62 (Fig. 7B)
58. *Aegopis acies* (A. Férussac, 1832): 14, 60, 72, 78, 79, 81, 82, 86, 88, 89, 90, 91, 93, 98, 101, 102 (Fig. 6A)
59. *Deroceras turcicum* (Simroth, 1894): 47, 56
60. *Monacha cartusiana* (O. F. Müller, 1774): 2, 7, 11, 13, 17, 18, 20, 25, 27, 28, 29, 32, 36, 51, 56, 64, 74, 81, 88, 89, 102, 104 (Fig. 8B)
61. *Monacha parumcincta* (Menke, 1828): 1, 2, 4, 5, 6, 7, 9, 12, 13, 14, 16, 17, 23, 24, 25, 27, 28, 29, 32, 34, 35, 37, 38, 39, 40, 42, 44, 45, 47, 48, 49, 50, 51, 54, 55, 56, 57, 58, 60, 62, 63, 65, 67, 68, 69, 70, 71, 72, 73, 74, 76, 77, 78, 79, 80, 81, 82, 83, 84, 86, 87, 88, 89, 90, 91, 92, 94, 96, 98, 99, 100, 101, 102, 103, 104 (Fig. 8A)
62. *Trochoidea trochoides* (Poiret, 1789): 22, 98 (Fig. 8F)
63. *Trochoidea pyramidata* (Draparnaud, 1805): 49 (Fig. 8G)
64. *Xerotricha conspurcata* (Draparnaud, 1801): 35, 52, 101 (Fig. 8H)
65. *Cochlicella acuta* (O. F. Müller, 1774): 2
66. *Cernuella virgata* (Da Costa, 1778): 49, 51, 58, 59, 81, 88, 100 (Fig. 8D)
67. *Cernuella jonica* (Mousson 1854): 2, 10, 15, 18, 22, 28, 32, 35, 44, 45, 47, 52, 76, 81, 88, 91, 98, 101, 102 (Fig. 8C)
68. *Hiltrudia mathildae* (Westerlund, 1875): 2, 3, 4, 5, 7, 8, 9, 11, 12, 16, 17, 19, 20, 21, 23, 25, 26, 29, 30, 32, 39, 40, 47, 48, 50, 56, 60, 62, 70, 71, 77, 78, 79, 82, 83, 86, 91, 92, 93, 94, 95, 96, 98, 101 (Fig. 8E)
69. *Liburnica setosa* (Rossmässler, 1836): 11, 12, 13, 17, 27, 28, 31, 32, 33, 35, 60, 62, 70, 71, 81, 83, 90, 91, 92, 93, 98, 102 (Fig. 9E)
70. *Liburnica denudata* (Rossmässler, 1836): 7, 26, 29, 37, 38, 39, 40, 42, 44, 50, 54, 57, 60, 63, 65, 67, 68, 69, 74 (Fig. 9F)
71. *Eobania vermiculata* (O. F. Müller, 1774): 1, 2, 4, 7, 8, 14, 15, 17, 18, 20, 22, 24, 25, 27, 28, 32, 35, 36, 37, 49, 51, 70, 71, 75, 78, 81, 82, 88, 91, 92, 93, 94, 96, 98, 100, 101, 102, 104 (Fig. 9A)
72. *Cantareus apertus* (Born, 1778): 28, 51, 52, 88, 100, 102 (Fig. 9B)
73. *Cornu aspersum* (O. F. Müller, 1774): 2, 7, 18, 22, 27, 32, 35, 50, 51, 52, 73, 75, 81, 91, 100, 102 (Fig. 9C)
74. *Helix secernenda* Rossmässler, 1847: 14, 31, 37, 38, 39, 40, 42, 44, 45, 53, 54, 56, 57, 60, 62, 63, 65, 68, 70, 71, 79, 102 (Fig. 9D)
75. *Sphaerium lacustre* (O. F. Müller, 1774): 56

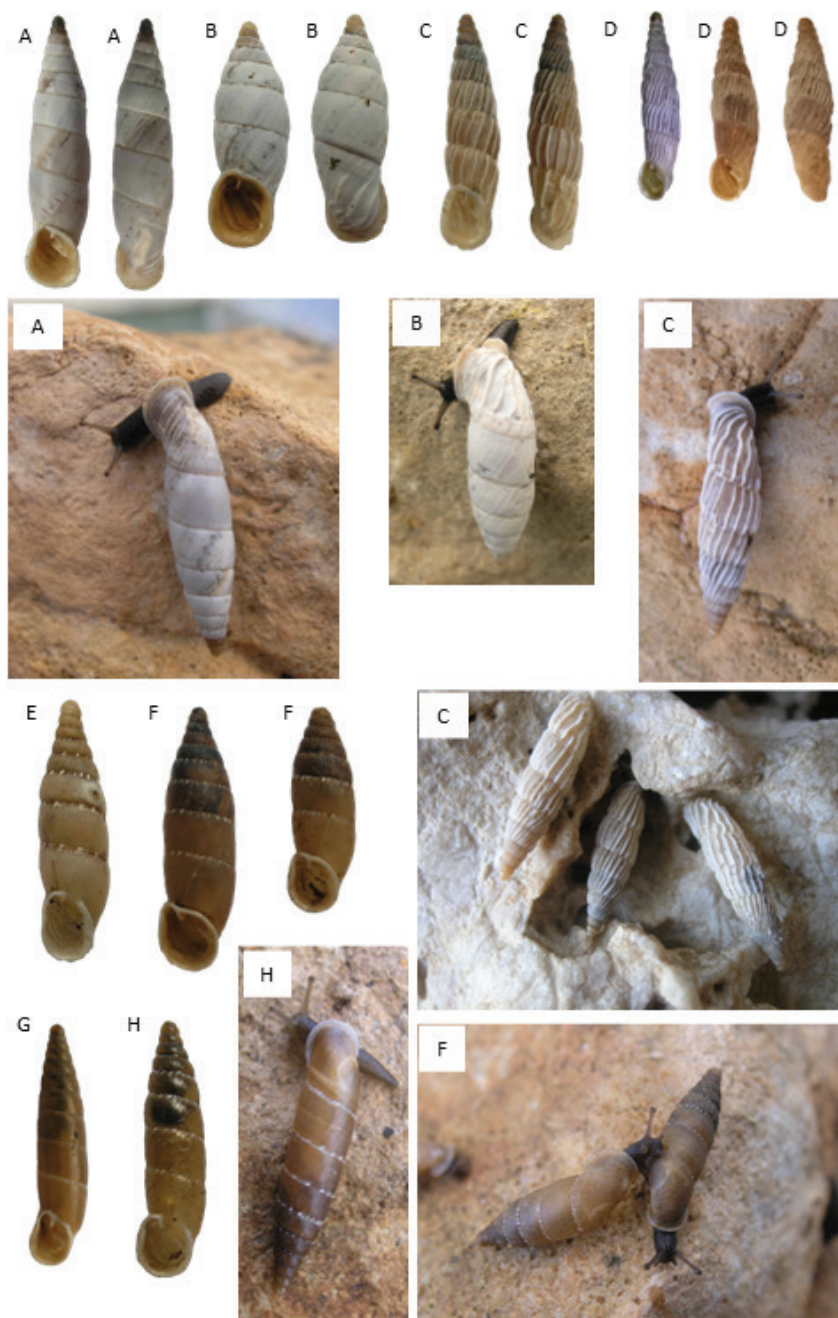


Fig. 3. Clausilids of Brač: A – *Medora almissana* – rock in Dol village, H 25 mm; B – *Medora contracta* – Vidova Gora, the top of the hill, H 18 mm; C – *Medora hiltrudae* – Sumartin, the limestone quarry, H 18 mm; D *Agathylla sulcosa* – the great doline north-west from Pražnice, H 15 mm; E – *Papillifera papillaris* – walls in Dol village, H 16 mm; F – *Delima semirugata* – left: Dol village, right, H 17 mm; Gažul – pastures around the farmhouse, H 10 mm; G – *Delima blanda conspurcata* – Sumartin, the limestone quarry, H 13 mm; H – *Delima hilrudis* – Sutivan area, a valley north from Hum hill, H 14 mm.

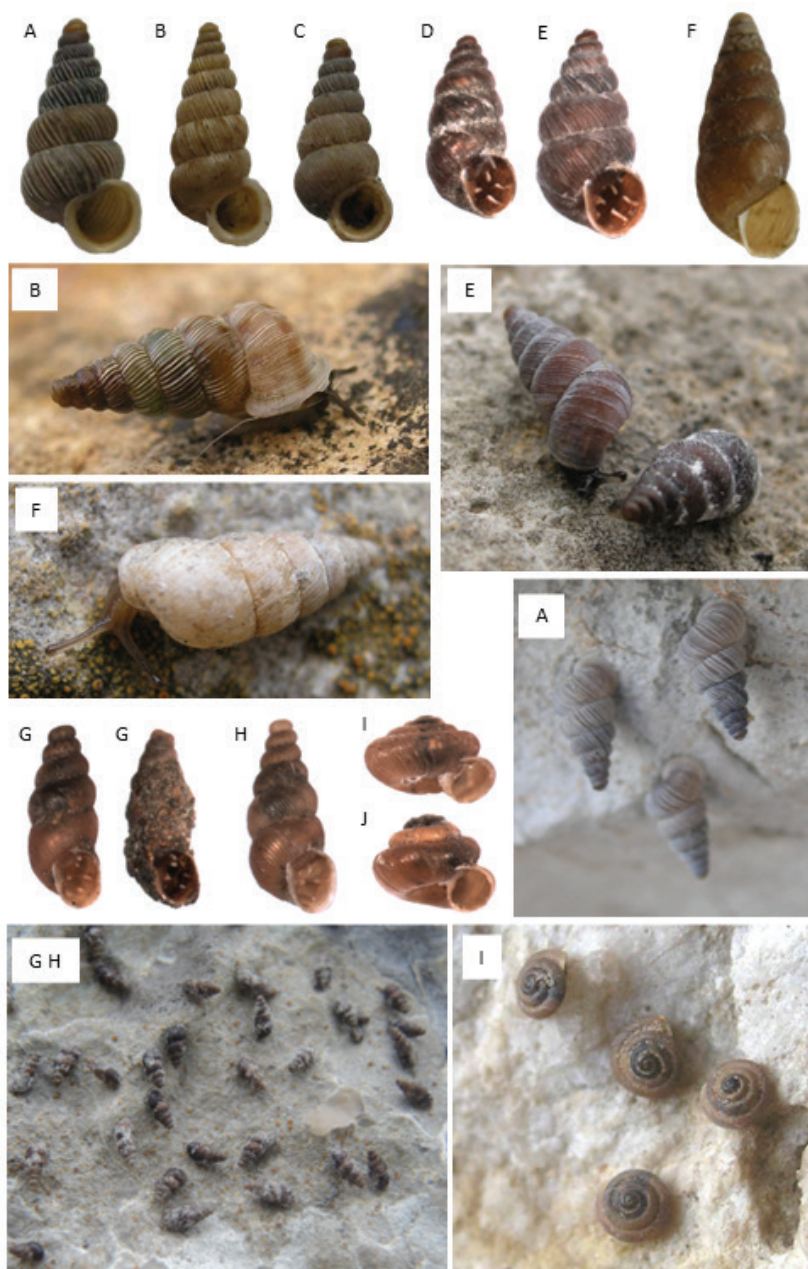


Fig. 4. Rocky dwelling species of Brač: A – *Cochlostoma cinerascens* – Vidova Gora, the top of the hill, H 7 mm; B – *Cochlostoma scalarinum* – Vela Zvirje bay, limestone cliffs, H 6.5 mm; C – *Cochlostoma gracile* – the valley upon the Blaca monastery, H 5.5 mm; D – *Chondrina spelta spelta* – Sumartin, the limestone quarry, H 3.5 mm; E – *Chondrina spelta ventilatoris* – Vidova Gora, the top of the hill, H 5 mm; F – *Ena subtilis* – Hladna Voda Valley near Dol village, H 12 mm; G – *Rupestrella philippii* – Rasotica – cliffs between the bay and the village, H 4 mm; H – *Rupestrella rhodia* – the valley upon the Blaca monastery, H 5 mm; I – *Pyramidula cephalonica* – Selca area, surrounding of St. John chapel, W 2 mm; J – *Pyramidula pusilla* – Sutivan area, valley north from Hum hill, W 2 mm.

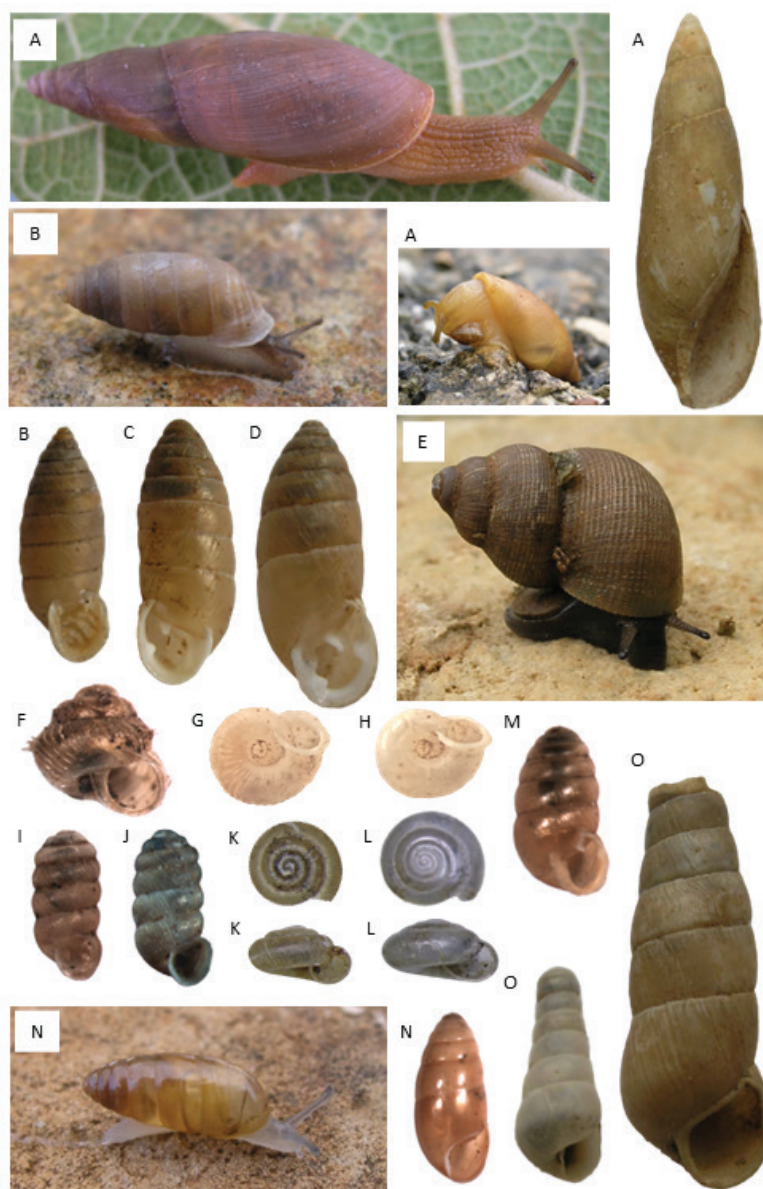


Fig. 5. Epigeic species of Brač: A – *Poiretia cornea* – Dol village, H 3.2 mm; B – *Granaria frumentum illyrica* – the valley upon the Blaca monastery, H 9.5 mm; C – *Pseudojamina seductilis* – Gažul, pastures around the farmhouse 12 mm; D – *Chondrula quinquedentata* – Selca area, surrounding of St. John chapel, 13 mm; E – *Pomatias elegans* – Sumartin, the limestone quarry, H 13 mm; F – *Acanthinula aculeata* – the valley upon the Blaca monastery, H 1.75 mm; G – *Vallonia costata* – Bol, Dominikanski samostan, W 2 mm; H – *Vallonia pulchella* – Bol, Dominikanski samostan, W 2 mm; I – *Truncatellina callicratis* – the valley upon the Blaca monastery, H 1.5 mm; J – *Truncatellina claustralis* – Hladna Voda Valley near Dol village, H 1.75 mm; K – *Punctum pygmaeum* – Hladna Voda Valley near Dol village, W 1.3 mm (Photo R. Coufal); L – *Lucilla scitintilla* – Bol, Dominikanski samostan, W 3 mm (Photo R. Coufal); M – *Lauria cylindracea* – Sumartin, the limestone quarry, 3 mm; N – *Hypnophila pupaeformis* – Rasotica – cliffs between the bay and the village, H 6.5 mm; O – *Rumina decolata* – the way from Bol to Murvica, the dump, H 2.8 and 1.5 mm.



Fig. 6. Zonitids of Brač: A – *Aegopis acies* – Sumartin, former camp Manjana, W 2.8 mm; B – *Oxychilus draparnaudi* – Sutivan, ruins and surrounding of the church; W 10 mm; C – *Oxychilus cellarius* – the great doline north-west from Pražnice, W 10 mm; D – *Mediterranea planorbis* Selca area, 9 mm; Vela Zvirje bay; E – *Oxychilus* sp. – Bol, Dominikanski samostan (Photo R. Coufal); F – *Mediterranea hydatina* – Hladna Voda Valley near Dol village; G – *Vitrea subrimata* – Rasotica, cliffs between the bay and the village, W 4 mm; H – *Vitrea botteri* – the great doline north-west from Pražnice, W 3 mm.

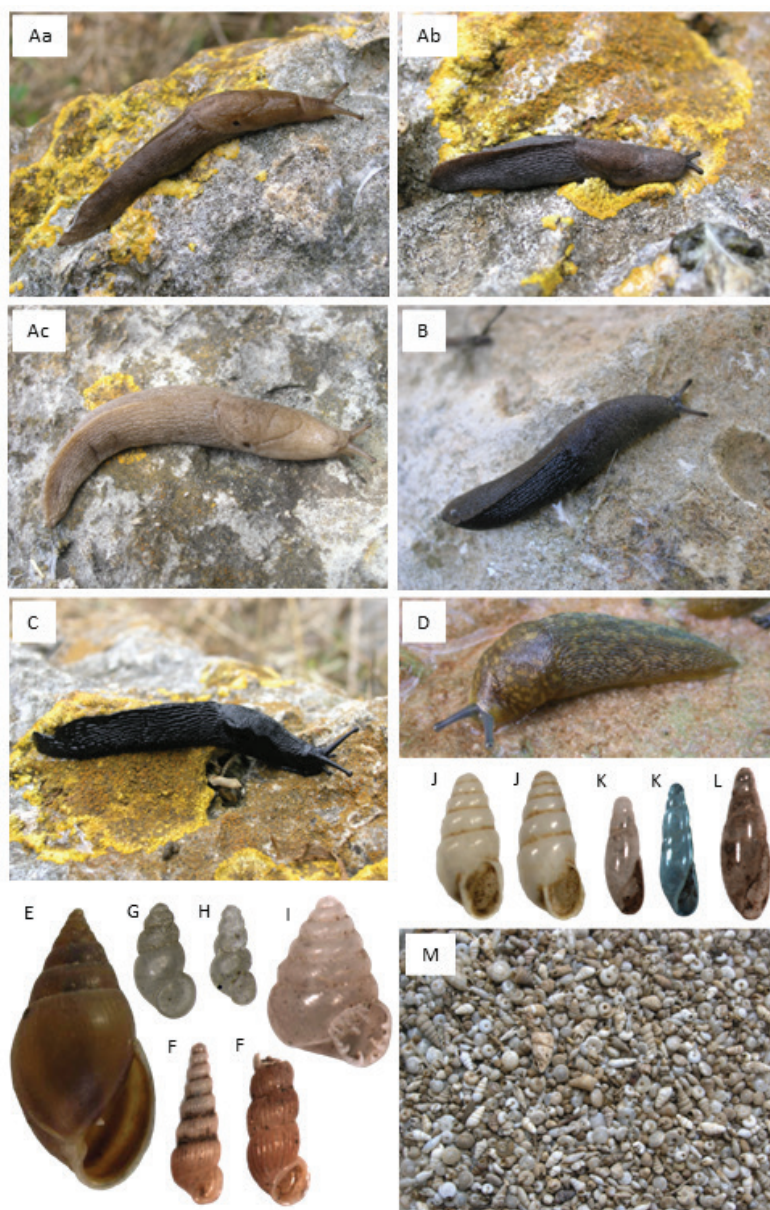


Fig. 7. Slugs of Brač: Aa,b – *Tandonia fejervaryi* – the great doline north-west from Pražnice; Ac – *Tandonia fejervaryi* – Gažul, Trolokve; B – *Tandonia reuleauxi* – Koloč rock gate; C – *Limax wohlberdeti* – Pražnice area – doline on the way from the airport to the main road; D – *Limacus* cf. *flavus* – city Sumartin; Halophilic species of Brač: E – *Myosotella myosotis* – Rasotica bay, salt march, H 4 and 5 mm; Subterranean species of Brač: G – *Litthabittella* cf. *chilodia* – Hladna Voda Valley near Dol village (Photo R. Coufal); H – cf. *Paladilhopsia* sp. – Hladna Voda Valley near Dol village (Photo R. Coufal); I – *Odontocyclas kokeilii* – the great doline north-west from Pražnice, H 3.75 mm; J – *Spelaeoconcha paganettii* – Hladna Voda Valley near Dol village, H 5.5. mm; K – *Cecilioides acicula* – the valley upon the Blaca monastery, H 3 mm; Hladna Voda Valley near Dol village, H 4 mm; L – *Cecilioides veneta* – the valley of the dry brook Murvica 1 km south from Mirca, H 6 mm; M – flood deposit from Hladna Voda valley.

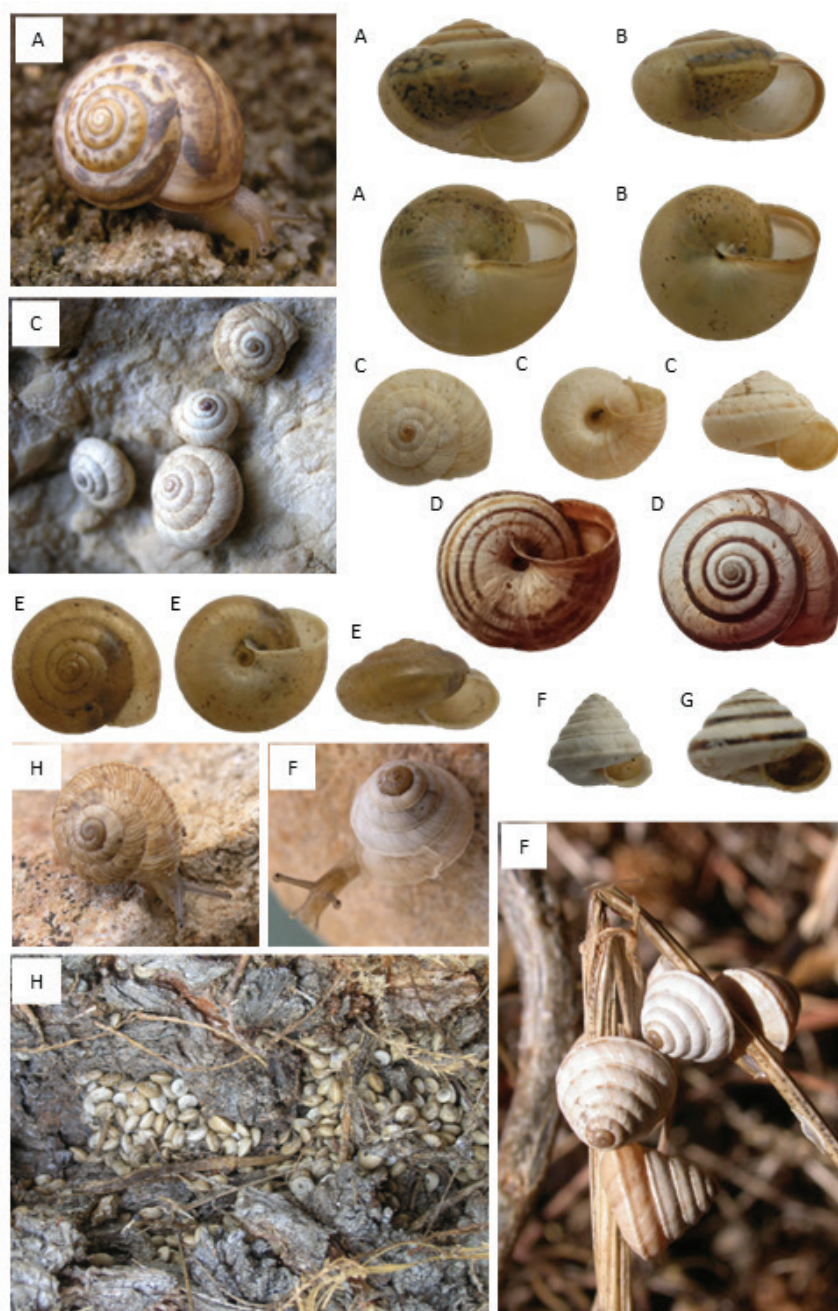


Fig. 8. Hygromiids and Geomitrids of Brač: A – *Monacha parumcincta* – the great doline north-west from Pražnice, W 13 mm; B – *Monacha cartusiana* – Sutivan area, valley north from Hum hill, W 11 mm; C – *Cer-nuella ionica* – Rasotica, cliffs between the bay and the village, W 7 mm; D – *Cer-nuella virgata* – SW from the airport, W 15 mm; E – *Hiltrudia mathildae* – Dol village, W 9 mm; F – *Trochoidea trochoides* – Rasotica bay, W 6 mm; G – *Trochoidea pyramidata* – the way from Bol to Murvica; H – *Xerotracha conspurcata* – Sumartin, the limestone quarry, W 5 mm.

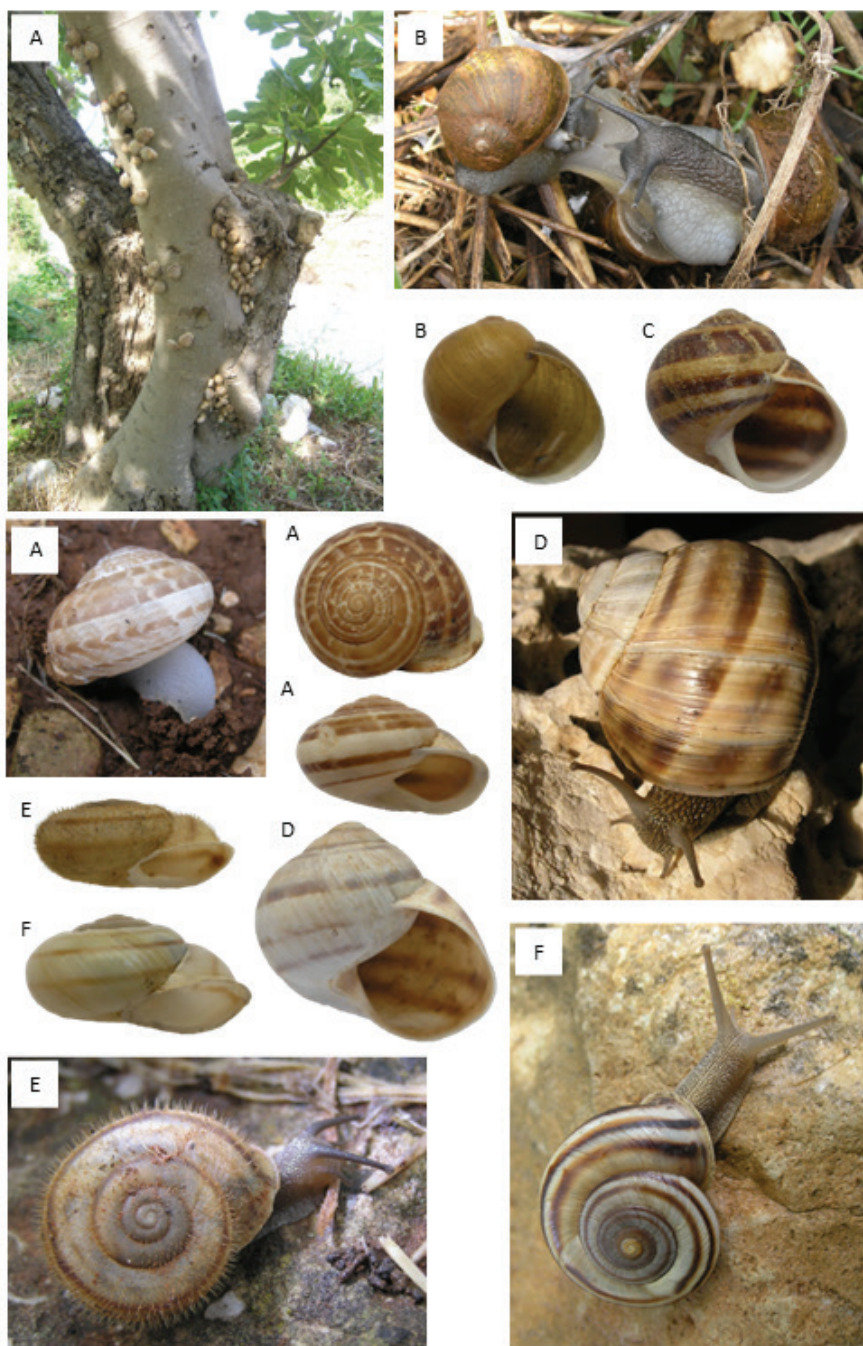


Fig. 9. Helicids of Brač: A – *Eobania vermiculata* – Sumartin, former camp Manjana, W 32 mm; B – *Cantareus apertus* – Sumartin, former camp Manjana, W 27 mm; C – *Cornu aspersum* – Dol, the church garden, W 32 mm; D – *Helix secernenda* – the great doline north-west from Pražnice, W 45 mm; E – *Liburnica setosa* – Dol village, W 25 mm; F – *Liburnica denudata* – the valley upon the Blaca monastery W 30 mm.

DISCUSSION

There are 79 species of non-marine molluscs on the island of Brač, more than any other Croatian island. Of course, the different intensities of research on individual islands can distort these results. Our research constituted probably the longest continuous survey of molluscs carried out on any Croatian island, with a high number of localities surveyed, many of them repeatedly. However, several natural factors contribute to the high biodiversity of Brač, especially its geomorphological diversity and high altitude.

Comments to important species records

Medora hiltrudae which is endemic to Brač was described and so far known only from its type locality – the limestone quarry in Sumartin (NORDSIECK, 1970; ŠTAMOL, 1986). ŠTAMOL (1986, 1987) warned of the threat to this population from the expansion of the quarry. We confirm the occurrence of *M. hiltrudae* in the type locality, where it seems to successfully occupy even the rocks between the quarry and the road. We also found two new sites of *M. hiltrudae* located in two nearby bays on the south-eastern coast of Brač, where it lives on the inaccessible cliffs almost without any surrounding settlement. However, these populations are less abundant than at the type locality.

Two other species of the genus *Medora* occur on the island, *M. contracta* is common in its type locality – the very top of the island around Vidova Gora and we have even found it on the highest peaks of this massif. *Medora almissana* was mentioned by ŠTAMOL (1987) in Dol, where it still occurs on a single small, isolated rock in the upper part of the village. However, two shells were found in the alluvium of a temporary stream in the valley of Hladna Voda, so there is probably another isolated population on the surrounding cliffs that we looked for in vain. This species is relatively common on the mainland opposite the island (Štamol 1987, unpublished records). Brač is the only island where more than one species of the genus *Medora* lives, as ŠTAMOL (1987) points out.

Delima hiltrudis has been also described as endemic to Brač. It is known from three localities in the northwest of the island, including the type locality in Sutivan (NORDSIECK, 1969; ŠTAMOL, 1986). We have found three other localities. All localities are concentrated in the western part of the island and represent the southeastern limit of the distribution of this species. It is more common on Šolta Island, adjacent to Brač in the northwest (ŠTAMOL et al., 2017).

Very little is known about the distribution and delimitation of individual taxa of the genus *Agathylla*. The Neretva River region was considered to be the northernmost limit of the genus' distribution (FEHÉR et al., 2013) but *Agathylla lamellosa* (J.A. Wagner, 1829) was found on the islands of Dugi otok and Kornati (ŠTAMOL, 2004; ŠTAMOL & KLETEČKI, 2005; ŠTAMOL et al., 2012). We found a single isolated population, morphologically corresponding to *Agathylla sulcosa* (J. A. Wagner, 1829), inhabiting small, shaded rocks at the bottom of a large sinkhole near Pražnice. As emphasized by FEHÉR et al. (2013), a revision of this highly variable genus is necessary.

ŠTAMOL (1986) and later KITTEL (2002) listed five species of slugs based on earlier literature records reported from Brač but did not provide any additional records of their own: *Deroceras agreste* (WAGNER, 1937), *D. turcicum* (GROSSU, 1972, as *D. bosniensis*), *Milax gagates* (WAGNER, 1935), *Tandonia reuleauxi* (WAGNER, 1931), and *T. sowerbyi* (SIMROTH, 1909, locality S. Pietro – probably Supetar). According to WIKTOR (1996) these records

cannot be accepted without revision or further confirmation, except for that of *D. turcicum*. WIKTOR (1996) did not confirm the occurrence of *M. gagates* in the entire territory of former Yugoslavia and quoted only the old references including WAGNER's (1935) record from Brač. He also did not revise any material of *Deroceras agreste* from former Yugoslavia and considered the former identifications as doubtful (WIKTOR, 1996). Hence, we also considered WAGNER's (1937) record from Supetar doubtful. *Limax wohlberedti* was recorded from Croatia only from 'Rijeka' (SIMROTH, 1909), which was questioned by WIKTOR (1996). Based on examination of our samples, we confirm the occurrence of *Tandonia releauxi*, and *Derocers turcicum*, as well as adding three new slugs: *Tandonia fejervaryi*, previously known with certainty only from the Croatian mainland (Velebit), is recorded for the first time from Croatian islands, and the occurrence of *Limax wohlberedti* in Croatia is confirmed. The non-native species *Limacus* cf. *flavus* was only found in the village of Sumartin, where it was probably introduced. In the same year when the new species *Tandonia bolensis* (DE MATTIA & NARDI, 2014) was described from a locality near Bol, we also observed it at this locality, but our individuals were not dissected.

KITTEL (2002) quoted Maasen's unpublished records of *Granopupa granum* (Draparnaud, 1801) and *Truncatellina cylindrica* (Férussac, 1807) from Sumartin. However, although Sumartin and its surroundings are now one of the best-sampled areas on the island, we have not been able to confirm the occurrence of these two species there or elsewhere on the island, so their occurrence on Brač remains doubtful.

Unlike the relatively well-known fauna of surface snails, the subterranean fauna is only poorly known and confused, including four previously recorded species: *Spelaeoconcha paganettii polymorpha*, *Cecilioides acicula jeskalovicensis* (WAGNER, 1914; ABSOLON & KSENNEMANN, 1942), *Zospeum amoenum* (BOLE, 1974), and *Odontocyclas kokeilii* (ŠTAMOL, 1986). Moreover, ABSOLON & KSENNEMANN (1942) wrote that *C. a. jeskalovicensis* deserves the status of a good species and listed '*Cecilioides incognita* n. sp. (Abs. Peterb. in litt.)', which differs from *C. spelaea* (Wgnr), *C. acicula* (Müller) and *C. vetusta* (De Betta et Martinati), but was found only in one perfectly preserved adult specimen also from Ješkalovica cave. However, the supposed joint paper by Absolon and Petrboš was never published later, and as there is no description of *C. incognita* in ABSOLON & KSENNEMANN (1942), this name is not available according to ICZN (1999) and the identity of the species remains 'incognizable'.

Spelaeoconcha paganettii polymorpha was described from the caves Ješkalovica, Studenški Rataš, and Belušica by WAGNER (1914). ABSOLON & KSENNEMANN (1942) were the first who illustrated this taxon. We found empty shells of this rare species at four localities, probably washed out from the underground by spring rains. The richest material comes from the drifts in the Hladna Voda valley near Dol. Several empty shells of a small prosobranch resembling the genus *Paladilhio* were also found at the same site, but due to their similarity with the shells of many subterranean freshwater species and genera, they cannot be identified more precisely from conchological material alone. These shells may belong to a new genus. Troglobiont and groundwater snails have not been specifically studied by us and more detailed research may increase the number of species inhabiting the island as shown in previous studies (RADOMAN, 1983, 1985; RAĐA *et al.*, 2020).

Due to the lack of surface aquatic habitats on the island, the number of freshwater species is lower than on other islands rich in aquatic habitats, such as the islands of Pag (BERAN, 2014), Rab (BERAN, 2015) and Krk (BERAN, 2018), where a significantly higher number of freshwater species was found.

Comments on the identity of several taxa

Several species found on the island are classified as common European species. However, experience with these species from Central Europe raises doubts as to whether they are the same species. Although *Vitrea subrimata* corresponds morphologically approximately to Central European populations, its ecology differs dramatically. While on Brač it occurs in dry forests or maquis, in Central Europe it is a sensitive species of humid mountain forests. The only shell of an unspecified taxon of the family Oxychilidae (Fig. 6E) was found in the park in Bol.

The species *Punctum pygmaeum* is reported in the literature as Holarctic. On Brač, it lives in denser maquis or forests, where it lives mainly in moss. In Central Europe it lives practically everywhere. However, the Brač populations differ morphologically from those of Central Europe mainly in the height of the shell.

The species *Cecilioides acicula* has been reported from Brač repeatedly, but morphologically it is somewhere between *C. acicula* and *C. tumulorum* (Bouguignat, 1856). The identity of this taxon needs to be verified.

Traditionally, the species of the family Geomitridae are hard to identify. From Brač, there have been reports of the species *Cerņuella ionica*, which conchologically does not differ much from the species *C. cisalpina*. *Monacha cartusiana* is mainly synanthropic on the island, so it seems to be non-native there. However, this species is morphologically indistinguishable from the related *Monacha claustralis* (Menke, 1828), which is best distinguished by molecular characters (ČEJKA et al., 2015). The distribution of this species in the Mediterranean is unclear. Similarly, the slug *Limacus flavus* is difficult to distinguish from *L. maculatus* Kaleniczenko, 1851, which should not have invaded the Adriatic at all. However, it has been introduced into Central Europe in recent years (ČEJKA et al., 2015), so its occurrence here cannot be completely ruled out. It is clear from the above that the taxonomic identity of several species will require future verification.

When can the Croatian islands be considered explored?

It is hard to say. The first survey was conducted by ŠTAMOL in 1986; our thirteen years of research have yielded a third more species in four times more sites. Although we found the most species in the first three years of the survey, we found additional species almost every year (Fig. 2). This was partly due to better orientation in the complex local karst terrain, but also largely due to chance. Some of the species new to the island are introduced non-native species or species that are common on the mainland and are usually introduced to the island's harbors. However, some of the native species are found in small, isolated areas, which only a detailed and systematic survey can reveal. In particular, looking for the island-like occurrences of rock-dwelling species is comparable to the proverbial search for a needle in a haystack. If similar faunistic data are used in different ecological or macro-ecological studies, they may be significantly biased, and this must be taken into account.

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