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# Revision of the Argninae, 1. The species of *Agardhiella* from the countries bordering the Adriatic Sea

**(Gastropoda: Pulmonata: Pupillidae)**

Peter Subai

Kurzfassung

Die *Agardhiella*-Arten im Westteil ihres Verbreitungsgebietes werden revidiert. Es werden zwei neue Arten aus Albanien beschrieben: *Agardhiella extravaganta* n. sp. und *Agardhiella zoltanorum* n. sp. Alle Arten werden durch Fotos und Zeichnungen abgebildet, ihre bisher bekannte Verbreitung auf Karten dargestellt. Für *A. formosa* wird ein Neotypus festgelegt.

**Schlüsselwörter:** Taxonomie, Anatomie, *Agardhiella*, neue Arten, Verbreitung.

Abstract

The *Agardhiella* species in the western part of their area of distribution are revised. Two species from Albania are described as new: *Agardhiella extravaganta* n. sp. and *Agardhiella zoltanorum* n. sp. All species are illustrated by photos and drawings. Their hitherto known area of distribution is presented on several maps. For *A. formosa*, a neotype is designated.

**Key words:** Taxonomy, anatomy, *Agardhiella*, new species, distribution pattern.

## Introduction

During several collecting trips of Hungarian malacologists to Albania, a number of yet unknown land snail species have been discovered. These collectors entrusted me with the determination of their *Agardhiella* specimens to be used for a revision of the whole group.

Comparing these specimens to material of this genus collected from Montenegro, two species from Albania turned out to be new to science and are described here. At the same time a revision of the Argninae is started to increase the scarce knowledge of this subfamily. In the first part of the revision, the *Agardhiella*-species of the western part of the distribution area of the genus will be treated, i.e. Italy, Austria, Slovenia, Croatia, Bosnia and Hercergovina, Montenegro, Albania and northwestern Greece. A few records of *A. truncatella* from Serbia and Slavic Macedonia are also mentioned.

## Material and Methods

The shells of the species of *Agardhiella* are mainly found in the debris of waterbodies, while records from primary habitats are extremely rare. This can be explained by the cryptic way of life of these animals. *Agar-*

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*dhiella* species live in the soil interstitial provided by roots and small stones in the immediate vicinity of rocks. They clearly prefer calcific types of soil. The interstitial keeps humidity over a considerable period of time and thus constitutes an ideal biotope for several small-sized snail species. For example, the excavated soil between the roots of a small tree near Loutra (= 5 km N of Amarandos) in Epirus, northwestern Greece yielded, besides *Agardhiella truncatella*, the shells of species of *Orcula*, *Sphyradium*, *Acanthinula*, *Punctum*, *Vitrea*, *Gyralina* and *Daudebardia*!

The preferred sampling method is as follows: carefully stir the soil in a bucket full of water, and the tiny shells which are filled with air will swim at the surface. They then can be easily skimmed by a fine sieve. This is the only method which yields numerous specimens of actually rare *Agardhiella* species. Besides that, *Agardhiella* species can be found in caves and rock cavities which provide access to the subterranean habitats. Some *Agardhiella*-species like for example *A. dabovici* and other species in Romania have exclusively been found in caves.

Often, the number of ribs on the last whorl is used to characterize species (e.g. species of *Agardhiella*, *Renea*, *Spelaeodiscus* and others). However, it has been shown that in shells with varying sizes, the number of ribs varies as well. For example, a slender specimen has less ribs on the last whorl than a broader one of the same population. Therefore, the number of ribs within 1 mm (on the last whorl) as used by PILSBRY (1924) is added to complete the usual set of characters.

The spelling of Albanian localities follows FEHÉR et al. (2004).

All measurements in millimetres.

Abbreviations:

| | |
|---|---|
| CNHM | Croatian Natural History Museum, Zagreb |
| E | private collection Z. ERŐSS, Budapest |
| H | private collection A. HUNYADI, Budapest |
| HNHM | Hungarian Natural History Museum, Budapest |
| Maa | private collection J. M. W. MAASSEN, Duivendrecht |
| MMMB | Munkácsi Mihály Museum, Békéscsaba |
| NMW | Natural History Museum, Vienna |
| NMWE | Collection EDLAUER in NMW |
| NMWK | Collection KLEMM in NMW |
| NMWR | Collection RUŠNOW in NMW |
| NNM | Nationaal Natuurhistorisch Museum, Leiden |
| S | private collection P. SUBAI, Aachen |
| Sch | private collection H. SCHÜTT, Düsseldorf-Benrath |
| SMF | Naturmuseum Senckenberg, Frankfurt am Main |
| ± | more or less |
| alk. | specimen preserved in alcohol |
| D | shell diameter |
| AD | diameter of aperture |
| H | height of the shell |
| AH | height of the aperture |
| juv. | juvenile specimen |
| n. det. | UTM-Code could not be determined |
| UTM | UTM-Code for the inventory of European Invertebrates |

## Taxonomic account

### ***Agardhiella truncatella*** (L. PFEIFFER 1841)

Plate 1, Figs. 1–4, textfigs 1–3

1841 *Pupa truncatella* L. PFEIFFER, Symbolae ad historiam heliceorum, **1**: 46 [locus typicus: "...in monte Karst prope Castel nuovo, inter Tergestum et Fiume" (partim); type material: lost].

1842 *Pupa truncatella*, – ROSSMÄSSLER, Iconographie der Land- & Süßwasser-Mollusken, (1) **2** (5): 12, Tafel 53, Fig. 733 (partim, not the varieties).

1848 *Pupa truncatella*, – L. PFEIFFER, Monographia heliceorum viventium, **2**: 303 (partim).

1850 *Pupa truncatella*, – KÜSTER, In: MARTINI & CHEMNITZ: Systematisches Conchylien Cabinet, **I** (15): 34, Tafel 4 Fig. 20–21 (partim).

1886 *Pupa* (*Sphyradium*) *truncatella*, – POLLONERA, Monografia degli *Sphyradium* italiani: 16.

1887 *Sphyradium truncatella*, – CLESSIN, Die Mollusken-Fauna Mitteleuropas, II. Teil, Die Molluskenfauna Österreich-Ungarns und der Schweiz: 242, Fig. 144.

1887 *Pupa* (*Coryna*) *truncatella*, – WESTERLUND, Fauna der in der paläarctischen Region lebenden Binnenconchylien, **3**: 88.

1890 *Pupa* (*Coryna*) *truncatella*, – FLACH, Verhandlungen der physikalisch-medizinischen Gesellschaft zu Würzburg, (2) **24**: 52.

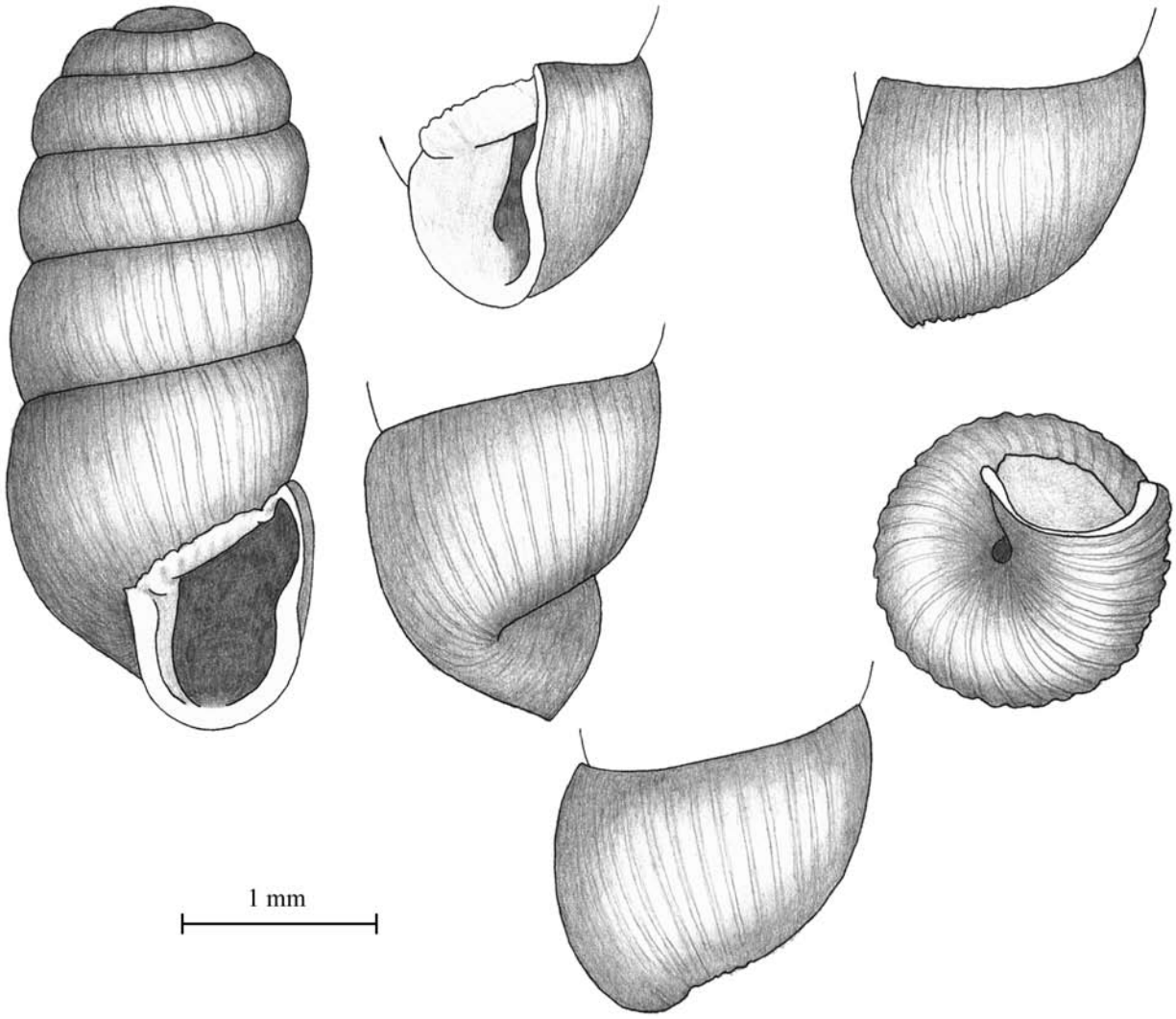
1915 *Agardhia* (*Agardhia*) *truncatella*, – STURANY & WAGNER, Schriften der Kaiserlichen Akademie der Wissenschaften in Wien, mathematische- naturwissenschaftliche Klasse, **91**: 64, Tafel 18, Fig. 102.

1926 *Agardhia* (*Agardhiella*) *truncatella*, – PILSBRY, Manual of Conchology, **27**: 162, Plate. 19 Fig. 2–5.

? 1939 *Agardhia truncatella depressa* PETRBOK, – Věstnik Čs. zoologické společnosti v praze, **6/7**: 344 [locus typicus: „...in the rocky clefts of the Karst at Čebič..." type material: unknown].

? 1959 *Sphyradium truncatella*, – TOMIĆ, Akademija, **27**: 32 (partim).

1971 *Agardhia* (*Agardhiella*) *truncatella*, – ALZONA, Atti della Società Italiana di Science Naturali e del Museo Civico di Storia Naturale di Milano, **111**: 70.



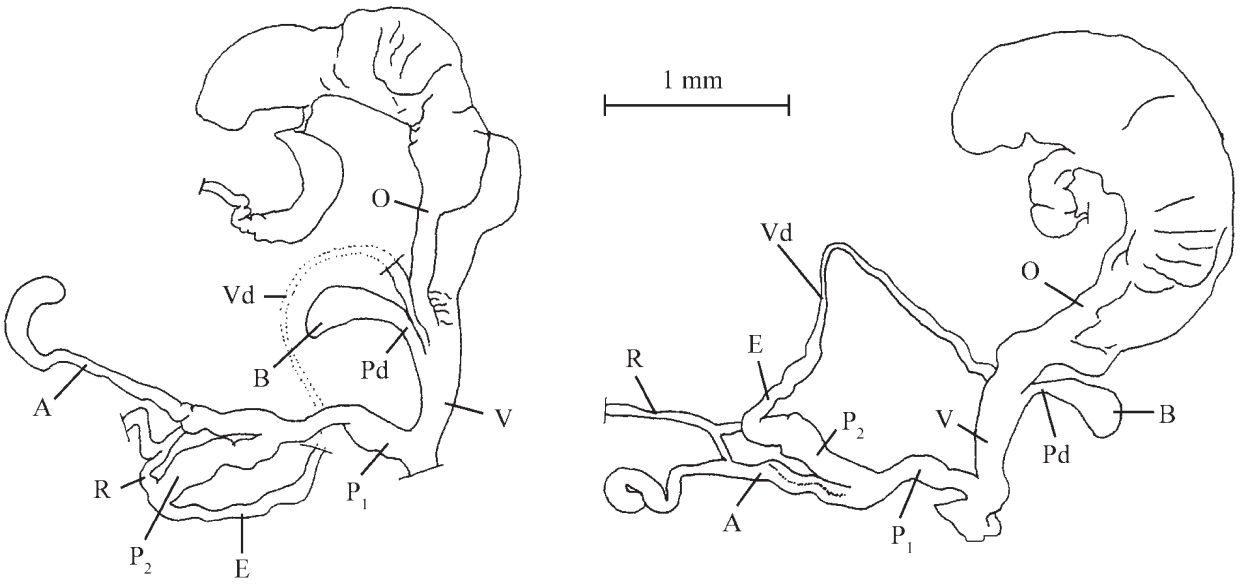

Textfig. 1. *Agardhiella truncatella* (L. Pfeiffer 1841). Austria, Carinthia, Karawanken Mts., Tscheppa Gorge (= S of Klagenfurt), at limestone rocks, UTM VM 44, (H = 3.81, D = 1.62 mm).

1974 *Argna* (*Agardhiella*) *truncatella*, – Klemm, Denkschriften der Österreichischen Akademie der Wissenschaften, mathematisch-naturwissenschaftliche Klasse, **117**: 169, distribution map 42 (p. 168).
1974 *Agardhiella truncatella*, – Gittenberger, Basteria, **38**: 3, Fig. 1 (shell sculpture), Fig. 3–4 (genital organs).
1975 *Agardhiella truncatella truncatella,* – Gittenberger, Zoologische Mededelingen, **48** (24): 286, Fig. 6 (genital organs).
1983 *Argna* (*Agardhiella*) *truncatella*, – Kerney, Cameron & Jungbluth, Die Landschnecken Nord- und Mitteleuropas: 123, Fig. p.124, distribution map 110.
1985 *Agardhiella truncatella,* – Zilch, Archiv für Molluskenkunde, **116** (1/3): 129.
1985 *Agardhiella truncatella skipetarica*, – Maassen, De Kreukel, **21** (1–2): 4, Plate 1, Fig. 1–3, distribution map [non *skipetarica* A. J. Wagner 1915].
1985 *Agardhiella truncatella truncatella*, – Maassen, De Kreukel, **21** (1–2): 4, Plate 1, Fig. 5–8, distribution map.
1999 *Agardhiella truncatella skipetarica,* – Subai, Schriften zur Malakozoologie, **13**: 45, Fig. 3(shell), Fig. 5 (distribution map), Plate. 9, Fig. 2 (shell) (partim).

D i a g n o s i s : small, aperture small, with infraparietalis and angularis. Lower 2/3 of the palatal wall slightly bulge-like thickened.

D e s c r i p t i o n : Shell relatively small, cylindrical with a rounded apex; upper 1.75 teleoconch whorls smooth, slightly granulated; after these whorls, the perpendicular ribbing pattern begins and increases rapidly; on the last whorl there are 34–63 (9–14/mm) ribs. Between the main ribs there are irregular perpendicular ribs only recognizable with high magnifications.

Whorls 5.25–6.75; the last whorl up to 51–63 % of the total height; umbilicus narrow, somewhat pointed. Aperture with an infraparietalis and angularis. Both teeth weakly developed, stretching straight towards the interior of the shell. Apertural rim u-shaped in frontal view, interiorly slightly enlarged like a lip and widened exteriorly; at the columellar side, it slightly bents towards the umbilicus; in the centre of the palatal side of the aperture, the aperture may be somewhat thickened but




Textfig. 2 a–b. *Agardhiella truncatella* (L. PFEIFFER 1841), situs of the genital organs. Albania, Periferi Elbasan, S of Gurri i Zi, 13 km from the Elbasan junction on the road to Qafa e Shtyllës, limestone rocks, 900 m alt., UTM DL 26. — Abbreviations to the drawings of genital organs: A = appendix, B = bursa, E = epiphallus, O = oviductus, $P_1$ = proximal part of penis, $P_2$ = distal part of penis, Pd = pedunculus, R = retractor muscle, V = vagina, Vd = vas deferens.

never forms a tooth (see remarks); sometimes, this area is marked by forming a slight furrow; above this the aperture is recessed, and the apertural rim is narrow without lip. Above the angularis, a short sinulus is present. The peristomial rims connected by a well recognisable callus covering the upper part of the aperture and concealing the ribs of the last whorl. In side view, the upper part of the apertural rim is slightly protruding.

Measurements (n = 106): H = 2.87–4; D = 1.31–1.75; AH = 1.06–1.37; AD = 0.75–0.94.

Characters of genital organs (according to 2 specimen from Albania, S of Gurri i Zi; GITTENBERGER 1974: 3–6, Fig. 3–4 and 1975: 286, Fig. 6): The retractor muscle of the right eye-stalk runs between penis and vagina; penis subdivided in a slender distal and a swollen proximal part of equal length; the appendix inserts in the middle between the two parts of the penis; its central part is narrow, while the distal and the proximal part reach double of the width of the central part. GITTENBERGER found the branches of the penis retractor muscle to be of different length, while in the specimens from Albania, the branches are of equal length. Additionally, in GITTENBERGER's specimen, the appendix retractor inserts shortly behind the insertion of the appendix to the penis, while in the Albanian specimens, it connects at the end of the distal (wider) part of the appendix. The epiphallus of the Austrian specimen (GITTENBERGER 1974: Fig. 3–4) and of the Slovenian specimen (GITTENBERGER 1975: Fig. 6) reaches about the size of the penis. It consists of a long, narrow proximal part and a short distal part (1/4–2/5 of its total length) which may reach double the diameter of the proximal part. In the Albanian specimens, the epiphallus only reaches half of the length of the Austrian/Slovenian specimens, and the transition zone between the narrow and the broad part is inconspicuous. The oviduct is longer than the vagina. The pedunculus of the bursa copulatrix of the Austrian/Slovenian specimen is remarkably longer if compared to that of the Albanian specimens. In the latter, the vesicle of the bursa copulatrix is large and broad on a short stem.

Differential diagnosis: Apart from the parietal teeth, *A. biarmata* has a well developed long parietal lamella, and some specimens up to three columellar teeth. In the aperture, its parietal wall is stronger with a more developed indentation. Its apertural rim is not as strongly lipped as in *A. truncatella*. However, the columellar side of the aperture is stronger in *A. biarmata* than in *A. truncatella*.

The shell of *A. skipetarica* is more slender, and the ribbing pattern is more dense. Moreover, its aperture has no teeth. In *A. skipetarica*, the palatal wall of the aperture is more protruded but less strengthened.

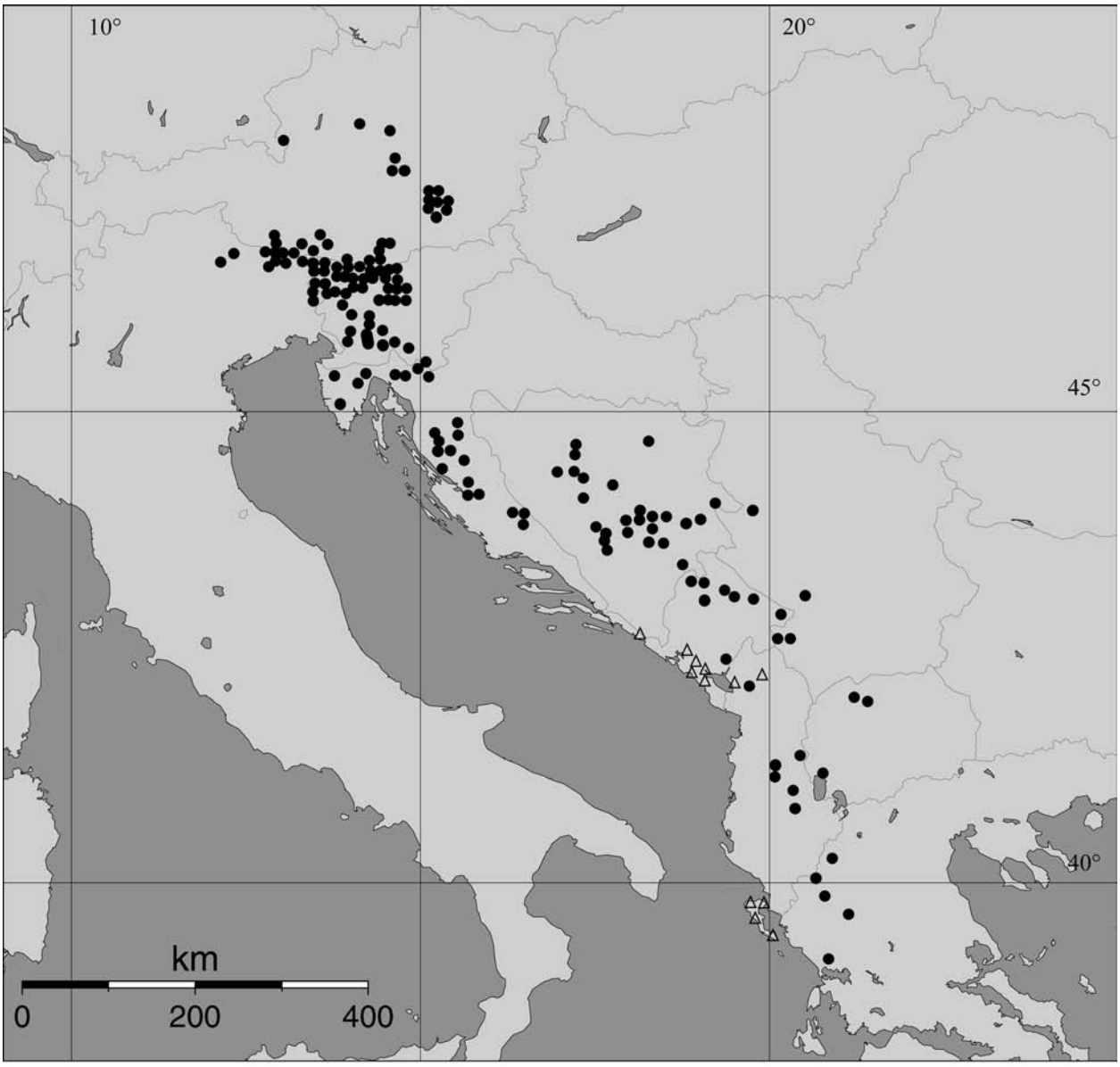
Types: lost.

Material examined: **Austria**: East Tyrol, Tristacher Lake near Lienz, UTM UM 38, (ex WIEDEMAYR) NMWE 8487/1; Tristacher Lakewall, UTM UM 38, leg. KLEMM 30.7.1948, NMWK 27534/2 (juv./damaged); leg. SEIDL 26.5.1967, NMWK 54976/1.

Upper Austria, Steinbach a. d. Steyr, UTM VP 41, leg. GANSLMAYR, NMWK 50429/2 + 1 (damaged); Küpfern, UTM VP 70, leg. GANSLMAYR, NMWK 48783/4; Weyer a. d. Enns, UTM VP 70, NMWK 38390/1; Weyer a. d. Enns, Bichlbauerkogel, UTM VP 70, leg. GANSLMAYR, NMWE 37576/1.

Salzburg, Salzburg City, UTM UN 59, NMW 68443/2.

Styria, Leopoldsteiner Lake, Hochschwab, UTM VN 86/96, leg. FRANZ 11.10.1943, NMWK 61106/1; Pretterau SW slope, road Hieflau-Eisenerz, Mörchjassingau, UTM VN 87,




Textfig. 3: Distribution map of *A. truncatella* and *A. skipetarica*. ● = *truncatella*; △ = *skipetarica*

leg. Franz, NMWE 39147/1 (juv.); front of the Radmer Valley, „Gesäuse“, UTM VN 87, leg. Franz 3.10.1946, NMWK 61107/1 (juv.); leg. Edlauer, NMWK 56096/5; Radlpass, UTM WM 16, leg. Frank 10.10.1972, NMWK 66375/2; Grand, W of the Hohen Rannach, UTM WN 22, leg. Boeckel 1930, NMWE 9455/2; Glaserer, UTM WN 22, NMW 30902/1; Pfaffenkogel near Stübing, UTM WN 22, leg. Kreissl 19.3.1970, NMWK 63393/1; Hohenstein, peak near Stift Rein, UTM WN 22, leg. Klemm 9.1943, NMWK 21255/1; Hohenstein near Stift Rein, slope to Hörgasgraben, UTM WN 22, leg. Klemm 9.1943, NMWK 21256/1; Hörgasgraben near Stift Rein, rocks at the slope of Hohen Stein, UTM WN 22, NMWE 36300/1 + 1 (juv.); Mühlbachgraben, UTM WN 22, NMW 30903/2; Peggau, UTM WN 22, leg. Franz 12.7.1946, NMWK 40829/2 (juv.); rocks on the right banks of Mur river near Peggau, UTM WN 22, leg. Klemm 9.1943, NMWK 21257/1; Peggauer wall near Peggau, UTM WN 22, leg. Klemm 9.1943, NMWK 21258/1 + 3 (juv.); Waterfall at ruins of Peggau, UTM WN 22, leg. Klemm 9.1943, NMWK 21259/3 + 4 (juv./damaged); southwestern slope Tanneben towards Peggau, UTM WN 22, NMWE 27379/10(partly damaged); (ex Paget), HNHM/1; Peggau, gorge above Badlgalerie, UTM WN 23, NMWE 36744/9; gorge below Badlgalerie, Mur Valley, UTM WN 23, leg. Klemm 9.1943, NMWK 21253/2 + 1 (juv.); Badelgalerie, UTM WN 23, NMW 30890/3 + 6 (juv./damaged); Badlgalerie, Hochtrötsch, UTM WN 23, leg. Fuchs, NMWR/1; (ex Fuchs, ex Käufel) NMW 59768/5; Badlgraben near Peggau, UTM WN 23, NMWE 27717/18 + 3(juv), 30412/1, NMWK 38372/3, SMF 200505/4; Badlgraben, Mur Valley, UTM WN 23, leg. Klemm 9.1943, NMWK 21252/1; wall on the right bank of Mur river opposite of Badlgalerie, UTM WN 23, leg. Klemm 9.1943, NMWK 21254/1; [Mountain] Gschwendt near Frohnleiten, UTM WN 23, NMW 30899/1; Bärenschützklamm near Mixnitz, UTM WN 24, NMWK 38368/1; leg. Franz 18.6.1947, NMWE 53754/2 (juv.); Eggenberg, UTM WN 31, leg. Frank 31.7.1973, NMWK 66377/1 + 1 (juv.);

debris of Tur cave near Semriach, UTM WN 32, leg. Kreissl 2.11.1969, NMWK 60825/2; Andritz source, UTM WN 32, NMW 30901/1 + 2 (juv.); Radegund near Graz, UTM WN 32, Novistein, leg. Franz 17.4.1950, NMWE 55159/1; Klamm near St. Radegund, climb to Göstinger-hut, UTM WN 32, leg. Franz 19.5.1959, NMWK 46529/1 (juv.); Raabklamm, UTM WN 33/44, leg. Franz, NMWK 57266/1; Weiz near Gleisdorf, UTM WN 42, NMWK 38389/2; Weizklamm, UTM WN 43, leg. Franz 23.5.1948, NMWE 54584/1; leg. Franz 17.7.1959, NMWK 46534/3; Weizklamm, Trögersteig, UTM WN 43, leg. Kofler 28.4.1942, NMWK 56901/2 + 1 (juv.); Weiz near Gleisdorf, Weizklamm behind Feister, lime wall N-side, UTM WN 43, leg. Franz 25.5.1948, NMWE 54236/1.

Carinthia, UTM n. det., SMF 51763/1, 51776/1, 51777/3, 110480/3, 247179/3, 247180/1 ( + 3 *L. cylindracea*); leg. Kokeil 1862, NMW 68/4 + 1 (juv.); lower Wolayer Valley, UTM UM 36, leg. Ehrmann 1906, SMF 51758/4; Soleck, UTM UM 37, leg. Klemm 6.1932, NMWK 1518/14 (partly damaged); Wildensender Valley, UTM UM 37, (ex Ehrmann) SMF 51756/1; Kötschach-Mauthen, Valentinklamm (= Mauthner Klamm), UTM UM 46, leg. Klemm 6.1931, NMWK 941/1; leg. Klemm 7.1940, NMWK 7156/6 + 2 (juv.); leg. Schlickum 26.8.1941, SMF 274293/13; leg. 10.1942, (coll. S. H. Jaeckel) SMF 200506/2 + 1; leg. Neuteboom 13.8.1952, NNM/1; leg. Schütt 7.8.1958, Sch 123/1; leg. Nordsieck 2.10.1962, SMF 205799/1; leg. Gittenberger 9.1964, NNM/12; leg. Gittenberger & Ripken 9.1964, NNM/4; leg. Seidl 24.7.1965, NMWK 54977/2; leg. Stummer 8.8.1978, S 9362/12; leg. Maassen 9.1979, Maa/7; Northern part Valentinklamm, UTM UM 46, leg. Klemm 29.8.1948, NMWK 27410/1, NMWK 27441/5 + 4 (juv.); lower Valentinklamm, UTM UM 46, leg. Seidl 27.5.1987, NMWK 54978/1 + 1 (juv.); Plöckenpass at Ederwirt, UTM UM 46, leg. Schlickum 9.8.1958, SMF 274294/1; leg. Gittenberger 9.1964, NNM/1; Plöckenpass, Valentinbank, 1050 m alt., UTM UM 46, leg. Neuteboom 14.7.1958, NNM/5; Plöckenpass below Cellonkofel, UTM UM 46, leg. Ehrmann, SMF 51760/2; Plöckenpass, at limestone rocks, 1360 m alt., UTM UM 46, leg. Subai 13.7.2006, S 20810/15 + 3 (juv.); gravels E of Plöckenpass, 1370 m alt., UTM UM 46, leg. Gittenberger 9.1964, NNM/8; Kronhofgraben, UTM UM 56, leg. Höbbel 9.6.1956, NMWK 40973/1; Weissbriach, UTM UM 67, leg. Klemm 27.7.1948, NMWK 27356/4 + 2 (juv./damaged); Obervellach, Groppenstein, UTM UM 76, leg. Thorson 30.6.1930, NMWK 62890/1 + 2 (juv.); ruins of Ortenburg, UTM UM 88, (ex Gallenstein), NMW 53816/3; nearly of dam of Weissenbach, between Zlan and Wiederschwing (= 5.5 km W of Paternion), 700 m alt., UTM UM 97, leg. Breure 17.6.1986, NNM/7; Federaun, [Mountain] Dobratsch, UTM VM 05, leg. Klemm 3.6.1960, NMWK 44652/1 (damaged); Dobratsch near Ober-Federaun, 750 m alt., UTM VM 05, leg. Gittenberger 5.9.1969, NNM/3; Karawanken Mountains, Mallestig, UTM VM 15, leg. Klemm 1.8.1960, NMWK 44577/2 (juv.); Kanziani Mountain near Villach, UTM VM 15, leg. Klemm 7.1940, NMWK 7193/4; Goritschach, UTM VM 15 (or VM 65), leg. Strouhal 23.8.1957, NMWK 57628/1 + 3 (juv./damaged); Ossiacher Tauern near Villach, VM 16, leg. Kühnelt 10.10.1942, NMWK 60949/2; Annenheim at Ossiacher Lake, UTM VM 16, leg. Sturany 1893, NMW without Nr./1 (juv.); Maria-Elend, Grosser Suhagraben, 750 m alt., UTM VM 25, leg. Neuteboom 12.8.1952, NNM/3; Karawanken, Rosenbach in Rosental Valley, UTM VM 25, leg. Klemm 6.1934, NNM/5; leg. Karnekamp 8.1970, Maa/4; leg. Mildner 7.4.1971, NMW 79388/1; Rosenbacher Schweiz, rocknarrows, UTM VM 25, leg. Klemm 6.1934, NMWK 2182/5, 2183/8 (damaged); along the road to Bärental Valley, 790 m alt., UTM VM 34, leg. Gittenberger 9.1964, NNM/1; road from Bärental Valley to Bauer Aurig, UTM VM 34, leg. Gaschott, (ex Käufel) NMWK 16190/1 + 1 (juv.); Sattnitz, UTM app. VM 35/45/55, NMWK 33071/5; (ex Fuchs, ex Käufel) NMW 59769/4; (Clessin, p. 242) NMW 22079/1; (ex Gallenstein) NMW 53815/23(± damaged); Tscheppa Gorge (S of Klagenfurt), at limestone rocks, UTM VM 44, leg. Klemm 3.7.1960, NMWK 44224/7 + 5 (juv.); leg. Schuster 1975, NMWK 69306/1 (juv.); leg. Subai 24.8.1981, S 8344/23 + 3 (juv.); Tschaukofall at Loibl Pass, UTM VM 44, leg. Gittenberger 9.1964, NNM/1; Kotla of Ferlacher Horns, UTM VM 44, leg. Klemm 6.7.1960, NMWK 44276/1 + 1 (juv.); Loiblpassheight, UTM VM 44, leg. Klemm 10.7.1960, NMWK 44351/1 + 3 (juv.); Loibl slope, UTM VM 44, NMW 18233/2 + 6 (juv.); Loiblpass road ( S of Klagenfurt), 2 km N from restaurant „Deutscher Peter“, UTM VM 44, leg. Maassen 9.1979, Maa/2 + 2 (juv.); same spot, 50 m S of restaurant „Deutscher Peter“, UTM VM 44, leg. Subai 24.8.1981, S 8353/10 + 2 (juv.); same spot, 500 m S of restaurant „Deutscher Peter“, 1000 m alt., UTM VM 44, leg. Maassen 9.1980, Maa/4 (juv.); Karawanken Mountains, Rabenberg, UTM VM 45, NMWK 40942/1 (juv.); Roggenberg near Maiernigg, UTM VM 46, leg. Strouhal 13.7.1956, NMWK 57621/1; Koschutta at Koschutta-hut, UTM VM 54, leg. Franz 31.8.1960, NMWK 46549/2 + 2 (juv.); Karawanken Mountains, western side of Kuhberg (Hochobir), UTM VM 54, leg. Klemm 8.8.1960, NMWK 44742/3; Freibachgraben, western side Hochobir, UTM VM 54/55, leg. Fauer 31.8.1965, NMWK 52698/3 + 3 (juv.); Gurnitz, gorge Sattnitz, UTM VM 56, leg. Klemm 25.7.1960, NMWK 44475/1 + 1 (damaged); leg. Mildner 1.5.1971, NMW 79387/1; Launsdorf, castle of Hochosterwitz, 650 m alt., UTM VM 57, leg. Neuteboom 8.7.1952, NNM/3; Magdalensberg, UTM VM 57, (ex Gallenstein), NMW 53813/2; leg. Falkner 9.1966, NMWK 56509/4 (damaged); ruins of Kraig, UTM VM 58, (ex Gallenstein) NMW 53818/3 + 1 (juv.); S-part of Vellacher Kocna, 1150 m alt., UTM VM 63, leg. Gittenberger 29.7.1981, NNM/2; Eisenkappel, UTM VM 64, leg. Klemm 6.1932, NMWK without Nr./5; Eisenkappel, Vellach banks, 530 m alt., UTM VM 64, leg. Neuteboom 9.8.1952, NNM/1; Lobnikgraben near Eisenkappel, UTM VM 64, leg. Klemm 8.1941, NMWK 7533/6 + 3 (juv.); Lobnik near Eisenkappel, UTM VM 64, leg. Klemm 6.1932, NMWK 1395/1 + 8 (damaged); Trögernklamm SW of Eisenkappel, UTM VM 64, leg. Maassen 9.1979, Maa/1; Boziceva Gora near Eisenkappel, UTM VM 64/65, leg. Klemm 8.1941, NMWK 7901/3; waterfall of Wildenstein, UTM VM 65, leg. Klemm 12.8.1960, NMWK 44822/3 + 1 (juv.); leg. G. & P. Subai 22.8.1981, S 8388/9; leg. Maassen 5.1985, Maa/22 + 5 (juv./damaged); Eberstein, UTM VM 68, (ex Gallenstein), NMW 53814/1; Kupitzklamm near Eisenkappel, UTM VM 74, leg. Klemm 6.1932, NMWK 1396/1 (damaged); leg. Klemm 8.1941, NMWK 7565/3 + 2 (damaged), 7844/3 + 2 (juv.); leg. Neuteboom 9.8.1952, NNM/5; leg. Maassen 5.1985, Maa/17 + 3 (juv.); leg. Schütt 26.5.1985, Sch 1157/2; 8 km WSW of Bleiburg, cave entrance Dumpelnica near Globasnitz, UTM VM 75, leg. Gittenberger 8.1981, NNM/2; ruins of Rabenstein, UTM VM 97, (ex Gallenstein), NMW 53817/2.

**Italy:** Pieve di Cadore, UTM TM 94, leg. Fentrop 12.8.1959, NNM/12; Auronzo, Fiume Ansiei, 845 m alt., UTM UM 05, leg. Neuteboom 20.7.1968, NNM/1; Sáuris di Sopra, UTM UM 24, (ex Ehrmann), SMF 51755/2; Forni Avoltri, UTM UM 26, leg. Ehrmann 1911, SMF 51751/1; between

Cima Sappada and Forni Avoltri, UTM UM 26, leg. Ehrmann 1911, SMF 51759/4; Rigolato-Comegliáns, Degano Valley, UTM UM 35, leg. Ehrmann 1906, SMF 51748/1; lower Frasnetta near Collina, UTM UM 36, leg. Ehrmann 1911, SMF 247178/1; Rivo, S. Pietro Valley, UTM UM 45, leg. Ehrmann 1905, SMF 51757/2; Malborghetto (= Malborgeth), UTM UM 75, (ex C. R. Boettger) SMF 110482/3; Val Canale (= Canal Valley), UTM UM 75/85/95, NMW 24809/3 + 2 (damaged); (ex Ressmann, coll. Kobelt) SMF 51773/6; (ex Ressmann 1876, coll. Jetschin) SMF 110479/3; Val Canale, Lußnitzgraben, UTM UM 75, leg. Ehrmann 1904, SMF 51794/3; Stupizza al Natisone (= Stupizza), UTM UM 81, leg. Nordsieck 27.8.1965, SMF 205800/1; upper Seissera Valley, UTM UM 84, leg. Ehrmann 1904, SMF 51754/5; Bartolograben, UTM UM 85, leg. Ehrmann 1904, SMF 51747/1; Seebach Valley at Weißenfels, UTM UM 94, leg. Ehrmann 1904, SMF 51750/1; Slizza Canyon near Tarvisio (= Tarvis), UTM UM 94, NMWE 46027/1; Coccau di Sopra (= Goggau near Tarvis), UTM UM 95, (ex Stussiner 1888, coll. O. Boettger), SMF 51768/4; doline Percidol near Opicina (= N of Triest), UTM VL 05, leg. 1916, NMWE 8489/1.

**Slovenia** (= Krain, Carniolia): UTM n. det., HNHM/1; SMF 51767/1, 51770/6, 51779/4, 110477/9, 200508/3, NMW 61278/2 + 1 (juv.) (very slender specimens); (ex Schmidt 1862) NMW 94/2; Žaga, Boka-waterfall, UTM UM 82, leg. Maassen 9.1982, Maa/2 (damaged); left shore N of Žaga, UTM UM 82, NMWK 48604/6 + 1 (juv.); leg. Käufel, NMWK 2799/1; Žaga, source at river Soča, 600 m alt., UTM UM 82, leg. Maassen 7.1982, Maa/3; rockbottom 1 km below Žaga, UTM UM 82, NMWE 10914/10; (ex Edlauer, ex Schlickum), SMF 274292/2; Srpenica (= 2 km S of Žaga), UTM UM 82, leg. Maassen 9.1985, Maa/1; Staro Selo near Robič, UTM UM 82, leg. Maassen 9.1985, Maa/5; source Perilo near Robič near Kobarid, UTM UM 82, leg. Schütt 17.5.1975, Sch 775/1; Vrh [ = peak] Rombon near Bovec, UTM UM 83, leg. Maassen 9.1985, Maa/3; Kanin Mountain near Bovec, 900 m alt., UTM UM 83, leg. Maassen 7.1982, Maa/2; same spot, 2000 m alt., UTM UM 83, leg. Maassen 7.1982, Maa/11; 2 km N of Kobarid, 200 m alt., UTM UM 92, leg. Maassen 9.1982, Maa/1 (damaged); Soča at river Soča (= Isonzo) (N of Flitsch), UTM UM 93, (ex Kuščer) NMW 50580/3; Soča, alongside of Trenta [= rock wall], UTM UM 93, leg. Maassen 9.1985, Maa/1; Mountain Nanos, UTM VL 26/27, (ex Gysser, ex Ullepitsch), SMF 51762/4; 5 km S of Idrija, UTM VL 29, leg. Maassen 9.1979, Maa/1; 3 km E of Postojna, 650 m alt., UTM VL 46, leg. Gittenberger 9.1970, NNM/3; rocks nearly of Planinska cave near Planina, UTM VL 47, leg. Maassen 9.1979, Maa/2; Vrhnika, rocks at side Source of Ljubljanica near Mirke, UTM VL 48, NMWE 16088/1 + 1 (juv.); Vrhnika-Dolenji Logatec, UTM VL 48, leg. Nordsieck 10.9.1961, SMF 205797/1; doline near Laze (= NNE of Planina), UTM VL 48, leg. Maassen 9.1979, Maa/1; Vrhnika (= Oberlaibach), rocks on the left bank of Retovje Source, UTM VL 49, NMWE 15974/2; Vrhnika, at the Močilnik Source, UTM VL 49, leg. Edlauer, NMWK 2798/1; leg. Nordsieck 12.9.1961, SMF 205798/1; Vrhnika, rocks above Močilnik Source, UTM VL 49, NMWE 15949/20 + 1 (juv.), without Nr./2 + 1 (juv.); entrance of Ibline cave near Kompolje, UTM VL 76, (ex Käufel) NMWK 16195/1 + 2 (damaged); in „stopar teva skedeunza“ near Ponikve, UTM VL 77, (ex Käufel) NMWK 16191/1; entrance of „Raska Skedeunta“ near Ponikve, UTM VL 77, (ex Käufel) NMWK 16194/1 (damaged); Kočevje (= NE of Rijeka), UTM VL 85, NMWK 38376/3; „sestra treh bratov“ near Kočevje, UTM app. VL 85, (ex Kuščer) NMWE 48840/8 + 2 (damaged); cave NE of Kočevje, UTM VL 95, NMWK 38364/1; cave of Zeljne (= NE of Kočevje), UTM VL 95, NMWE 45136/1 + 1 (damaged); (ex Käufel) NMWK 16192/2 + 2 (damaged); N of Tolminka, bifurcation of Tolminka and Zadlascica, 250 m alt., UTM VM 01, leg. Gittenberger 9.1970, NNM/1; slap Savica near Bohinj, UTM VM 02, leg. Maassen 7.1980, Maa/3; Vršičpass southern side, 1350 m alt., UTM VM 04, leg. Maassen 9.1982, Maa/6; same spot, 1600 m alt., UTM VM 04, leg. Maassen 6.1987, Maa/25 + 3 (juv./damaged); Stopnik (= NW of Idrija), UTM VM 10, leg. Maassen 9.1979, Maa/1 (juv./damaged); lake of Bohinj, UTM VM 12, (ex Kuščer) NMWE 48895/1; Bohinj (= Wochein), „Hot. Zlatorog-kantine“, slap Savica, UTM VM 12, (ex Käufel) NMWK 16188/2; Gozd-Martuljek, at limestone rocks nearly of Jerman Stream, UTM VM 14, leg. Subai 20.8.1987, S 13578/3; western slope of Babji Zob, 1000 m alt., UTM VM 23, (ex Käufel) NMWK 16199/1; summit of Veliko Osojnica, 750 m, UTM VM 23, (ex Käufel) NMWK 16197; Mlinca, UTM VM 24, (ex Kuščer) NMWE 48807/1; cave Mlinca, UTM VM 24, (ex Stussiner, ex O. Boettger), SMF 51766/4; „Stuncu pri Selcah“ nearly of the railway station Sava, UTM VM 24, NMW without Nr./1; (ex Kuščer) NMWE 49635/1; „Zaška kukava doline“ N of the railway station Planina, UTM VM 24, NMWE 20179/8, NMWK 48603/3; Bled, castle Mountain, UTM VM 33, leg. Klemm 6.1934, NMWK 2181/1 (juv.); Save bank near Ribno, Bled, UTM VM 33, (ex Käufel) NMWK 20219/1 + 1 (damaged); „Hud. Sava Bohinjska“ near Ribno, 420 m, UTM VM 33, (ex Käufel) NMWK 16196/1 + 1 (damaged); Vintgarklamm near Bled (= Veldes), UTM VM 33, NMWE 15109/12; leg. Maassen 7.1979, Maa/2; Karawanken Mountains, Southern slope of the Mountain Stol, UTM app. VM 34, (ex Käufel) NMWK 51688/4, 38367/1; Završnica Valley, slope of Stol, UTM VM 34, NMWK 29758/2 + 1 (juv.), 38367/1; slope of Stol, Završnica Valley, N-slope of Pecit, 650-700 m, UTM VM 34, leg. Käufel, NMWE 44525/2; Loiblpass 3 km S from the border of Austria, UTM VM 44, leg. Maassen 5.1984, Maa/3; „Zarica“ Save Gorge below Kranj, UTM VM 51, (ex Kuščer) NMWE 15996/3; Duplica, UTM VM 61, (ex Kuščer), NMWE 48518/1; rocks on the left bank of Bistrica N of Stahovica, UTM VM 62, NMWE 10654/2 + 4 (juv.); 2 km N of Grad (= 11.5 km ENE of Kranj), 550 m alt., UTM VM 62, leg. Gittenberger 24.7.1981, NNM/1; rockwall at the road Stahovica-Bistrica koča, UTM app. VM 62/72, NMWE 14271/2 + 3 (juv.); Grintovca, Kankar Saddle, UTM VM 63, NMWK 38370/2; Jezersko, 20 km NE of Kranj, 950 m alt., UTM VM 63, leg. de Winter 29.9.1980, NNM/4; neighbourhood of Jezersko, UTM VM 63, leg. Maassen 9.1980, Maa/22(partly damaged); Grintavec-slope in Kankar Saddle, 200 m below Zoishut, UTM VM 63, NMWE 10632/2; Kamniška Bela Valley 13 km N of Kamnik (= NW of Velika Planina), 600 m alt., UTM VM 63, leg. Gittenberger 23.7.1981, NNM/1; 1.5 km W of „Dom v Kamniški Bistrici“, 12 km N of Kamnik, 610 m alt., UTM VM 63, leg. Gittenberger 23.6.1981, NNM/11; grottos of Moräutsch, UTM VM 71, (ex Stussiner, coll. O. Boettger) SMF 51775/3; entrance of grottos near Aich, UTM VM 71, (ex Robič 1879, ex Jetschin), SMF 110481/3; NW Velika Planina in „Dolski Graben“, 875 m alt., UTM VM 72, leg. Gittenberger 9.1970, NNM/1; rocks above the eastern Bistrica Source, UTM VM 73, NMWE 10686/2; between „Frisaufov Dom“ and „Logarska dolina“, 1350 m alt., UTM VM 73, leg. Gittenberger 26.8.1971, NNM/2; „Savinjal. solcav“, UTM VM 73/74**,** NMWK 38373/2; „Naplov savinje pri Solčavi“

(= Solčava), UTM VM 74, (ex KUŠČER) NMWE 48675/4; entrance of Lisična cave near Luče, UTM VM 83, (ex KUŠČER) NMWE 49095/2.

**Croatia:** Istria, Režanci, cave, UTM VK 18, leg. KOVAČIĆ 7.8.1980, CNHM/1; Istria, Motovun, debris of the Mirna, UTM VL 02, leg. MAASSEN 5.1991, Maa/3 (juv.); Istria, Učka Mountain (= Mte. Maggiore), rocks im small dolinas below refuge, UTM VL 31, leg. 1927, NMWE 21351/1; Učka Mountain near Poklon, 970 m alt., UTM VL 31, leg. MAASSEN 9.1982, Maa/1 (juv.); Učka Mountain western side near Veprinac, 350 m alt., UTM VL 42, leg. MAASSEN 9.1982, Maa/1 + 1 (juv.); forest above Ičići (= between Poljane and Veprinac), at limestone rocks, UTM VL 42, leg. SUBAI 4.9.1986, S 13157/1 (damaged); 3 km W of Gornje Jelenje (= NE of Rijeka), UTM VL 72, leg. MAASSEN 9.1982, Maa/1 (juv.); Delnice, UTM VL 82, leg. ATTEMS 8.10.1907, NMW 46132/1; Dinara Plateau near Kijevo S of Protoztop, app. 1000 m alt, UTM XJ 07/17, NMWE 16379/3 + 1 (juv.), NMWK 38371/3; Vrlika, UTM XJ 16, leg. MAASSEN 8.1986, Maa/1; castle ruin in Vrlika, at limestone rocks, UTM XJ 16, leg. SUBAI 30.8.1986, S 12188/3 + 1 (juv.); Krupa Valley (= S of Gračac), UTM WJ 69/79, NMWE 33884/1 + 1 (juv.); cave Mramornica near Otočac, UTM WK 16, (ex KUSCER), NMWE 49905/1; Brušane (= between Karlobag and Gospić), UTM WK 22, leg. MAASSEN 8.1986, Maa/1; southern side of Brušane, debris of Brušanka Stream, UTM WK 22, leg. SUBAI 3.9.1986, S 13170/2; Lika-Region, Tomašićeva kuća, between Perušić and Ličko Lešće, UTM app. WK 24/25/34, leg. ŠTAMOL 28.6.1981, CNHM/1 + 1 (juv.), 1 (juv.), 5 + 9 (juv./damaged); Plitvice lakes, southern side of Plitvički Ljeskovac, UTM WK 46, leg. VERMEULEN 1988, NNM/6; Plitvice lakes, UTM WK 46/47, leg. VERMEULEN 1988, NNM/6; Plitvice (= W of Bihać), limestone rocks at a large waterfall, UTM WK 47, leg. PINTÉR, SUBAI & SZIGETHY 6.8.1972, HNHM/1, S 2706/1 (damaged); National Park Plitvice, near entrance 2, UTM WK 47, leg. MAASSEN 9.1985, Maa/1 + 3 (juv.); Plitvice, 40 m above Milanovac Lake, UTM WK 47, leg. MAASSEN 9.1975, Maa/5; Plitvice, „Milka Trnina“ cave near Gavanovac Lake, UTM WK 47, leg. MAASSEN 9.1975, Maa/1 (damaged); Devčićevac, Plitvice Lakes, UTM WK 47, leg. STURANY 6.1895, NMW 23490/1 + 2 (juv.); 2 km N of Jošan, 650 m alt., UTM WK 53, leg. MAASSEN 5.1983, Maa/10(partly damaged); Čerovačka cave 4 km SSE of Gračac, UTM WK 60, leg. MAASSEN 9.1988, Maa/3 + 1 (damaged); Presika (= N of Vrbovsko) 600 m alt., UTM WL 02, leg. MAASSEN 9.1982, Maa/13; Lukovdol, UTM WL 13, leg. HIRC, CNHM 682/1; (ex HIRC, ex MACEK) CNHM 683/2 + 1 (juv.); Kordun-Region, Mikašinovići near Gornje Dubrave, close Zala caves, UTM WL 21, leg. JALŽIĆ 13.3.1983, CNHM/1; southern Croatia, Kapela, UTM n. det., (ex REITTER, coll. O. BOETTGER) SMF 51771/1.

**Bosnia and Hercegovina:** Karanovac, UTM BQ 85, leg. NORDSIECK 3.8.1966, SMF 205796/1; Ivan [ = mountain WSW of Sarajevo], UTM BP 54/55, 64/65, leg. APFELBECK, NMW 32350/2; Preslica-walls against Bradina (= S of Ivan), UTM BP 54/64, NMWE 15926/3 (juv./damaged), NMWK 38375/1; Vrelo Bosna (= W of Ilidža near Sarajevo), UTM BP 85, leg. MAASSEN 7.1980, Maa/4 + 4 (juv./damaged); leg. MAASSEN 5.1984, Maa/2; Željeznica-debris near Ilidža, UTM BP 85, leg. WINNEGUTH, NMW 62147/1 + 1 (juv.); Miljacka-debris near Sarajevo, UTM app. BP 85/95, leg. WINNEGUTH, NMWE 20834/6; leg. KUŠČER, NMWK 33619/2; (ex KUŠČER) NMWE 49638/2; Reljevo near Sarajevo, UTM BP 86, NMWK 38369/2 (juv./damaged), 38374/1; (ex KUŠČER, ex WINNEGUT) NMWE 49373/4(damaged, without teeth); 2 km S of Dobro Polje, alongside of Dobropoljanka Stream, UTM BP 92, leg. MAASSEN 5.1984, Maa/37 + 6 (juv./damaged); 3 km E of Dobro Polje (= 35 Km SSE of Sarajevo alongside of Dobropoljanka Stream, 800 m alt., UTM BP 92, leg. MAASSEN 17.9.1980, NNM/6 + 1 (damaged); 4.5 km N of Trnovo, at rocks along a stream, 800 m alt., UTM BP 94, leg. MAASSEN 5.1984, Maa/2 (juv.); hillslope 11 km NE of Miljevina (= country road Sarajevo-Foča), alongside of Rijeka Bistrica, 800 m alt., UTM CP 02, leg. DE WINTER 18.9.1980, NNM/1 + 4 (juv./damaged); 15 km outside Miljevina (= S of Dobro Polje), alongside of Dobropoljanka Stream, UTM CP 02, leg. MAASSEN 9.1980, Maa/37 + 6 (juv./damaged); Jahorina Pale (= E of Sarajevo), at limestone rocks beside of Miljacka-river, 900 m alt., UTM CP 05, leg. SUBAI 17.8.1987, S 16842/1; Prača Valley, 2 km S of Kukavice (= ± 25 km ESE of Višegrad), 475 m alt., UTM CP 34, leg. MAASSEN & DE WINTER 27.9.1980, NNM/8 + 8 (juv./damaged); N of Ustiprača im Prača Valley, 500 m alt., UTM CP 44, leg. MAASSEN 9.1980, Maa/11; Mountain Stolac, border of Bosnia and Serbia, UTM CP 66, leg. PENTHER 1905, NMW 41080/1; 10 km S of Vinac (= S of Jajce), UTM XJ 89, leg. MAASSEN 9.1988, Maa/1; 3.4 km outside Čađavica (= between Ključ and Mrkonjić Grad), UTM XK 52, leg. MAASSEN & DE WINTER 16.9.1980, Maa/2 + 3 (damaged), NNM/1 (damaged); 22.1 km from Jajce towards Banja Luka (= S of junction towards Mrkonjić Grad), at limestone rocks, UTM XK 72, leg. SUBAI 3.8.1987, S 16813/2 + 2 (juv.); Vrbas banks near Krupa na Vrbasu, UTM XK 74, leg. MAASSEN 5.1984, Maa/14; Vrbas Valley at S-margin of Banja Luka, deciduous forest with limestone rocks, UTM XK 75, leg. SUBAI 3.8.1987, S 16902/1; rocks on the riverbank near Jajce, UTM XK 81, leg. MAASSEN 9.1980, Maa/1; Jajce, near the bridge, UTM XK 81, leg. MAASSEN 9.1988, Maa/1; Jablanica → Rama Valley, UTM YJ 14/23, leg. NORDSIECK 12.8.1966, SMF 205801/1; mountain slope 10.8 km from Jereza Dubrovica towards Jablanica [ = between Jablanica and Mostar], at limestone rocks, UTM YJ 21/22, leg. SUBAI 3.8.1987, S 16939/20 + 29 (damaged); [Mountain] Plasa near Jablanica, UTM YJ 23, NMWK 16189/1; leg. PENTHER 1900, NMW 33565/1 + 2 (juv.); Mountain Vlašić near Travnik, 1500 m alt., UTM YK 10, leg. MAASSEN 5.1984, Maa/3; source below Vrelo Knijeginjac near Sarajevo, UTM n. det., leg. SCHÜTT 8.9.1959, Sch 158/2.

**Serbia:** Novi Pazar, gorge at path to monastery Sopoćani, UTM DN 57, leg. SCHÜTT 1.6.1960, NMWK 45832/2 (damaged), Sch 192/1; Užice, UTM DP 05, (ex KUŠČER) NMWE 49123/1; Zlatibor Mountains, 1 km S of Užice, UTM DP 05, leg. ERŐSS, FEHÉR & KOVÁCS 1.4.2001, coll. ERŐSS 7075/1; 2 km S of Užice (= Užice-Nova Varoš country road), app. 470 m alt., UTM DP 05, leg. ERŐSS, FEHÉR & KOVÁCS 6.4.2001, HNHM 85673/1; Vrelo Raške near Užice, UTM app. DP 05, (ex KUŠČER) NMWE 49416/2 + 1 (damaged); „tudi Vrelo Raške“, UTM app. DP 05, (ex KUŠČER) NMWE 49903/1 + 1 (damaged), NMWK 38365/1.

Kosovo, Rugovska Gorge 2.5 km W of Kućište, 1300 m alt., UTM DN 22, leg. MAASSEN 9.1980, Maa/1 (juv.); Rugovska Gorge 5 km W of Peć, UTM DN 32, leg. MAASSEN 6.1987, Maa/4.

**Montenegro:** 1 km from the bifurcation on country road towards Mratinje near Plužine, UTM CN 29, leg. MAASSEN 9.1980, Maa/5; Durmitor [Mountains], UTM CN 37/47, leg. DABOVIĆ 1936, NMWE 21620/2; Rijeka Bijela S of Šavnik, 600 m alt., UTM CN 45, leg. MAASSEN 9.1980, Maa/2; 4 km S of Kruševice (= between Nikšić and Šavnik), UTM CN 45, leg. MAASSEN 9.1980, Maa/2; along the country road between

Nikšić and Šavnik, 8 Km S of Mokro Kale, 1450 m alt., UTM CN 45, leg. De Winter 20.9.1980, NNM/1 (juv./damaged); Crno Lake near Žabljak, UTM CN 47, 1450 m alt., leg. Maassen 9.1980, Maa/4; Bistrica in Tara Valley, UTM CN 76, leg. Maassen 7.1979, Maa/3 + 2 (damaged); Biogradsko Lake, UTM CN 85, 1200 m alt., leg. Maassen 6.1987, Maa/1 (juv.); near Motel in Sjenogošte (= N of Kolašin), UTM CN 85, 950 m alt., leg. Maassen 9.1980, Maa/2; leg. De Winter 23.9.1980, NNM/2 + 1 (juv.); 5 km S of Zaton along the road Ivangrad-Vrapče Polje, 650 m alt., UTM DN 05, leg. Maassen 9.1980, Maa/11; between Ribariće and Rožaje (= 20 km from the bifurcation at Tutin), limestone rocks, UTM DN 34, leg. Pintér, Subai & Szigethy 19.7.1972, S 2707/10 + 1 (damaged); Ibar Valley 3 km N of Rožaje (= S of Novi Pazar), 1000 m alt., UTM DN 34, leg. Maassen 9.1980, Maa/2.

**Macedonia:** rocks longside of the Drim-river 3 km N of Lukovo, UTM DL 68, leg. Maassen 5.1975, Maa/5; Ohrid, UTM DL 85, (ex Kuščer) NMWE 49046/1 + 2 (juv./damaged); outside of Vratnica, UTM EM 16, (ex Kuščer), NMWE 48921/1; source at Rašće (= W of Skopje), UTM EM 25, (ex Kuščer) NMWE 48171/1 + 2 (juv./damaged).

**Albania:** Periferi Malësia, a mountain pass 2 km N of Rraps, along the road from Hai i Hotit to Vermosh, limestone rocks, UTM CM 79, leg. Erőss & Fehér 30.6.1996, HNHM 90976/1; Periferi Shkodër, W of Shllak (= 18 km from the Mes bridge), 1020 m alt., limestone rocks, UTM CM 96, leg. Erőss, Fehér, Hunyadi & Murányi 16.4.2006, HNHM/1; Periferi Elbasan, S of Gurri i Zi, 13 km from the Elbasan junction on the road to Qafa e Shtyllës, limestone rocks, 900 m alt., UTM DL 26, leg. Erőss, Fehér, Hunyadi & Murányi 10.4.2006., HNHM/2(alk.) + 2(juv., alk.); Periferi Tiranë, 6 km S of Qafa e Shtylles, along the road from Tiranë to Klos, karst plateau, limestone rocks, 1420 m alt., UTM DL 27, leg. Erőss, Fehér, Kontschán & Murányi 22.10.2002, HNHM 91699/1; Periferi Pogradec, Shpellë (= 4 km SSE of Bishnicë), Shkemb i Qytetit, limestone and conglomerate rocks, 1140 m alt., UTM DL 52, leg. Erőss, Fehér, Kontschán & Murányi 1.7.2003, HNHM 93070/1; Qukës-Shkumbin, over the quarry in the left side of the Lumi i Shkumbinit, limestone rocks, 500 m alt., UTM DL 54, leg. Erőss, Fehér, Kontschán & Murányi 30.6.2003, HNHM 93055/1.

**Greece:** Macedonia, Grámmos Mountain, slope to the lake on the E-side of mount Epáno Aréna (= NW of Pefkófito), at limestone rocks and under stones, 1900 m alt., UTM DK 96, leg. Subai 15.7.1990, S 16383/2.

Ípiros, app. 38 km S of Ioannina (= 51 km along the country road), rocks W of country road near paleolitic caves, 150 m alt., UTM DJ 84, leg. E. & E. J. Gittenberger 31.5.1991, NNM/1 (damaged); Loutrá (= 5 km N of Amárantos) limestone western hillside, 1270 m alt., UTM DK 74, leg. Riedel & Subai 12.4.1988, S 14906/65 + 17 (juv./damaged); Loutrá near Amárantos, at N-exposed limestone rocks and in woods app. 500 m SE of Loutrá, 1250 m alt., UTM DK 74, leg. Subai & Szekeres 16.5.1997, S 17057/34 + 6 (damaged); Zagoria, Kipi, limestone rocks near old bridge, UTM DK 81, leg. Sattmann 21.8.1990, NMW 102816/4; rocks between Mikra Peristeri and Mega Peristeri, UTM EJ 09, leg. Reischütz 7/87, NMW 85654/2 + 1(juv).

R e m a r k s : *Pupa truncatella* was described by L. Pfeiffer (1841: 46) without illustrations. His specification of the locus typicus is: „...monte Karst prope Castel nuovo, inter Tergestum et Fiume“. Castelnouvo is the former name of Podgrad. The small town is located between Triest (= Tergestum) and Rijeka (= Fiume). The “small species (= /*truncatella*/)” mentioned in Pfeiffer’s original description is found there.

Rossmässler (1842: 12) recapitulated Pfeiffer’s localities and added a record by Schmidt from near Ljubljana (= Laibach); additionally, he illustrated two “varieties” he received from Frivaldszky “from Turkey”. It is only his figure 733 that shows *A. truncatella*.

Küster (1842: 34) referred to both, Pfeiffer and Rossmässler, repeated their statements and added as new locality “lower Dalmatia (Neumeier)“ and figured the specimens on his plate 4 Fig. 20–25. It is impossible to identify the species illustrated in Figs. 20–23. Since Küster characterized the aperture as “...without foldings and teeth…” and the drawing shows a dense ribbing pattern it is likely that the first picture shows the later described *A. skipetarica*, which in fact lives in lower Dalmatia. But it is also possible that he had the true *A. truncatella* before him, but was not able to recognize the tiny teeth. The “varieties” (figs. 24–25) clearly show that species which was later described by Pfeiffer (1848: 331) under the name *Pupa parreyssii* (a valid taxon living in Bulgaria). However, Pfeiffer (1848: 303) supplied a modified description of *A. truncatella* repeating the inaccurate information about the locus typicus. Additionally, he described a variety β under the name *Pupa formosa* (see there).

It was not possible to identify the species Petrbok had at hand when naming his “*Agardhia truncatella* var. *depressa*” (1939: 344, footnote). His description is not sufficient enough to differentiate *depressa* from “*Agardhia truncatella biarmata* for. *minor*” which lives at the same spots. Very likely, both taxa describe the small, toothless form of *A. truncatella* from northern Bosnia since both originate from Čebič, a place which could not be located (see also *biarmata*).

V a r i a b i l i t y : *A. truncatella* is moderately variable concerning shell size and shape, the pattern of ribbing and the formation of the apertural teeth. Maassen (1985: 4) described an interesting form of *A. truncatella* living in northern Bosnia (Karanovac, Vrbas Valley near Banja Luka and 10 km S of Vinac). It is smaller and more slender than the usual form of *A. truncatella*, with lacking apertural teeth (see Fig. 2). Near Krupa na Vrbasu in the Vrbas Valley, the population is larger and wider, but sill the teeth are missing. Finally, the form near Vrelo Bosna (= SW of Sarajevo) is slender and only slightly smaller than the usual form with hardly recognizable but existing teeth and a very faint, hardly elevated keel-like parietal ridge. The specimen from the most southward habitat in Greece (app. 38 km S of Ioannina, fig. 3.) has a poorly developed palatal tooth and an inconspicuous parietal lamella. All other characters are shared with the usual form. Near Kipi at the Turkish bridge in Zagoria, large specimens were found (see fig. 4.). At a locality between Mikra- and Mega Peristeri, two specimens of

*A. truncatella* were found. One of them shows a coarse and widely spaced mode of ribbing with an indication of an infraparietalis, while the second specimens is densely ribbed without an infraparietalis.

All these differences recorded here are interpreted as individual variation since all the shells hitherto examined share the remaining characters of *A. truncatella.*

Distribution: This species is known from near Upper Austria south of Salzburg to Steyr area throughout Austria, north-eastern Italy, western Slovenia, south-western Croatia, Bosnia and Hercegovina, Montenegro, the western border of Serbia and Kosovo, western Macedonia, Albania to northwestern Greece. It clearly is an inland species which does not live in the mountains of the Adriatic coast southeast of Kvarner Bay to Greece.

### ***Agardhiella biarmata*** (O. BOETTGER 1880)

Plate 1, Figs. 5–6, textfigs. 4–6

1880 *Pupa* (*Sphyradium*) *truncatella var. biarmata* O. BOETTGER, Bericht des Offenbacher Vereins für Naturkunde, **1880**: 109 [locus typicus: "...bei Ragusa und bei Pridworje gesiebt"; lectotypus design. ZILCH 1985: SMF 4658].

1887 *Pupa* (*Coryna*) *truncatella var. biarmata*, – WESTERLUND, Fauna der in der paläarctischen Region lebenden Binnenconchylien, **3**: 88.

1890 *Pupa* (*Coryna*) *biarmata*, – FLACH, Verhandlungen der physikalisch-medizinischen Gesellschaft zu Würzburg, (2) **24**: 53.

1906 *Coryna biarmata spelaea* KOBELT, Iconographie der Land- & Süßwasser-Mollusken, (2) **12** (1/6): 23, Plate. 311 Fig. 1979 [locus typicus: "...in einer Höhle bei Zavala in der Herzegowina, ...", syntypes: NMW, SMF].

1915 *Agardhia* (*Agardhia*) *truncatella biarmata,* – STURANY & WAGNER, Denkschriften der Kaiserlichen Akademie der Wissenschaften in Wien, mathematische- naturwissenschaftliche Klasse, **91**: 65, Plate. 18 Fig. 104 a–c.

1926 *Agardhia* (*Agardhiella*) *truncatella biarmata*, – PILSBRY, Manual of Conchology, **27**: 164, Plate. 19 Fig. 9–14.

1939 *Agardhia truncatella biarmata* for. *minor* PETRBOK, – Věstnik Čs. zoologické společnosti v praze, **6/7**: 344 [locus typicus: "...in the rocky clefts of the Karst at Čebič, ..."; type material: unknown].

1975 *Agardhiella formosa*, – GITTENBERGER, Zoologische Mededelingen, **48** (24): 284, Fig. 1 (shells) [partim, non *formosa* L. PFEIFFER 1848].

1985 *Agardhiella biarmata*, – ZILCH, Archiv für Molluskenkunde, **116** (1/3): 128, Plate 2, Fig. 19.

1985 *Agardhiella formosa*, – MAASSEN, De Kreukel, **21** (1–2): 4, distribution map [partim, non *formosa* L. PFEIFFER 1848].

Diagnosis: shell small, aperture small with angularis, parietal lamella and infraparietalis. Strongly developed palatal tooth, sometimes with columellar teeth.

Description: shell relatively small, cylindrical with a rounded apex. After ca. 1.75–1.95 smooth, slightly granulated whorls, a rapidly increasing radial rib sculpture begins. On the last whorl there are 35–55 (9–14/mm) ribs. Between the main ribs there are fine, irregular radial ribs which can only be recognized under high magnifications.

Whorls 6–7; the last whorl occupies more than the half of the total height. The umbilicus is narrow cylindrical.

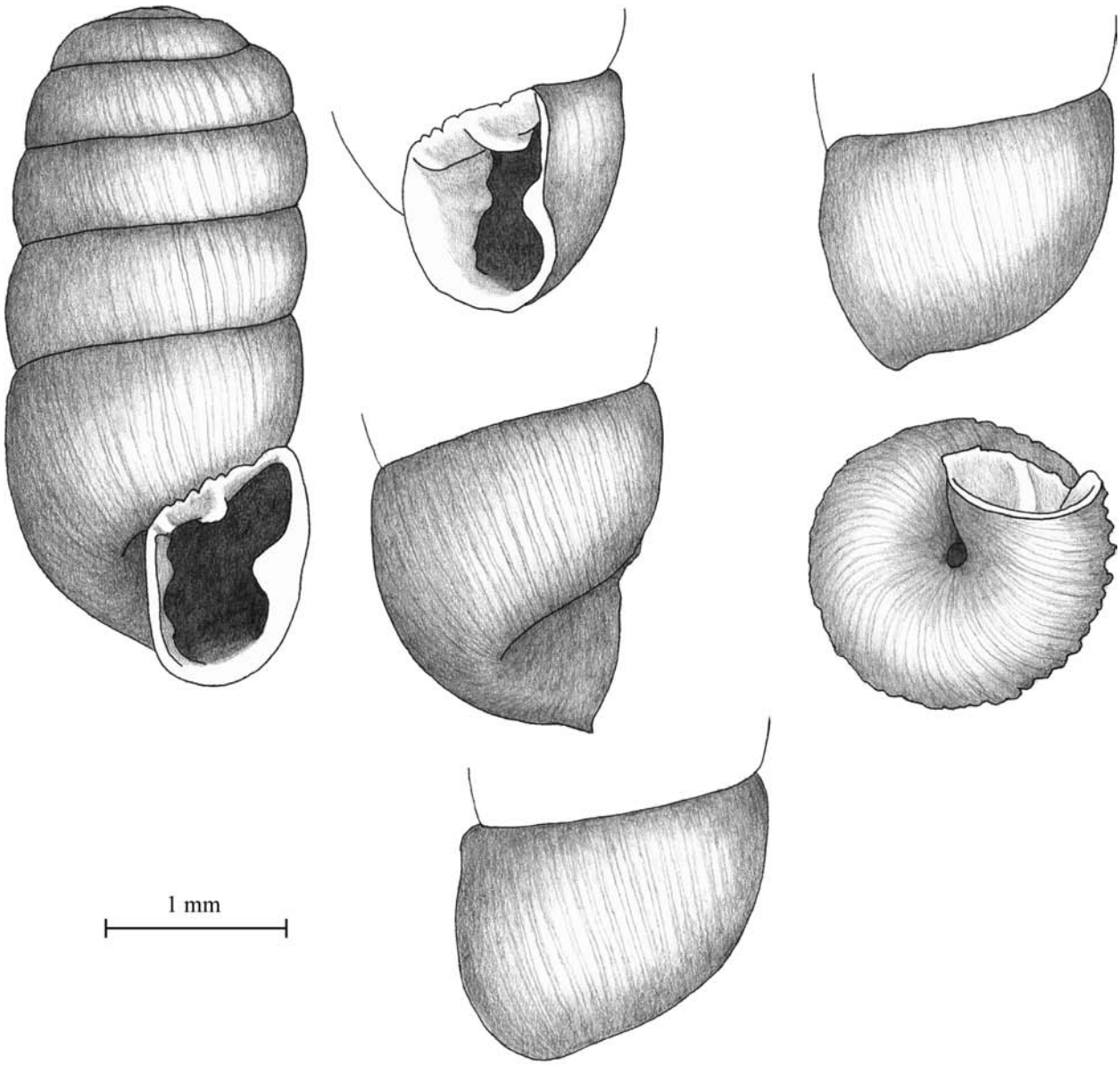
Aperture small, with an infraparietalis and an angularis. In general, both teeth are poorly developed and stretch straight towards the interior of the shell; a parietal lamella is present as well which often only reaches the height of the marginal teeth, but its size increases in the interior of the shell. In the upper part of the columella, there are sometimes two columellar teeth, and at the bottom a basicolumellaris. These columellar teeth are often very weak or missing at all. In frontal view, the apertural rim is u-shaped. Interiorly, it is strengthened by a slight lip and flared towards the outside. In the upper part of the columellar side it is slightly bent towards the umbilicus. The centre of the palatal side of the aperture is impressed by a strong tooth-like callus. The upper palatal aperture is slightly bulged without a lip. Sometimes, a very short sinulus is developed above the angularis. The peristomial rims are connected by a well developed callus which also covers the ribs above the aperture. In side view, the upper part of the apertural rim is slightly protruding.

Measurements (n = 23): H = 3.18–3.93; D = 1.43–1.75; AH = 1.19–1.37; AD = 0.75–0.87.

Characters of genital organs (after 2 specimen of Trebinje, Petrina, Matulica cave): The retractor muscle of the right eye-stalk runs between penis and vagina; proximal half of the penis slender, almost as long as the slightly swollen distal half of the penis. The appendix inserts centrally between the two penis parts; the central part is narrow, the basal and the terminal parts reach two to three times of its diameter; the appendix retractor muscle inserts at the widened proximal part of the appendix. The epiphallus reaches about half the length of the penis; in one of the specimens dissected, the distal epiphallus was constricted behind a slight swelling, while in the other specimen the epiphallus passed smoothly to the vas deferens. The oviduct is longer than the broad vagina. The pedunculus of bursa copulatrix is moderately long and inserts at a slightly swollen point at the distal part of the vagina.

Differential diagnosis: Its closest relative, *A. truncatella*, has a somewhat wider aperture with only two marginal parietal teeth. It always lacks the columellar teeth and the parietal lamella. Its parietal wall is slightly enlarged by a barren callus and not indentate as in *A. biarmata*. In *A. truncatella*, the apertural rim is more strengthened basally, but the columellar side is not as enlarged as in *A. biarmata*.

In *A. formosa*, the aperture is larger and wider; the rib sculpture of its teleoconch with coarser and wider ribs. This species is similar in the development of the apertural teeth, but the parietal lamella already starts at the parietal callus. The lower part of the aperture is more



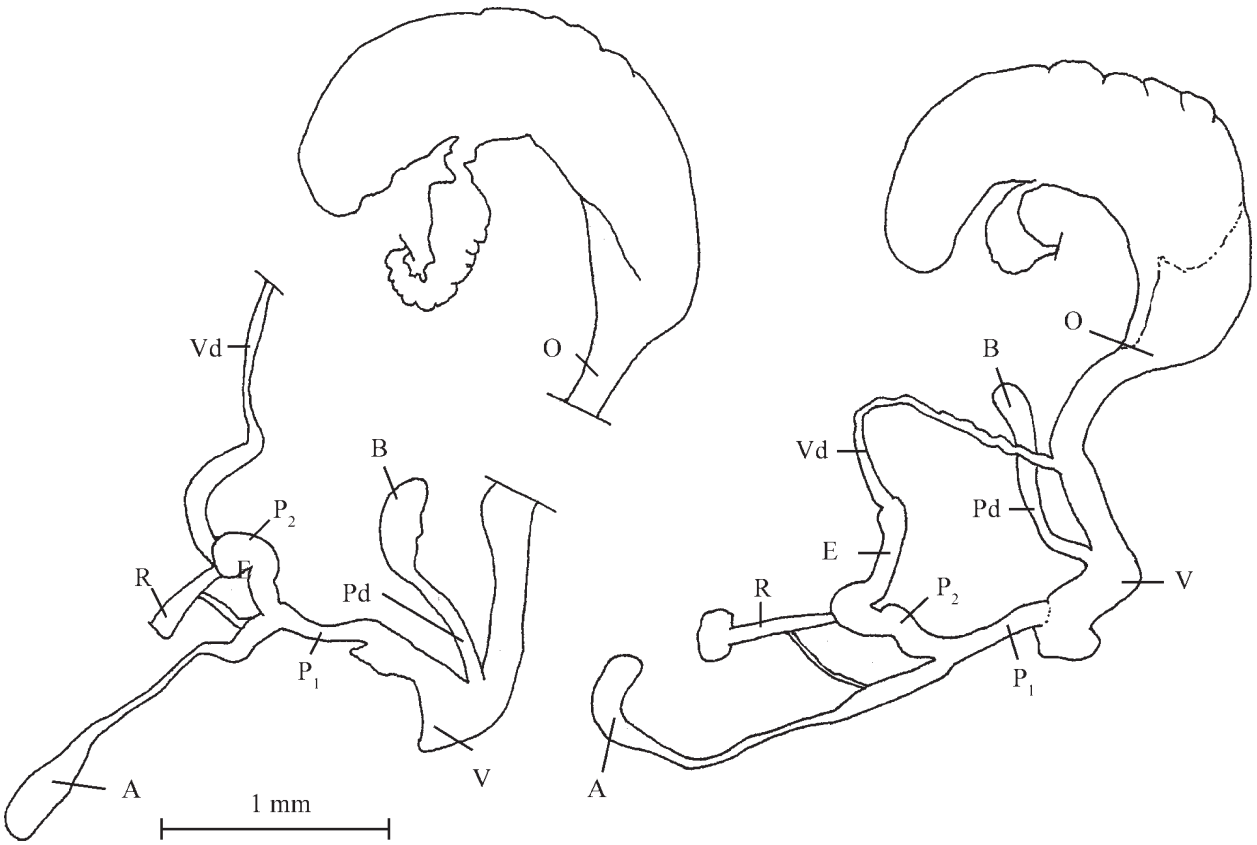

Textfig. 4. *Agardhiella biarmata* (O. Boettger 1880). Croatia, Island Korčula, mountain slope 2.8 km from Čara towards Korčula-City, at limestone rocks, UTM XH 55, (H = 3.75, D = 1.68 mm).

strongly enlarged, but a palatal tooth is always missing. In *A. formosa*, the parietal wall is only slightly enlarged. So far, no palatal teeth have been found.

T y p e s : Croatia, Dubrovnik (= Dalmatien, Ragusa), UTM BN 52/62, (coll. O. BOETTGER ex E. REITTER) lectotype *biarmata* (design. Zilch): SMF 4658/1; Pridvorje, UTM BN 81, (coll. O. BOETTGER ex E. REITTER) paratypes *biarmata*: SMF 4571/1 + 2 (juv.); cave near Zavala, UTM YH 44, leg. Paganetti 1903, syntypes *biarmata spelaea*: NMW 39555/4 + 1 (juv.); ex Sturany 1904, (coll. O. Boettger) SMF 51691/1.

A d d i t i o n a l m a t e r i a l e x a m i n e d : **Bosnia and Hercegovina:** small cave near Bihovo near Trebinje, UTM BN 72, (ex coll. Ehrmann), leg. Absolon 25.7.1912, SMF 51692/5; leg. Deeleman-Reinhold 21.6.1975, NNM/1 (damaged); cave near Trebinje, UTM BN 83, leg. Absolon, NMW 50236/3 (juv.); „cave 3 e“ near Trebinje, UTM BN 83, NMW 68444/1; (ex Käufel) NMWK 16200/1; Trebinje, Petrina, Matulica cave, UTM app. BN 83, leg. Pavić 8.9.2006, HNHM/3(alk.); Velika cave near Trebinje, UTM BN 83, (ex Kuščer) NMWE 48720/2; Trebišnjica Source near Bileća, UTM BN 84, leg. Schütt 8.9.1967, Sch 427/2 (damaged); Čepelica Source near Bileća, UTM BN 84, leg. Schütt 14.9.1959, Sch 140 b/2 (damaged); Buna near Mostar, UTM YH 39, (ex Kuščer) NMWE 48923/1 (damaged); Zavala, UTM YH 44, leg. Maassen 7.1982, Maa/2; Bjelušica, small cave near Zavala (Popovo polje), UTM YH 44, (ex Edlauer 16438), Sch/1 (damaged); (ex Kuščer) NMWE 48721/5; Zavala, small cave near monastery, UTM YH 44, leg. Edlauer, NMWK 47250/5, 2941/1; uppermost rocky front of Ostrog N of Zavala, UTM YH 44, NMWE 16417/1; district Trebinje, Djurkovina cave 15 minutes NE of „Gensdame ric grebci“, UTM n. det., leg. Remy 27.8.1936, NMWE 48275/1.

**Croatia:** cave „špilja za Gromačkom vlakom“ near Gromača near Dubrovnik, UTM BN 53, leg. Jalžić, 6.3.1998,




Textfig. 5 a–b. *Agardhiella biarmata* (O. Boettger 1880) situs of the genital organs. Bosnia and Hercegovina, Trebinje, Petrina, Matulica cave, UTM app. BN 83. — Abbreviations to the drawings of genital organs: A = appendix, B = bursa, E = epiphallus, O = oviductus, $P_1$ = proximal part of penis, $P_2$ = distal part of penis, Pd = pedunculus, R = retractor muscle, V = vagina, Vd = vas deferens.

CNHM/1 + 3 (juv.); 1 km E of Osojnik (= 8 km N of Dubrovnik), 450 m alt., UTM BN 63, leg. Gittenberger 8.5.1986, NNM/1; Pridvorje, UTM BN 81, (ex O. Boettger 1904) NMW 39286/1; Konavle Region, Sv. Stjepan Chapel near Duba Konavoska, UTM BN 82, leg. Jalžić, Kletečki & Štamol 23.11.2003, CNHM/1; at a fount at southern side of Slano, 5 m alt., UTM YH 34, leg. Gittenberger 6.5.1986, NNM/2 + 1 (juv.).

Peninsula Pelješac, southeastern mountain slope Sv. Ilija near Orebić, 200–650 m alt., UTM XH 76, leg. Maassen 10.1978, Maa/1 + 1, S 5240/1; Kučište, 150 m alt., UTM XH 76, leg. Maassen 5.1984, Maa/1; Zagorje-Gebirge, Mountain Čarović N-side 600 m of Zaradeže in direction Orebić, at limestone rocks, 370 m alt., UTM YH 04, leg. Subai 6.8.1987, S 13593/2 + 6 (juv./damaged); 2 km SW of Ston, UTM YH 14, leg. Gittenberger 6.5.1986, NNM/1; near Prapatna (= 3 km SW of Ston, 17 km WNW of Slano), UTM YH 14, leg. Gittenberger 6.5.1986, NNM/2; mountain slope at western side of Sparagovići (= Ponikve), at limestone rocks, 450 m alt., UTM YH 14, leg. Subai 6.8.1987, S 13643/1 + 2 (juv.).

Island Korčula, mountain slope 2.8 km of Čara in direction to Korčula-City, at limestone rocks, UTM XH 55, leg. Subai 8.8.1987, S 13632/3 + 3 (juv.); 4.3 km of Pupnat in direction of Pupnatska Luka, at limestone rocks, 170 m alt., UTM XH 65, leg. Subai 8.8.1987, S 13596/2 + 1 (juv.).

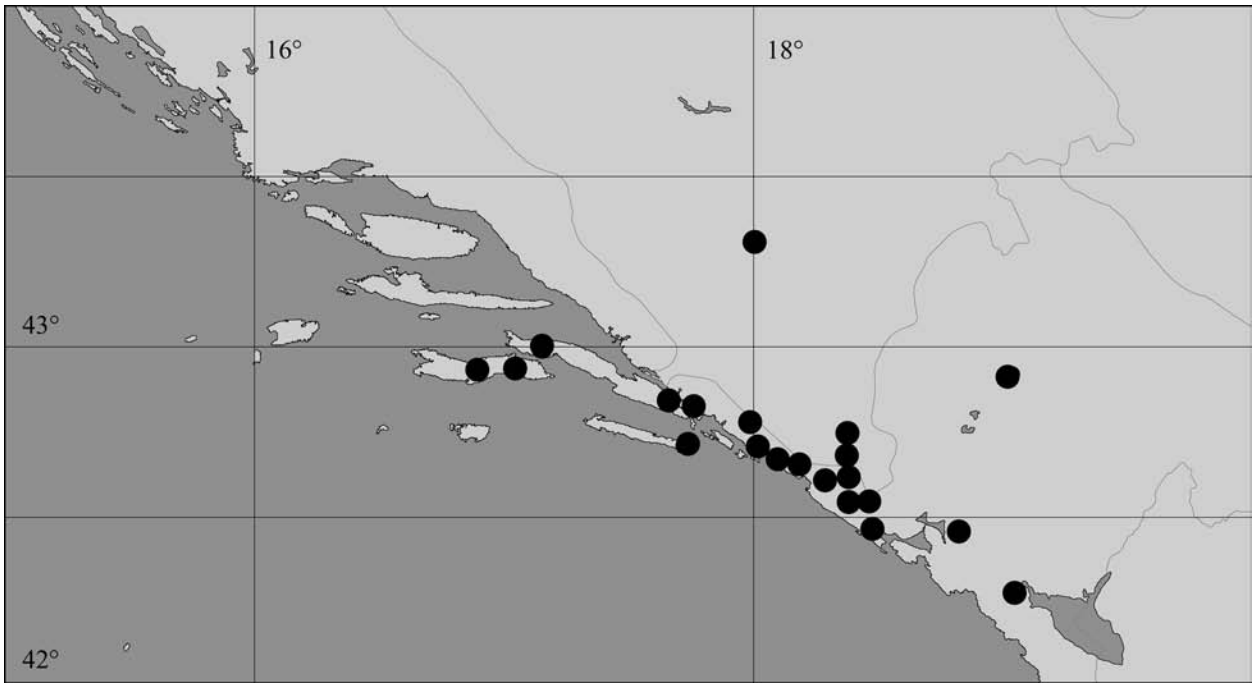
Island Mljet, grotto 200 m E of Sobra, 40 m alt., UTM YH 13, leg. Pintér & Szigethy 2.8.1972, HNHM/1, S 2705/1.

**Montenegro:** Northwestern side of Mokrine (= NNW of Herceg Novi), at limestone rocks, 520 m alt., UTM BN 90, leg. Subai 19.9.2005, S 20673/8 + 4 (juv./damaged); deciduous forest 4.2 km NW of Mokrine (= in direction of Trebinje, NW of Herceg Novi), at limestone rocks, 770 m alt., UTM BN 91, leg. Subai 13.10.2004, S 20537/1 + 1 (juv.); [mount] Sokol near Dupilo village, UTM CM 47, leg. Dabović, NMWE 49398/2; 1 km from Viluse towards of Trebinje, in a forest on mount Skorča, at limestone rocks, 1000 m alt., UTM CN 03, leg. Subai 12.8.1987, S 16903/4 + 1 (juv.); Njeguši, UTM CN 20, NMWK 38384/1 (large!); (ex Fuchs) NMWE 35216/2 + 2 (juv./damaged), 35217/1 + 2 (juv) + 1 (*formosa*!); Popova cave near Njeguši, UTM CN 20, NMWK without Nr./1; leg. Dabović, NMWE 18273/1, 49341/1 + 1 (juv, damaged); Bukovica River near Šavnik, UTM CN 45, NMWK 38360/3.

Unidentified locality: cave „pećina Marica Vuksanovica“, UTM n. det., leg. Dabović, NMWE 49224/1 (damaged).

Remarks: In the original description as well as in subsequent publications of other malacologists, *A. biarmata* was recognised as a subspecies of *A. truncatella*. However, it is a well characterised species with a relatively small distribution area.

Petrbok (1939) described the variability of “*Agardhia truncatella*” including the two new taxa “*Agardhia*




Textfig. 6. Distribution map of *A. biarmata*.

*truncatella* var. *depressa*“ and „*Agardhia truncatella biarmata* for. *minor*“ (both on page 344 in the footnotes). The illustrations of *A. biarmata* (2. and 3. row on page 343) with various pictures of apertural teeth contradict his statement that „*biarmata* for. *minor*“ is toothless. His somewhat confusing identification key (p. 340) does also not help. Until now, the type locality “Čebič” could not be identified, although detailed maps were consulted. The only similar-sounding locality name is Čepić in Northern Istria between Buje and Buzet, which is in the distribution area of *A. truncatella*. Moreover, the type specimens of both taxa could not been traced. Concluding, it is currently impossible to decide whether the specimens Petrbok had at hand belonged to the toothless form of *A. truncatella* from northern Bosnia or in fact to *A. biarmata*.

In the past, *A. biarmata* was confused with the geographically neighbouring *A. formosa* (Gittenberger 1975: 284, Maassen 1985: 4). Most likely this is due to the similarities in the development of the apertural teeth. Near Mokrine, *A. biarmata* and *A. formosa* have been found sympatric without any transitional forms, and also from the Njeguši both species are known (NMWE 35216 adv. 35217) without any overlap in characters. However, it has to be mentioned that from Njeguši (NMWK 38384/1) there is one specimen of *A. biarmata* with an extremely large shell. It approaches the average size of *A. formosa* and has a weaker palatal tooth. But in all other characters as the rounded whorls, the small aperture, only slightly enlarged apertural rim at the base and the development of the parietal lamella, this specimen is typical for *A. biarmata*.

Similar as in *A. truncatella*, *A. biarmata* is found in caves and in the duff of rocks. This separates both species from *A. formosa*, which lives exclusively subterraneous and is only found in rock cavities.

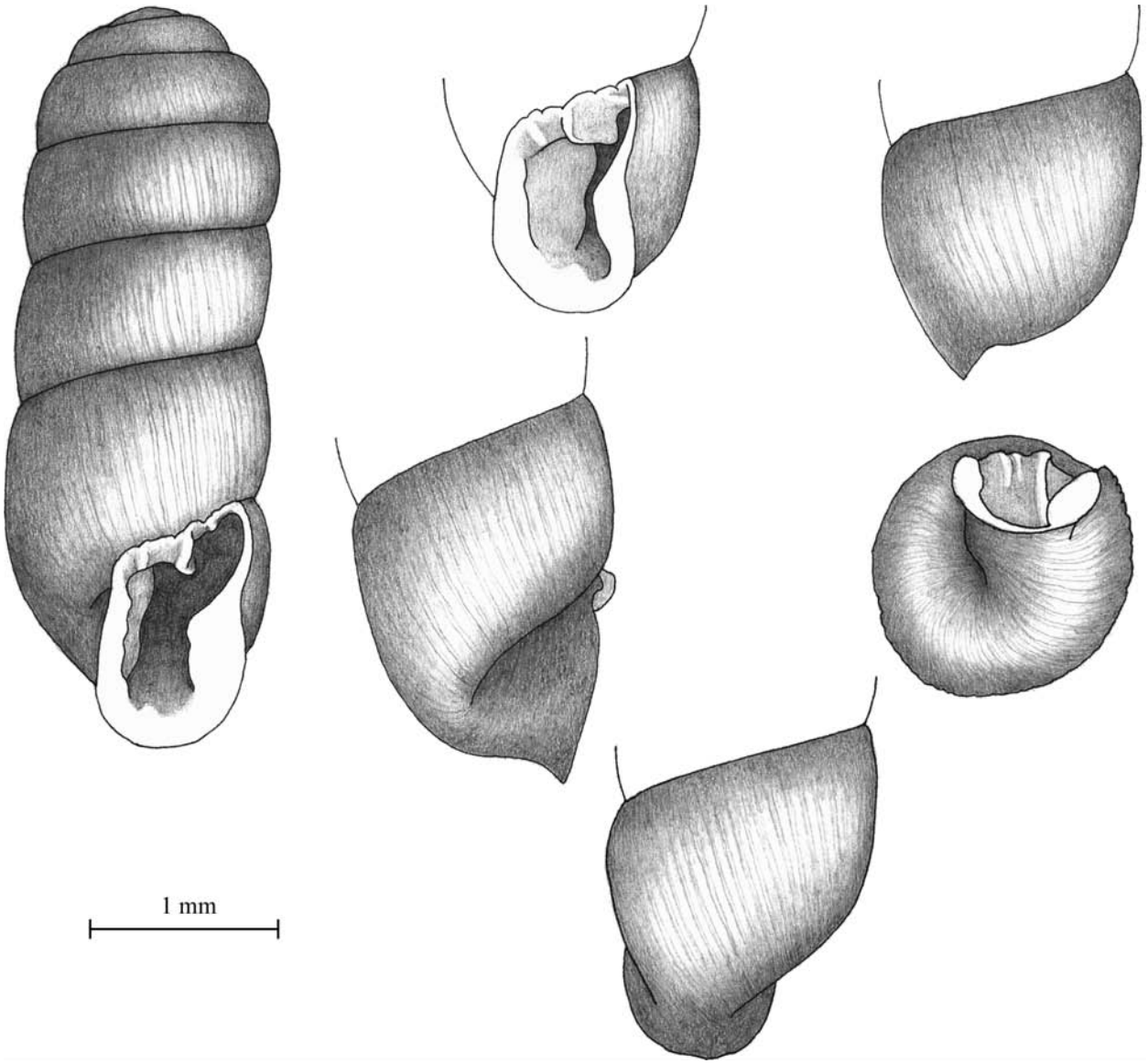
D i s t r i b u t i o n : The distribution of *A. biarmata* reaches the Island of Korčula, the peninsula Pelješac and the Croatian coast southeast of the Neretva Valley. Additionally, it has been found in the mountains of the southeastern part of Bosnia and Hercegovina and in western coastal parts of Montenegro.

### ***Agardhiella stenostoma*** (Flach 1890)

Plate 1, Fig. 10; textfigs. 7, 8.

1890 *Pupa* (*Coryna*) *stenostoma* Flach, Verhandlungen der physikalisch-medizinischen Gesellschaft zu Würzburg, (2) **24**: 53 [locus typicus: „Dalmatia“; holotype SMF 4597].
1926 *Agardhia* (*Agardhiella*) *stenostoma*, – Pilsbry, Manual of Conchology, **27**: 162.
1958 *Argna* (*Agardhiella*) *stenostoma,* – Zilch, Archiv für Molluskenkunde, **87** (4/6): 150, Plate 11, Fig. 1 a, Plate 12, Fig. 1.
1975 *Agardhiella stenostoma,* – Gittenberger, Zoologische Mededelingen, **48** (24): 285, Fig. 3.
1985 *Agardhiella stenostoma,* – Zilch, Archiv für Molluskenkunde, **116** (1/3): 129, Plate 2, Fig. 17.
1985 *Agardhiella stenostoma*, – Maassen, De Kreukel, **21** (1–2): 4, distribution map.

D i a g n o s i s : medium sized shells, aperture with infraparietalis, angularis and bent parietal lamella; strong vertical columellar lamella reaching the apertural rim and strongly impressed longitudinal palatal tooth.



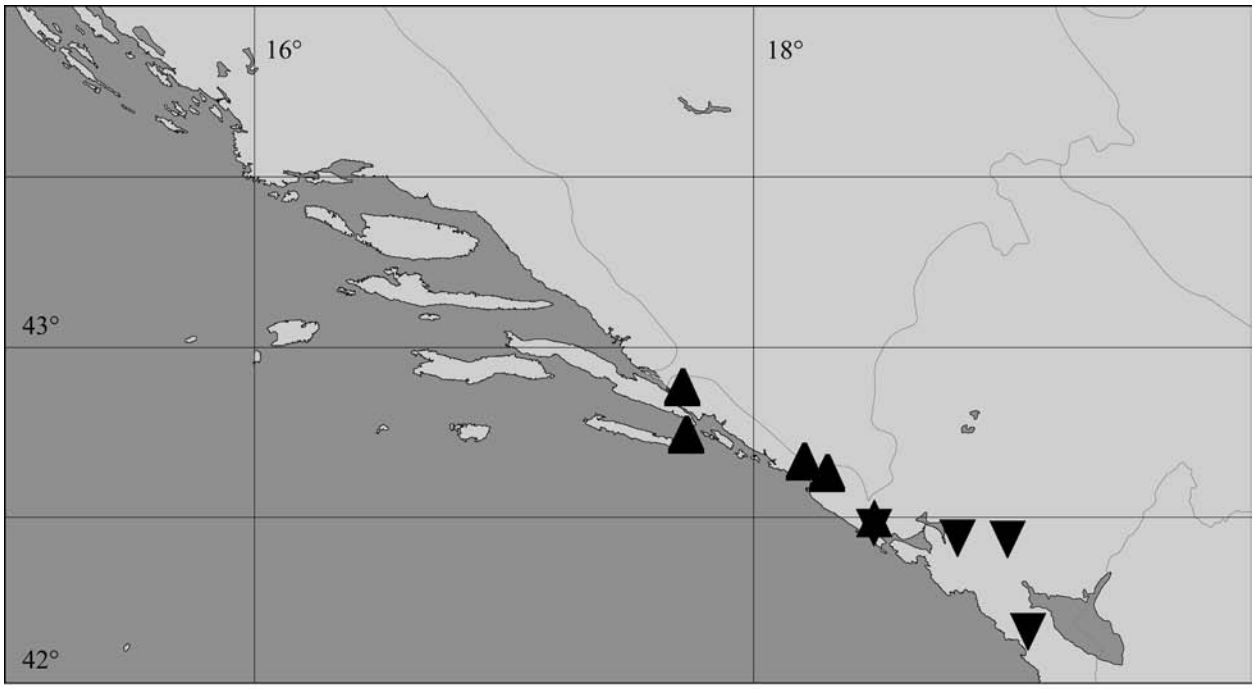

Textfig. 7. *Agardhiella stenostoma* (FLACH 1890). Croatia, graveyard of Komolac near Dubrovnik, at limestone rock beneath the chapel, UTM BN 62, (H = 3.93, D = 1.43 mm).

Description: Shell medium-sized, cylindrical with a rounded apex. The first 1.75 whorls smooth, slightly granulated, followed by radial rib sculpture on the preceding whorls; last whorl with 54–73 (13–14/mm) hardly elevated ribs; between the main ribs, there are fine, irregular radial ribs which can only be seen under high magnification.

Whorls 5.75–6.25; the last whorl up to 52–58 % of the total height; umbilicus narrow, falciform, partly covered by the last whorl.

Aperture long and slender, with weekly developed infraparietalis and angular teeth running straight to the interior of the shell; between them a parietal lamella, reaching two to three times the height of the teeth; it is pointed in front and projects above the level of the aperture; it is curved, narrowed in the middle but somewhat broader at its end inside the aperture. Deep in the aperture, an elongate, strong, vertical columellaris is visible. Apertural rim u-shaped in frontal view; at the columella bordered by a vertical ridge; flared at the base and the palatal side; lower part of the aperture constricted by a strong tooth-like vertical ridge; above this the aperture is recessed, and the apertural rim narrowed; in some specimens, a short sinulus can be recognised above the angularis. The peristomial rims connected by a well recognisable callus concealing the ribs of the last whorl. In side view, the upper part of the apertural rim is slightly protruding, and the upper third diagonally truncated.

Measurements (n = 19): H = 3.62–4.06; D = 1.37–1.56; AH = 1.25–1.37; AD = 0.68–0.87.




Textfig. 8. Distribution map of *A. stenostoma* and *A. formosa*; = ▲ *stenostoma*, = ✸ sympatric occurence of *stenostoma* + *formosa*; = ▼ *formosa*.

Characters of genital organs: unknown.

Differential diagnosis: In general, *A. zoltanorum* is higher and wider than *A. stenostoma*. Its ribs are higher and more widely spaced and it has an almost completely open umbilicus; aperture more stronger constricted in the basal part. Moreover, *A. zoltanorum* has a well developed basal tooth beneath the columellar lamella.

In *A. formosa*, the shell is also higher and wider and the ribs are more widely spaced than in *A. stenostoma*. Its aperture is wider and not constricted, the parietal lamella is lower and less curved, blunt and does not project over the apertural level; the columellaris is missing, the palatal tooth is small to almost reduced.

Types: "Dalmatia", holotype SMF 4597 (coll. O. Boettger).

Additional material examined: **Croatia:** surroundings of „camping Solitude" near Lapad near Dubrovnik, UTM BN 52, leg. Maassen 9.1988, Maa/2 + 1 (damaged); leg. Maassen 4.1989, Maa/1; graveyard of Komolac near Dubrovnik, at limestone rock beneath the chapel, UTM BN 62, leg. Schütt 8.6.1978, Sch 868/1 ("been given to Zagreb"); leg. Maassen 7.1982, Maa/1 (broken); leg. Maassen 5.1984, Maa/3; leg. Subai 25.9.2006, S 20850/11 + 2 (juv.).

Island Mljet, grotto 200 m E of Sobra, 40 m alt., UTM YH 13, leg. Pintér & Szigethy 2.8.1972, HNHM/1 (lower half), 72068/1 + 1 (juv.); rock cleft 1 km E of Sobra, UTM YH 13, leg. Maassen 6.1987, Maa/2.

Peninsula Pelješac, Prapatna near Ston, UTM YH 14, leg. Maassen 5.1984, Maa/1(fraction).

**Montenegro:** Sutorina mouth (= SW of Herceg Novi), debris, UTM BN 90, NMWK 16201/3 + 1 (damaged), 38386/1; leg. Käufel, NMWE 44507/2, NMWR/2; (ex Klemm, ex Schlickum 5381), SMF 274290/2.

Distribution: *A. stenostoma* is recorded from southeastern Dalmatia from habitats close to the sea along the coast between the peninsula Pelješac to south of Herceg Novi in the Kotor Bay in Montenegro. It lives subterraneous.

### ***Agardhiella skipetarica*** (A. J. Wagner 1915)

Plate 1, Fig. 8; textfigs. 3, 9.

1915 *Agardhia* (*Agardhia*) *truncatella skipetarica* A. J. Wagner, in Sturany & Wagner, Denkschriften der Kaiserlichen Akademie der Wissenschaften in Wien, mathematische- naturwissenschaftliche Klasse, **91**: 65, Plate 18, Fig. 105 [loci typici: „Zabljak in Montenegro; Kiribrücke nächst Mesi bei Skutari in Albanien"; lectotype design. Gittenberger 1975 NMW 43328/1].

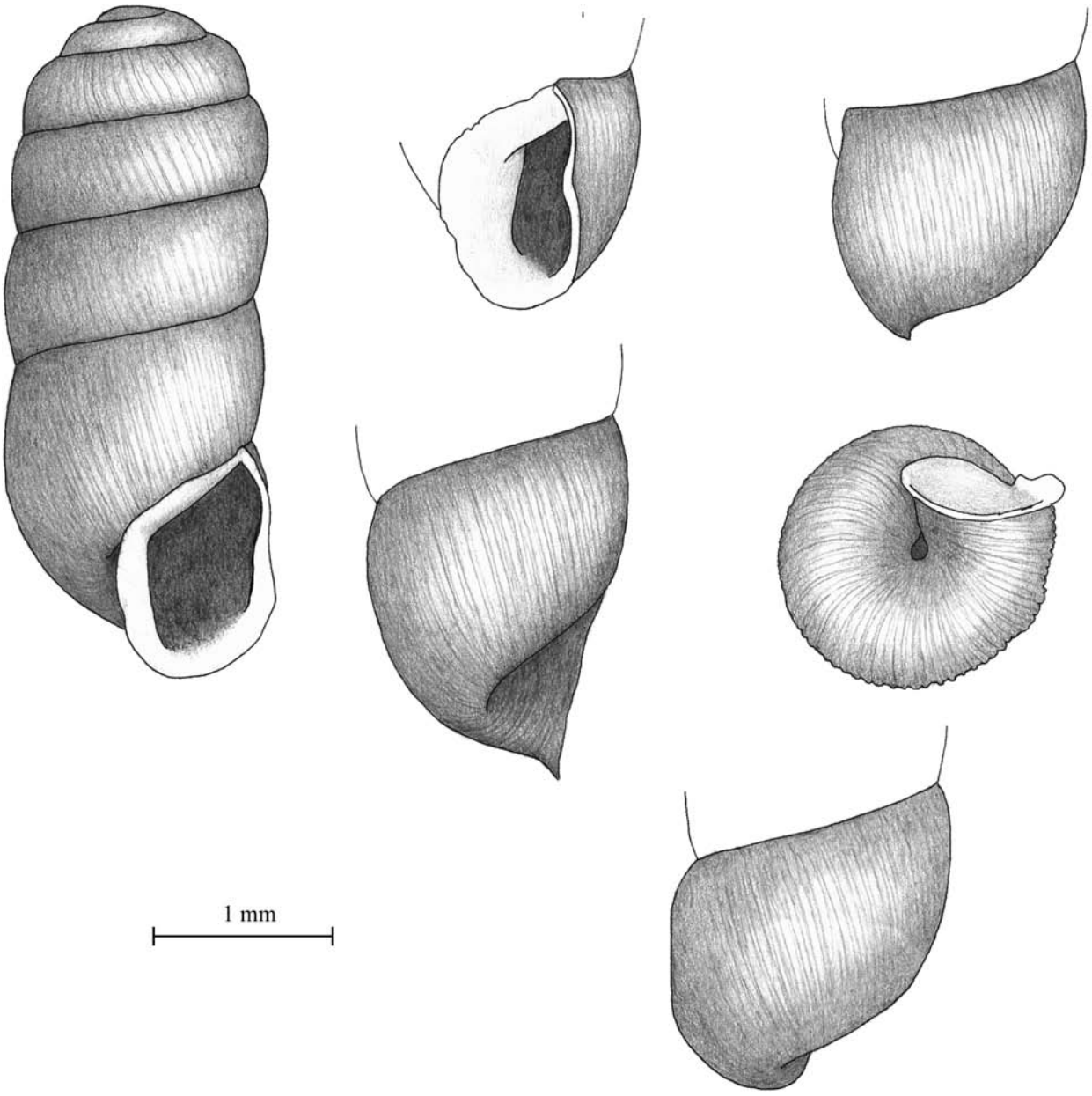
1926 *Agardhia* (*Agardhiella*) *truncatella skipetarica*, – Pilsbry, Manual of Conchology, **27**: 166, Plate 19, Fig. 15.

1975 *Agardhiella truncatella skipetarica,* – Gittenberger, Zoologische Mededelingen, **48** (24): 287.

1988 *Agardhiella truncatella skipetarica,* – Gittenberger, Annalen des Naturhistorischen Museums in Wien, **90** (B): 425.

1999 *Agardhiella truncatella skipetarica,* – Subai, Schriften zur Malakozoologie, **13**: 45, Fig. 5 (distribution map) [partim, only from Kérkira Island].

Diagnosis: shell slender, densely ribbed, aperture without teeth.




Textfig. 9. *Agardhiella skipetarica* (A. J. WAGNER 1915). Greece, Kérkira Island (= Korfu), southern side of road 1.5 km of Petália in direction of Pantokrátor-climax, in a cavity in limestone rocks, 720 m alt., UTM DK 00, (H = 3.75, D = 1.56 mm).

Description: shell relatively small, cylindrical with a rounded apex. The first 1.5–2 whorls slightly granulated, followed by radial rib sculpture on the preceding whorls; last whorl with 54–68 (13–16/mm) hardly elevated ribs; between the main ribs, there are fine, irregular radial ribs which can only be seen under high magnification.

Whorls 5.5–6.5; the last whorl up to 55–58 % of the total height; umbilicus narrow, elongate cylindrical.

Aperture without teeth; in frontal view, the apertural rim is u-shaped; interiorly with a slight lip, outside flared; palatal wall slightly impressed in the middle; above this area, the aperture is bulged, and the apertural rim is narrow and simple; a small sinulus is present. The peristomial rims are connected by a moderately developed callus. In side view, the upper part of the apertural rim is slightly protruding.

Measurements (n = 23): H = 3.43–4.31; D = 1.43–1.68; AH = 1.31–1.43; AD = 0.81–1.

Characters of genital organs: unknown.

Differential diagnosis: Shells of *A. truncatella* are generally broader than those of *A. skipetarica*. It has rounded whorls, and the ribs are more widely spaced and higher. In *A. truncatella*, an infraparietalis and angularis are present; it shows a furrow between the columellar wall and infraparietalis stretching towards

the umbilicus; the apertural rim is clearly lesser flared if compared to *A. skipetarica.*

Types: Albania, Kiri bridge near Mes (= Mesi) close to Shkodër (= Skutari), UTM CM 86, leg. Sturany 27.4.1905, lectotype NMW 43328/1.

Additional material examined: **Croatia:** Lokrum Island, UTM BN 62, leg Kuzmić, CNHM 681/5.

**Montenegro:** Njeguši, UTM CN 20, leg. Fuchs, NMWE 35215/1 + 2 (damaged); Petrovac, hill S of the road, UTM CM 37, leg. Gittenberger 6.5.1975, NNM/1 (damaged); in cave Obodska pećina near Rijeka Crnojevica, UTM CM 39, leg. Maassen 6.1978, Maa/1 (juv.); Virpazar, UTM CM 47, leg. Dabović, NMWE 48742/1 (damaged); cave Jabukov do (= 7 Km of Virpazar on the way to Komarno), UTM CM 48, leg. Gittenberger 6. u. 11.5.1974, NNM/1.

**Albania:** Periferi Shkodër, app. 15.5 km upstream from dam at Koman, Liquen i Komanit right bank, debris, 180 m alt., UTM DM 07, leg. Erőss, Fehér, Hunyadi & Murányi 15.4.2006, HNHM/2(juv. + damaged).

**Greece:** Kérkira Island (= Korfu), 500 m E of Troumpéta (= Pandeleimónas) at N-exposed rock cavities at the roadside and at S-exposed limestone rocks, UTM CJ 99, leg. Subai 6.8.1995, S 14256/2 (damaged); Sfakerá, larger source, UTM CK 90, leg. Schütt 16.7.1983, Sch 1078/1; at the bridge 1 km W of Messongi (= 16 km S of Kérkira-City), UTM DJ 07, leg. Gittenberger 17.4.1979, NNM/2 (juv./damaged); app. 1 km W of Benítses (= 8 km S of Kérkira-City), 100-150 m alt., UTM DJ 07, leg. Gittenberger 16.4.1979, NNM/1 (juv./damaged); rock cavity at roadside western part of Pantokrátor-high plateau, 700 m alt., UTM DK 00, leg. Gittenberger 10.1978, NNM/1 + 2 (damaged); southern side of road 1.5 km of Petália in direction of Pantokrátor summit, in a cavity in limestone rocks, 720 m alt., UTM DK 00, leg. Subai 5.8.1995, S 14255/20 + 5 (juv./damaged).

Remarks: A. J. Wagner described *A. skipetarica* as a subspecies of *A. truncatella*. After examination of more than 30 specimens, this taxon is considered to form an independent species. It is clearly distinguishable from all neighbouring species by its slender shell, the pattern of densely arranged ribs, and its aperture devoid of any teeth.

After Gittenberger (1975: 288), the paralectotype from Žabljak is in the Natural History Museum in Warsaw. It has not been examined by me.

Distribution: The hitherto known distribution area of *A. skipetarica* is split. In the north, it is found from Lokrum Island near Dubrovnik in a narrow range along the south Dalmatian coast Montenegro and northern Albania. A second area of distribution known is known on the Greek island Kérkira. The gap of records is probably due to limited collection efforts.

### ***Agardhiella formosa*** (L. Pfeiffer 1848)

Plate 1, Fig. 7; textfigs. 8, 10.

1848 *Pupa truncatella* β [*Pupa formosa*] L. Pfeiffer, Monographia heliceorum viventium, **2**: 304 [locus typicus: „...in monte Karst, prope Castelnuovo inter Tergestum et Fiume! In Carniolia, Dalmatia, Turcia.“ restricted by Gittenberger (1975: 284): Herceg Novi (= Castelnuovo); type material: lost].

1887 *Pupa* (*Coryna*) *truncatella* var. *formosa*, – Westerlund, Fauna der in der paläarctischen Region lebenden Binnenconchylien, **3**: 88.

1915 *Agardhia* (*Agardhia*) *truncatella formosa*, – Sturany & Wagner, Denkschriften der Kaiserlichen Akademie der Wissenschaften in Wien, mathematische- naturwissenschaftliche Klasse, **91**: 65, Plate. 18 Fig. 103.

1926 *Agardhia* (*Agardhiella*) *truncatella formosa*, – Pilsbry, Manual of Conchology, **27**: 164, Plate. 19 Fig. 6–8.

Diagnosis: Large shells, aperture large, with angularis, parietal lamella and infraparietalis; palatal tooth missing or reduced.

Description: Shell relatively large, cylindrical with rounded apex After ca. 1.75 smooth, slightly granulated whorls, a rapidly increasing radial rib sculpture begins. On the last whorl there are 36–50 (7–11/mm) well developed ribs. Between the main ribs there are fine, irregular radial ribs which can only be recognized under high magnifications.

Whorls 6.5–7.25; the last whorl occupies 45–56 % of the total height. The umbilicus is narrow cylindrical, elongate.

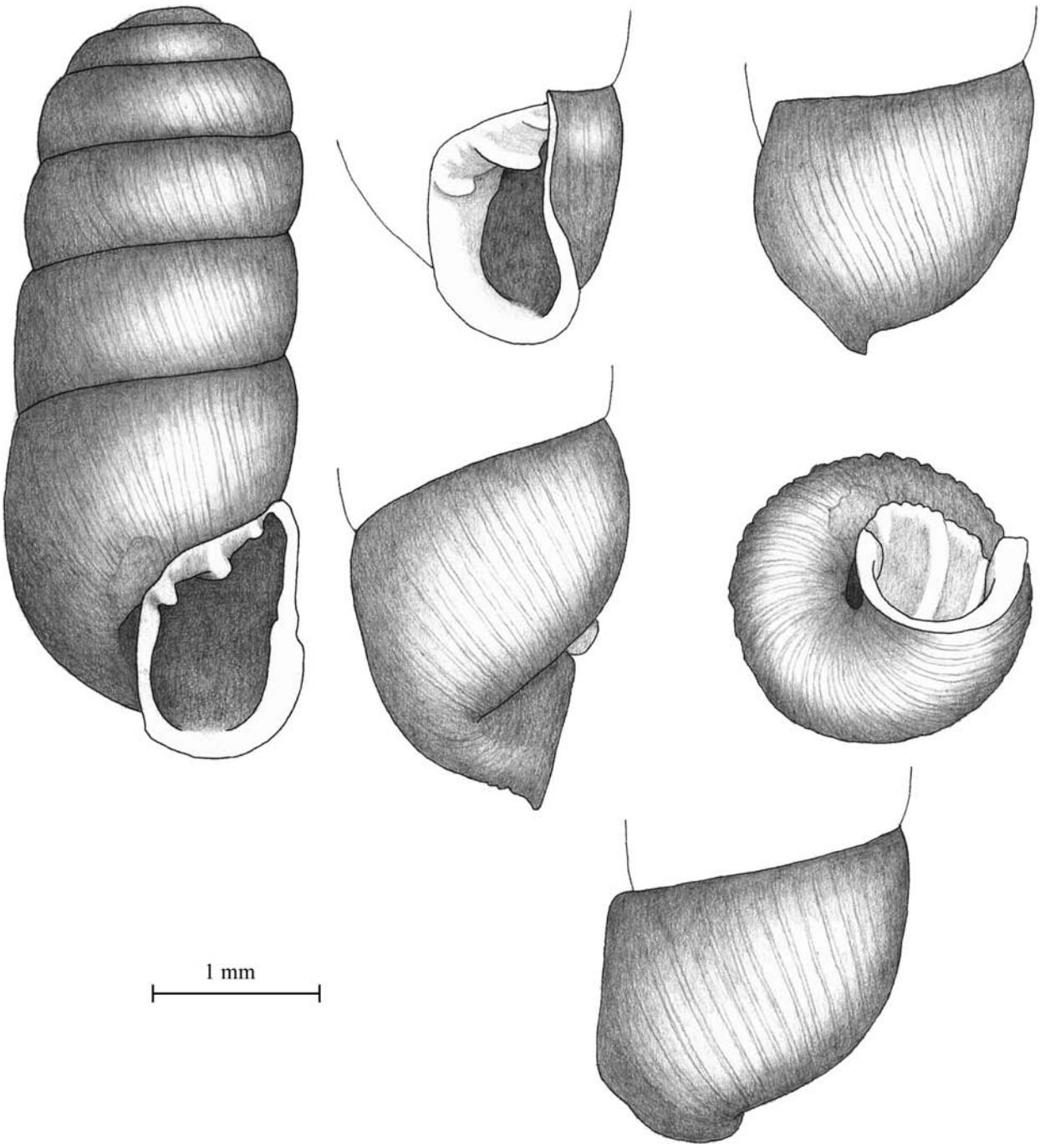
Aperture large with infraparietalis and angularis. In general, both teeth are poorly developed and stretch straight towards the interior of the shell; a parietal lamella is present as well which is slightly higher than the marginal teeth; it is straight and runs deep into the shell without changes in height. In frontal view, apertural rim almost u-shaped, slightly strengthened by an interior lip, moderately flared; slightly depressed between the upper columellar rim and the infraparietalis, forming a small furrow pointing towards the umbilicus; on the palatal side, it is slightly impressed with weak, teeth-like callosities; above that, the aperture is slightly bulged, rim narrow without lip, sometimes with a very short sinulus above the angularis. The peristomial rims are connected by a well developed callus which also covers the ribs above the aperture. In side view, the upper part of the apertural rim is straight, and the upper third diagonally truncated.

Measurements (n = 13): H = 4.3–5; D = 1.75–2; AH = 1.43–1.75; AD = 1–1.12.

Characters of genital organs: unknown.

Differential diagnosis: *A. biarmata* is constantly smaller and has a smaller aperture. The ribs on the shell's surface are more densely set and weaker. The apertural dentition is similar if compared to *A. formosa*, however, the parietal lamella starts at a somewhat lower point on the upper apertural rim. The lower part of the apertural rim is not that strongly enlarged and shows a well developed palatal tooth. Moreover, in some specimens of *A. biarmata* additional columellar teeth could be observed.

Types: original type material lost. Neotype (herewith designated): SMF 329426.




Textfig. 10. *Agardhiella formosa* (L. PFEIFFER 1848). Montenegro, N-exposed mountain side south of the crossroad Sutorina-Njivice-Igalo (= W of Herceg Novi), a rock cavity, UTM BN 90, (H = 4.56, D = 1.87 mm).

Additional material examined: **Montenegro:** Kameno, UTM BN 90, leg. PAGANETTI 1902, NMW 36742/1; S to SW of the mouth of Sutorina River near Igalo (= W of Herceg Novi), in rock creases and cave niches, UTM BN 90, leg. GITTENBERGER 13.5.1974, NNM/1; leg. GITTENBERGER 5.1975, NNM/2 + 3 (juv.); leg. MAASSEN 7.1977, Maa/2 + 5 (juv./damaged); N-exposed mountain side south of the crossroad Sutorina-Njivice-Igalo (= W of Herceg Novi), a rock cavity, UTM BN 90, leg. SUBAI 11.10.2004, S 20417/1; leg. SUBAI 19.9.2005, S 20231/10 + 18 (juv. + fragments); Njeguši, UTM CN 20, NMW 35217/1 ( + 1 + 2 (juv.) *biarmata*); cave Obodska pećina near Rijeka Crnojevica, UTM CM 39, leg. SCHÜTT 5.6.1978, Sch 862/1 (juv.); Rumija Mountains, 17 km from Tuđemili towards Virpazar, at limestone rocks next the country road, app. 470 m alt., UTM CM 47, leg. SUBAI 25.9.2005, S 20347/1.

Remarks: PFEIFFER (1848: 303–304) separated a variety "β" of *Pupa truncatella* and named it *Pupa formosa*. The localities he mentioned at the end of his text covers

almost the whole distribution area of the genus *Agardhiella* from Slovenia (= Carniola) to Bulgaria/Greece (as a part of Turkey at the time being). Regarding the explicitly named localities, the variety "β" is only found in the vicinity of Herceg Novi (= Castelnuovo). No type material could be traced in all relevant museum's collections, and the collection of Louis Pfeiffer is destroyed. As Pfeiffer did not illustrate the type specimen, clarification of the taxonomical concept can only be achieved by designating a neotype. In order to avoid future misinterpretations and to fix the use of the name *A. formosa*, the specimen figured in this paper (Plate 1, Fig. 7) is designated as neotype. It originates from the W-side of Herceg Novi (Igalo), the locus typicus of this species. After Pfeiffer it were Sturany & Wagner (1915: 65, Plate. 18 Fig. 103) who illustrated a large *Agardhiella* from Kameno (= ca. 2 km from Herceg Novi). Their description and measurements agree well with Pfeiffer's *P. formosa*, and they recorded the specimens from Dubrovnik (= Ragusa) and Herceg Novi (= Castelnuovo). Their information was repeated by Pilsbry (1926: 164). Gittenberger (1975: 284) considered *A. biarmata* a synonym of *A. formosa* due to the similar development of the apertural dentition. However, he already stressed the "remarkably large measurements" for *A. formosa* as mentioned by previous authors (Gittenberger 1975: 285). Recently collected specimens (2004–2006) of *A. formosa* from the area around Herceg Novi proved the concept that *A. formosa* and *A. biarmata* are two separate species. Their respective areas of distribution overlap in the area of Kotor Bay. *A. formosa* is exclusively found east of the bay, while *A. biarmata* is found in a larger area at the western side of Skadar Lake (= Skutari Lake) in western direction to the Neretva Valley. Sympatric occurrence could be recorded from Njeguši and Mokrine.

The species lives subterraneous. All recently collected specimens were found in rock cavities and rock crevices.

Distribution: So far this species has only been found in the mountains surrounding Kotor Bay and at the coastal stripe east of the Kotor Bay.

### *Agardhiella dabovici* Gittenberger 1975

Plate 1, Fig. 9; textfigs. 11, 12.

1975 *Agardhiella dabovici* Gittenberger, Zoologische Mededelingen, **48** (24): 281, Fig. 2 (shell), Figs. 4–5 (genital organs), Plate 1 Fig. 1–2 (radula), Fig 3–4 (shell) [locus typicus: "Velika jama im Südhang des Berges Soko bei Dupilo, westlich von Virpazar, in 300–400 m Höhe"; holotype NNM 55043].

1985 *Agardhiella dabovici*, – Zilch, Archiv für Molluskenkunde, **116** (1/3): 128.

1985 *Agardhiella dabovici*, – Maassen, De Kreukel, **21** (1–2): 4, distribution map.

Diagnosis: medium sized shells, aperture with infraparietalis, angularis and parietal lamella; palatal wall of the peristome short with strongly impressed palatal furrow; columellaris and basalis well developed.

Description: shell medium-sized, cylindrical with a rounded apex. After ca. 1.75–2 slightly granulated whorls, the radial rib sculpture begins. On the last whorl there are 37–47 (7–11/mm) ribs. Between the main ribs there are fine, irregular radial ribs which can only be recognized under high magnifications.

Whorls 6.5–7.25; the last whorl occupies 51–56 % of the total height. The umbilicus is narrow cylindrical, elongate.

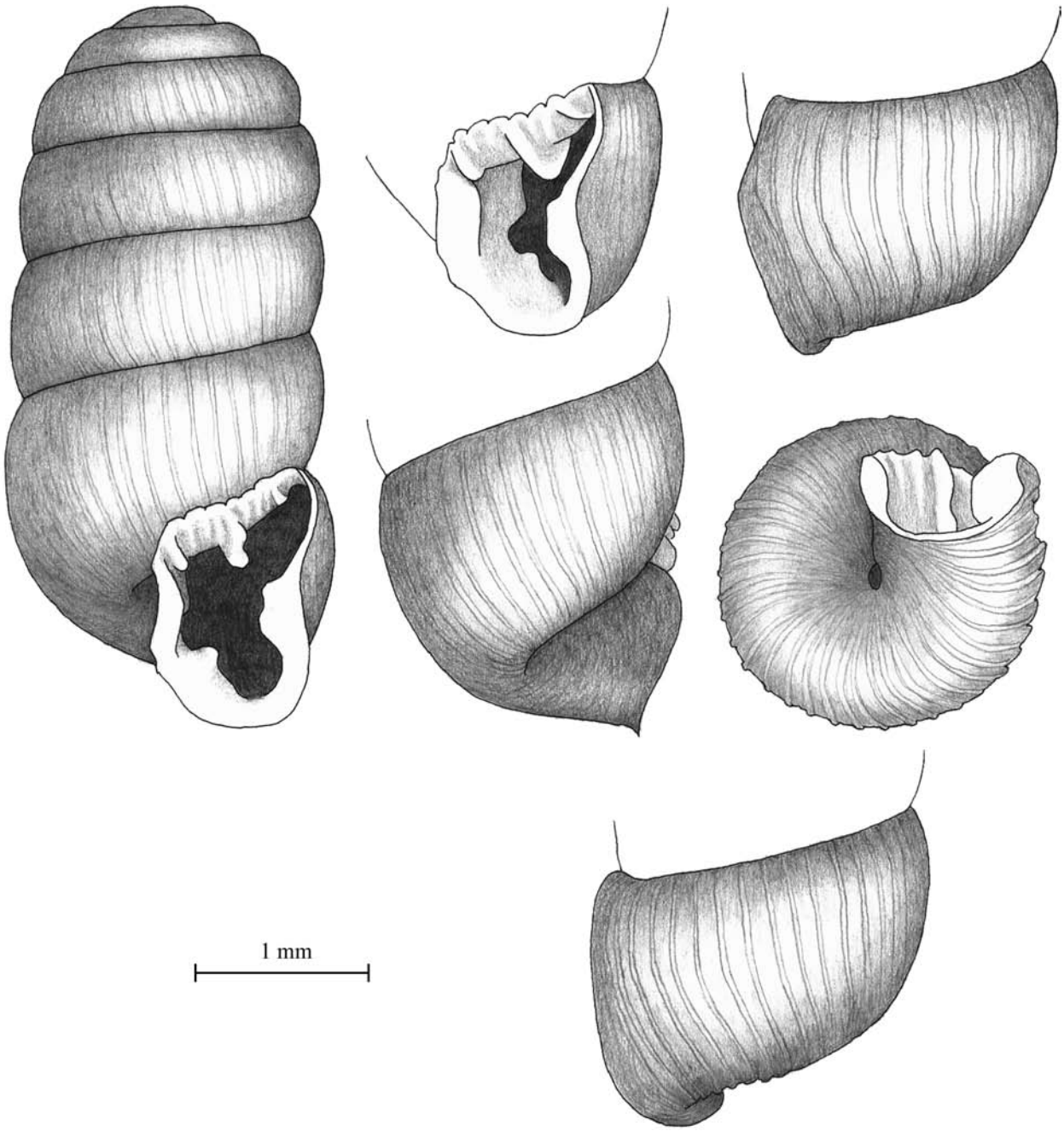
Aperture with infraparietalis and angularis, both teeth elongate towards the interior of the shell; a parietal lamella is present as well which continuously increases in height after the parietal callus followed by a small depression; then, it rises again in height to a certain maximum and almost disappears deep in the interior of the shell; in side view it is of triangular shape. Deep inside the aperture there is a well developed, vertical columellaris covering the upper half of the columella with its lower end slightly enlarged. The small basalis is shifted towards the apertural rim. Occasionally, there are one or more small, rounded nodules between the basalis and the columellar rim. In frontal view, apertural rim almost u-shaped and strengthened by an interior lip, slightly flared; apertural rim lightly depressed between the upper columellar rim and the infraparietalis, forming a small furrow pointing towards the umbilicus; palatal wall of the aperture considerably impressed forming a short palatal callus covering up to ¼ of the apertural height; above that, the aperture is slightly bulged, rim narrow without lip. In side view, the outer part of the apertural rim is centrally projecting above the apertural level.

Measurements (n = 63): H = 4.18–5.8; D = 1.87–2.3; AH = 1.43–1.8; AD = 0.87–1.3.

Characters of genital organs: see Gittenberger (1975: 282, Fig. 4–5).

Differential diagnosis: *A. zoltanorum* n. sp. differs from *A. dabovici* by its higher but narrower aperture. Its parietal lamella protrudes above the aperture level. In interior of the shell it is subdivided by a furrow and shows an undulating shape. Its palatal fold is very long, and occupies ca. 2/3 of the height of the aperture. Additionally, *A. zoltanorum* has smaller teeth on the somewhat enlarged columellar rim and a remarkably long columellaris. However, the basalis (if present at all), is located directly beneath the columellaris.

Types (juvenile respectively damaged specimen of the particular type series are also mentioned. In the original publication, these have not always been considered. These specimen (no paratypes) are added in brackets): **Montenegro:** cave Vilina pećina NW of Donja Seoca (= Vilina pećina near Kaluderac S of Virpazar), UTM CM 47, leg. Dabović, NMWE 19778/47 (paratypes) [ + 3 juv. o. damaged], 49630/75 (paratypes) [ + 1 ]; cave Velika jama (= Velajama, Sokopećina) at southern side of mount Sokol (= "Soko") near Dupilo (= W of Virpazar), UTM CM 48, NMW without Nr./40 (paratypes) [ + 5 juv. o. damaged], NMWE 19050/90 (paratypes) [ + 1 juv. o. damaged]; leg. Dabović, NMWE 48680/11(paratypes), 49631/9 + 3

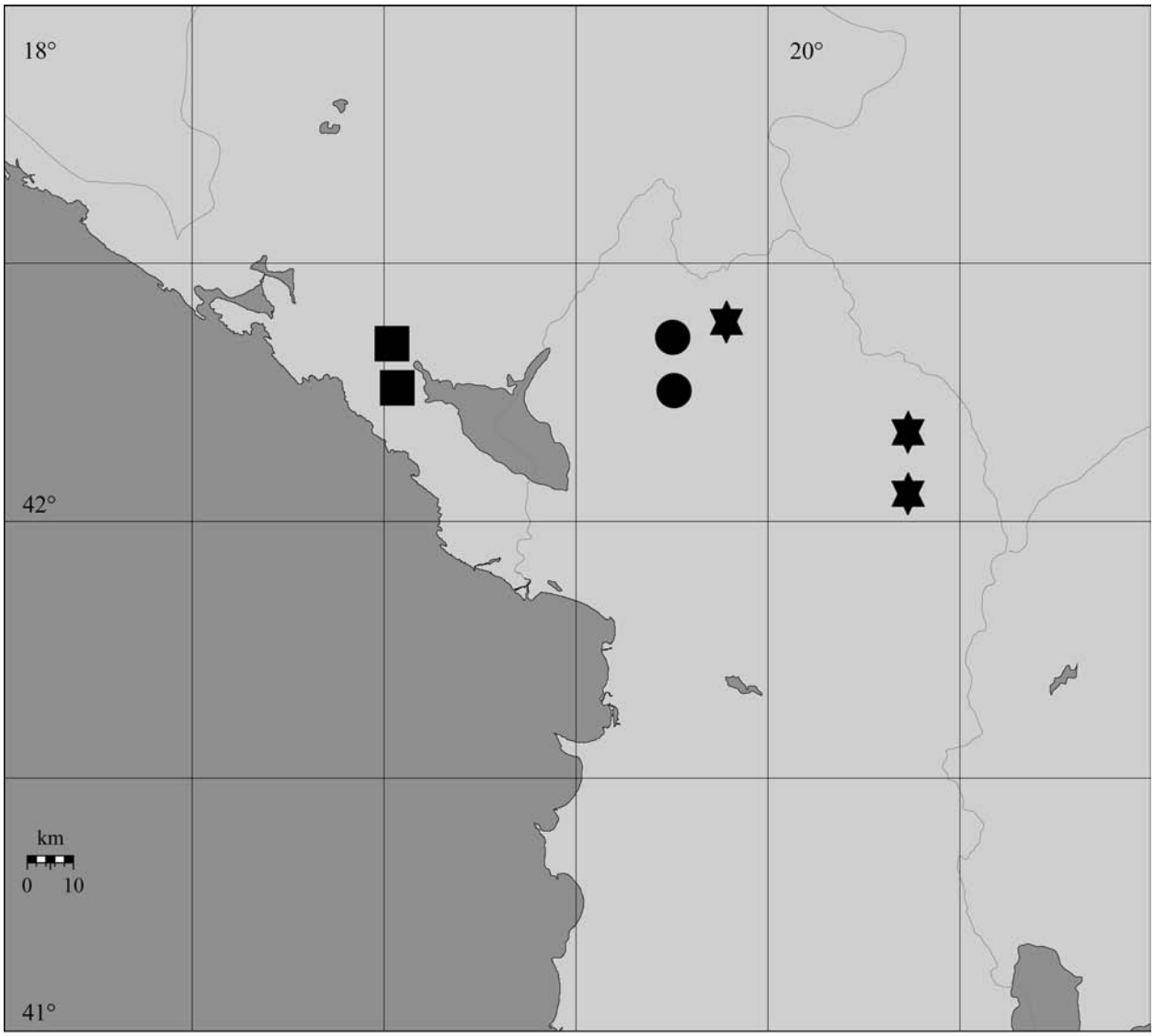



Textfig. 11. *Agardhiella dabovici* Gittenberger 1975. Montenegro, Jabukov do cave (= S of Komarno, NNW of Virpazar), UTM CM 48, (H = 4.18, D = 2 mm).

(juv./damaged) (paratypes), 49632/61 (paratypes) [ + 5 juv. o. damaged]; leg. Gittenberger 11.5.1974, SMF 239645/3 (paratypes); Jabukov do cave (= S of Komarno, NNW of Virpazar), UTM CM 48, leg. Dabović, NMWE 48396/2 (paratypes); leg. Gittenberger 6. u. 11.5.1974, NNM 55045/11 + 3 (juv.) (paratypes); cave Rid pećina near Popratnica, UTM CM 48, leg. Dabović, NMWE 20793/1 (paratype) [ + 1 ].

Additional material examined: **Montenegro:** cave Vilina pećina NW of Donja Seoca (= Vilina pećina near Kaluderac S of Virpazar), UTM CM 47, NMWK/4 (without Nr.) + 27(without Nr., mostly damaged), 38357/30; (ex Edlauer) NMWK 51693/3; cave Velika jama (= Velajama, Sokopećina) at southern side of mount Sokol (= "Soko") near Dupilo (= W of Virpazar), UTM CM 48, NMWK 38355/20, 38356/12, 38358/6, 38359/15, 51691/32, 51692/8; Jabukov do cave (= S of Komarno, NNW of Virpazar), UTM CM 48, leg. Maassen & Schütt 3.6.1978, Maa/3, Sch/1, S 5239/1; leg. Subai 23.9.2005, S 20401/3 + 1 (juv.).

Remarks: Although the specimens from Klemm's series in the collection of the NMW are obviously from the same habitat, even from the same collector, they are not to be considered as paratypes since the author did not




Textfig. 12. Distribution map of *A. dabovici*, *A. extravaganta* and *A. zoltanorum*; = ■ *dabovici*; =● *extravaganta* + *zoltanorum*; = ✸ *zoltanorum*

see them before the description. The correct name of the mountain at the locus typicus is "Sokol" and not "Soko". Also the cave Velika pećina on the labels is sometimes named „Sokol pećina".

In the lot from the cave Vilina pećina there are some remarkably large specimens of *A. dabovici*, but they do not differ in the other shell characteristics from the hitherto known specimens. So far, *A. dabovici* is only known from caves.

D i s t r i b u t i o n : Endemic to caves around Virpazar in southern Montenegro at the western side of Skadar Lake.

### ***Agardhiella extravaganta*** n. sp.

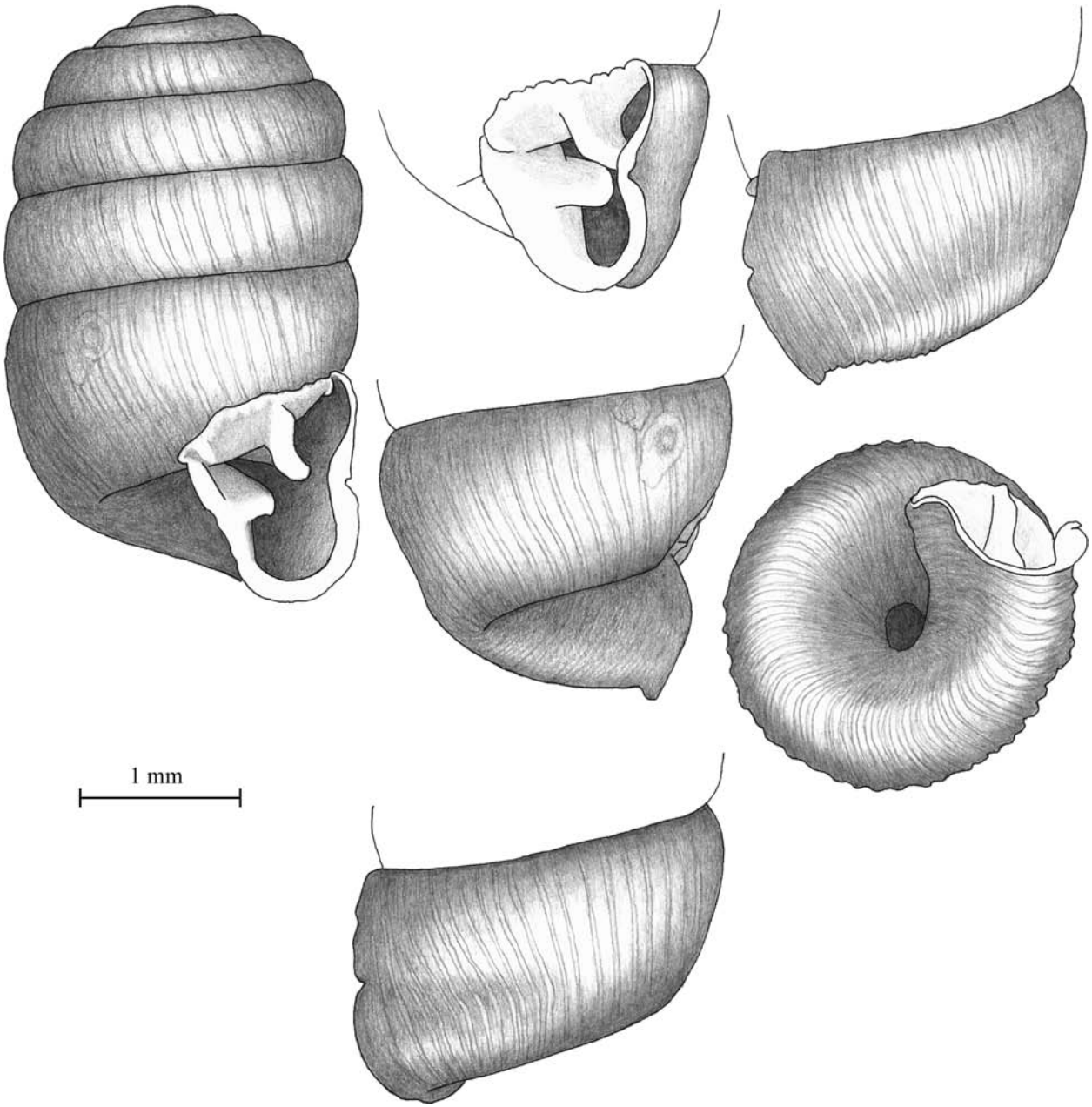
Plate 1, Fig. 12, textfigs. 12, 13

D i a g n o s i s : medium sized broad shells; aperture with infraparietalis and angularis, a strong parietal lamella and horizontal columellaris; umbilicus wide, last whorl strongly constricted at the base.

D e s c r i p t i o n : shell medium sized, broadly biconical with a rounded apex. After ca. 2 slightly granulated whorls, the radial rib sculpture begins. On the last whorl there are 37–62 (5–10/mm) ribs. Between the main ribs there are fine, irregular radial ribs which can only be recognized under high magnifications.

Whorls 6.5–7; the last whorl occupies 53–55 % of the total height. The shell is strongly, horizontally constricted at the base about half a whorl away from the aperture; umbilicus wide, rounded to elongate cylindrical.

Aperture with a strong infraparietalis and angularis which project straight to the interior of the shell. The parietalis is curved, starts at the apertural rim and stretches slowly increasing in height towards the interior of the




Textfig. 13. *Agardhiella extravaganta* n. sp. Albania, Periferi Shkodër, app. 18 km upstream from dam at Koman, a left side Valley of Liquen i Komanit, limestone rocks, debris, 170 m alt., UTM DM 07, paratype (H = 3.62, D = 2.25 mm).

shell. The horizontal columellaris is strong starting in the centre of the columella and is similarly shaped like the parietalis. Inside the aperture, they reach about the same height and run parallel to the interior of the shell. In frontal view, the apertural rim is u-shaped, slightly strengthened interiorly by a lip and flared; apertural rim slightly depressed between the upper columellar rim and the infraparietalis, forming a small furrow pointing towards the umbilicus. The peristomial rims are connected by a well developed callus which is indentate where it touches the ribs of the last whorls. The middle of the palatal wall of the aperture is impressed, a callus is missing; above that, the aperture is slightly bulged, rim narrow without lip. In side view, the central part of the apertural rim strongly projects above the apertural level.

Measurements (n = 4): H = 3.62–4.56; D = 2.18–2.37; AH = 1.37–1.68; AD = 1–1.06; measurements of the holotype: H = 4.56; D = 2.37; AH = 1.68; AD = 1.06.

Differential diagnosis: This species can be easily distinguished from all other species of *Agardhiella* by its broad biconical shell and the strong horizontal columellaris (which is more typical for species of *Argna*). Similar sized shells of *A. zoltanorum* n. sp. are less broad cy-

lindrical and never of biconical shape; its aperture is more strongly constricted, and its angularis hardly recognizable; a strong horizontal columellaris is missing, but it has a strong vertical columellaris deep in the aperture, and its columellar rim is straight; its palatalis projects above the apertural level, is lower than in *A. extravaganta* and somewhat undulating; its umbilicus is narrower and the base of the last whorl is only constricted shortly before the aperture.

Locus typicus: Albania, Periferi Shkodër, app. 18 km upstream from embankment dam at Koman, at the left side in the valley of Liquen i Komanit, limestone rocks, debris, 170 m alt., UTM DM 07. Besides the holotype all specimens mentioned are paratypes.

Types: from the locus typicus, leg. Erőss, Fehér, Hunyadi & Murányi 14.4.2006, holotype HNHM 96786, paratype H/1; **Albania:** district Shkodër, app. 17.5 km upstream from embankment dam at Koman, right bank, stream, debris and limestone rocks, 170 m alt., UTM DM 07, leg. Erőss, Fehér, Hunyadi & Murányi 15.4.2006, E/1; app. 1.5 km upstream embankment from dam at Koman, Liquen i Komanit right bank, side stream, debris, 180 m alt., UTM DM 06, leg. Erőss, Fehér, Hunyadi & Murányi 14.4.2006, HNHM 96787/1 (juv.).

Etymology: from Latin "extravaganta" for its unusual shell characteristics.

Distribution: Only known from northwestern Albania NE of Koman (= app. 20-25 km E of Shkodër) from the debris of the Drim River.

### *Agardhiella zoltanorum* n. sp.

Plate 1, Fig. 11; textfigs. 12, 14.

Diagnosis: medium sized shell, aperture strongly compressed, with infraparietalis, a strong parietal lamella and strong vertical columellaris; sometimes with a basalis and rudiments of tooth at the columellar rim; base of the last whorl constricted shortly before the aperture.

Description: shell medium sized, compact, cylindrical with a rounded apex. After 1.75 to almost 2 slightly granulated whorls, the radial rib sculpture begins. On the last whorl there are 43–66 (7–11/mm) moderately elevated ribs. Between the main ribs there are fine, irregular radial ribs which can only be recognized under high magnifications.

Whorls 5.75–6.75; the last whorl occupies 54–70 % of the total height; umbilicus moderately wide, rounded to elongate cylindrical.

Aperture with an infraparietalis and a parietalis, both teeth are strong and stretch straight to the interior of the shell; parietalis projects above the apertural level; it is subdivided in two part by a small depression behind the aperture and is undulating and decreasing in height towards its end deep in the interior of the shell; usually, an angularis is present, but it often fuses with the strongly elevated apertural callus; in some specimens, a few small, hardly developed teeth can be found between the infraparietalis and the parietalis. Deep inside the aperture there is a long, strongly elevated vertical columellaris with a small basalis directly beneath it. In frontal view, the apertural rim is u-shaped, slightly strengthened interiorly by a lip and flared; apertural rim slightly depressed between the upper columellar rim and the infraparietalis, forming a small furrow pointing towards the umbilicus; columellar rim often with rudimentary teeth. The peristomial rims are connected by a well developed callus which is slightly indentate above the aperture. Palatal wall of the aperture strongly impressed, forming a large palatal fold occupying about 2/3 of the apertural height; above that, the aperture is slightly bulged, rim narrow without lip. In side view, the outer apertural rim is straight, and the upper third diagonally truncated.

Measurements (n = 21): H = 3.5–4.68; D = 1.7–2.3; AH = 1.43–1.87; AD = 0.68–1.1; measurements of the holotype: H = 4.37; D = 2.18; AH = 1.62; AD = 1.

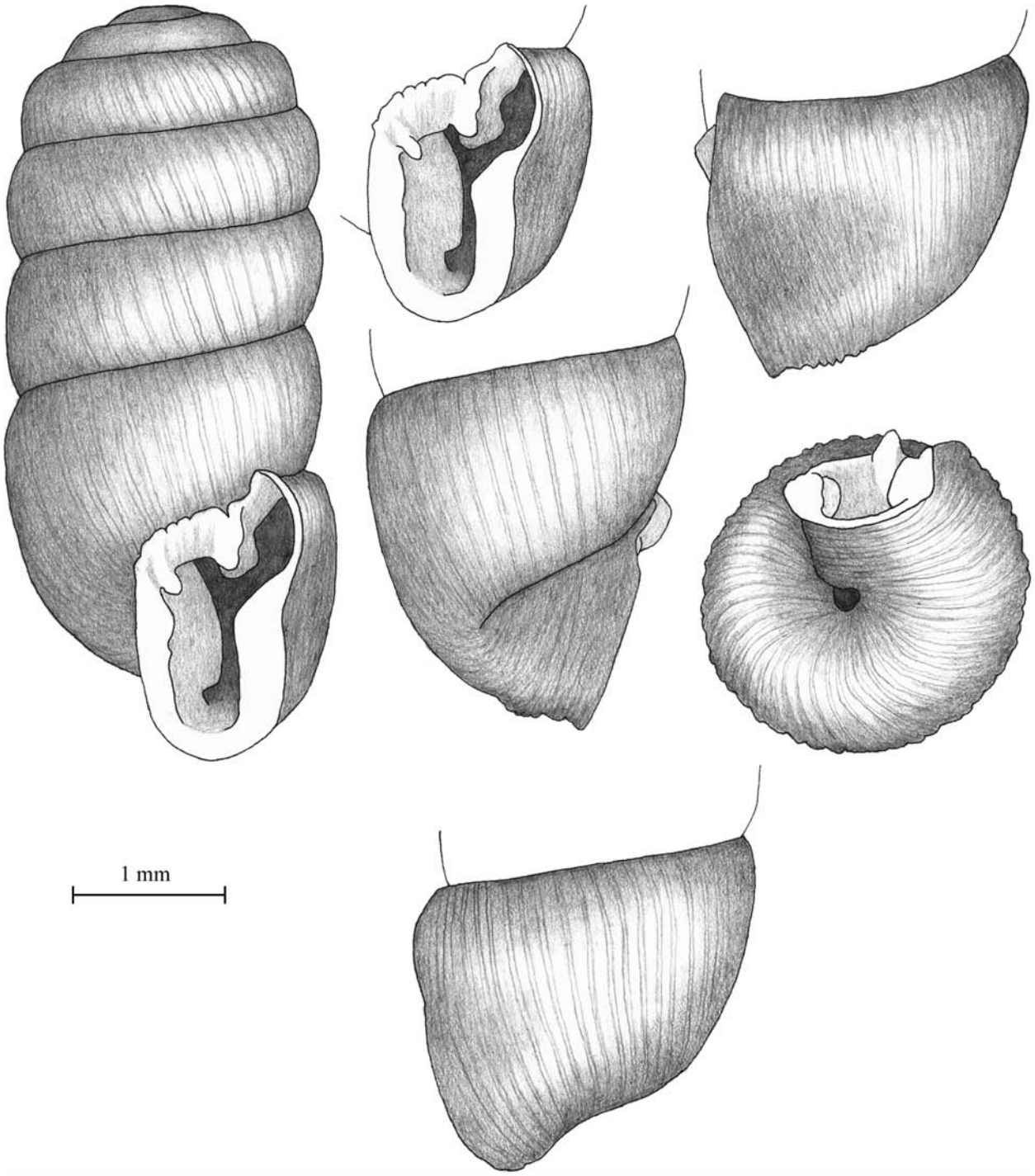
Differential diagnosis: Similarly sized shells of *A. reinhardti* and of *A. stenostoma* are more slender if compared to *A. zoltanorum* and have a denser ribbing pattern. It has a clearly visible angularis, but infraparietalis, parietalis and columellaris are weaker. In *A. reinhardti*, the teeth on the columellar rim are missing, while in *A. stenostoma* the basalis is missing.

The aperture of *A. dabovici* is less high and less impressed laterally. Its parietalis is low at the aperture and does not project above the apertural level; towards the interior of the shell, it shows a short hump and decreases then in height. The palatalis of *A. dabovici* is shorter and less shifted towards the centre of the aperture. It only occupies 1/3 of the apertural height. Occasionally occurring small teeth at the columella are not placed at the side as in *A. zoltanorum*, but deeper inside the shell. However, the basalis is closer to the apertural rim. Finally, its columellaris is much shorter than that in *A. zoltanorum*, its outer end is slightly enlarged.

For the differences with *A. extravaganta* n. sp., please refer to this species.

Locus typicus: Albania: Periferi Dibrë, S of Zall-Reç (= 5 km S of the bridge of river Drin i Zi), limestone rocks, 510 m alt., UTM DM 43. Besides the holotype all following specimen are considered as paratypes.

Types: from the locus typicus, leg. Deli, Erőss, Fehér & Murányi 9.10.2005, holotype HNHM 95900, paratype HNHM 95901/2. **Albania:** app. 1.5 km upstream from dam at Koman, Liquen i Komanit right bank, side stream, debris, 180 m alt., UTM DM 06, leg. Erőss, Fehér, Hunyadi & Murányi 14.4.2006, H/2 + 1 (juv.); app. 15.5 km upstream from dam at Koman, Liquen i Komanit right bank, debris, 180 m alt., UTM DM 07, leg. Erőss, Fehér, Hunyadi & Murányi 15.4.2006, E/1 + 1 (juv./damaged), H/1 + 1 (juv./damaged), HNHM 96790/1 + 3 (juv./damaged), MMMB/1; app. 17.5 km upstream from dam at Koman, Liquen i Komanit right bank, stream, debris and limestone rocks, 170 m alt., UTM DM 07, leg. Erőss, Fehér, Hunyadi & Murányi 15.4.2006, HNHM 96788/1; app. 18 km upstream from dam at Koman, a left side Valley of Liquen i Komanit, limestone rocks, debris, 170 m alt., UTM DM 07, leg. Erőss, Fehér, Hunyadi & Murányi 14.4.2006, HNHM 96789/3 + 11 (juv./damaged), E/3, S 20799/1; Tropojë




Textfig. 14. *Agardhiella zoltanorum* n. sp. Albania, Tropojë county, over Gurorë, 3 km N of the river Valbonë mouth, limestone rocks, and secondary hornbeam bush, 289 m alt., UTM DM 18, paratype (H = 4.62, D = 2.1 mm).

county, over Gurorë, 3 km N of the river Valbonë mouth, limestone rocks, and secondary hornbeam bush, 289 m alt., UTM DM 18, leg. DELI, ERŐSS, FEHÉR & MURÁNYI 7.10.2005, E/1, HNHM 96791/1 + 1 (juv.); Kukës county, Gurri i Arrënit, E of Arrën (= 35 km S of the Shkodër - Kukës road), limestone rocks, devastated beech forest, 1598 m alt., UTM DM 44, leg. DELI, ERŐSS, FEHÉR & MURÁNYI 8.10.2005, HNHM 96802/1, MMMB/1 (juv.).

Etymology: This new species is dedicated to its discoverer, the Hungarian malacologists Dr. ZOLTÁN ERŐSS and Dr. ZOLTÁN FEHÉR.

Distribution: This species is known from northern Albania north of Lezhë in the west and the Korab Mountains at the eastern border of the country.

## Discussion

The remarkably large distribution area of *A. truncatella* can be explained by its autecology. It lives in rock duff and rock debris and thus can easily be transported over larger areas with the help of rainfalls and strong winds. A similar way of life is known for *A. biarmata*, but this species is also recorded from caves along the Dalmatian coast. There are other species which live subterraneous and are exclusively found in a few caves (e.g. *A. dabovici*) or in rock crevices and rock holes (e. g. *A. formosa*, *A. skipetarica*, *A. stenostoma*). Their area of distribution is relatively small and restricted to a few neighbouring cave systems or neighbouring mountains.

Specimens found in their primary habitats like a cave or from rock crevices only show little individual variation, whereas specimens of the same species of *Agardhiella* collected from river debris show a large variation in size, number of ribs, apertural shape etc. This observation can be explained by the fact that a river debris contains shells originating from various populations within its catchment area, washed in by rain from the soil or rock crevices. This is contrasted by populations from cave systems with restricted genetic exchange. A good example is *A. dabovici*, which occurs in caves west of Virpazar in the small typical form, while specimens originating from the cave Vilina pećina near Donja Seoca are constantly much large although they share all other shell characteristics of the species. These caves are east of Virpazar and belong to another mountain ridge with a separate cave system.

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Plate

Plate 1
all photos × 15, phot. E. NEUBERT

Figs 1–4. *Agardhiella truncatella* (L. PFEIFFER 1841).
1) Austria, Carinthia, Karawanken Mts., Tscheppa Gorge (= S of Klagenfurt), at limestone rocks, UTM VM 44 (characteristic specimen, SMF 329425 H = 3.62, D = 1.62 mm).
2) Bosnia and Hercegovina, Karanovac, UTM BQ 85 (small, teethless, SMF 205796/1, H = 3.1, B = 1.5 mm)
3) Greece, Ípiros, app. 38 km S of Ioannina (= 51 km along the country road), rocks W of country road near paleolitic caves, 150 m alt., UTM DJ 84 (faintly developped palataltooth and slightly beginning parietal lamella, NNM/1, H = 3.37, B = 1.68 mm)
4) Greece, Ípiros, Zagoria, Kipi, limestone rocks near old bridge, UTM DK 81 (large specimen, NMW 102816/4, H = 3.8 mm)

Figs 5–6. *Agardhiella biarmata* (O. BOETTGER 1880).
5) lectotype SMF 4658, Croatia, Dubrovnik (= Dalmatien, Ragusa), UTM BN 52/62 (H = 3.74 mm).
6) *Coryna biarmata spelaea* KOBELT 1906, syntype SMF 51691, Bosnia and Hercegovina, cave near Zavala, coll. O. BOETTGER ex STURANY 1904 (H = 4.1, B = 1.9 mm)

Fig. 7. *Agardhiella formosa* (L. PFEIFFER 1848).
Montenegro, N-exposed mountain side south of the crossroad Sutorina-Njivice-Igalo (= W of Herceg Novi), a rock cavity, UTM BN 90 (Neotype SMF 329426, H = 4.8, D = 1.87 mm).

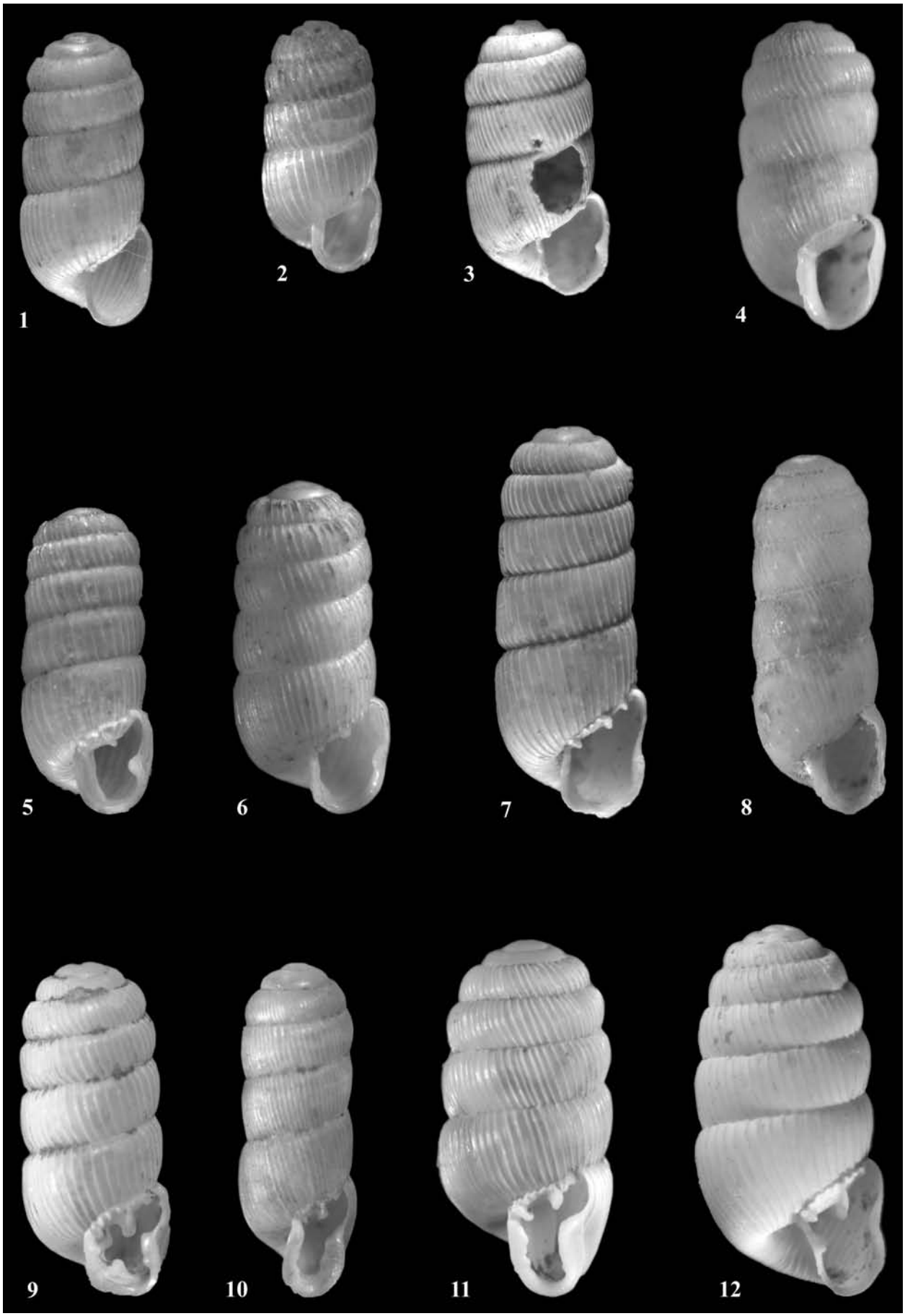
Fig. 8. *Agardhiella skipetarica* (A. J. WAGNER 1915).
Lectotype NMW 43328, Albania, Kiri-Bridge near Mes (= Mesi) near Shkodër (= Skutari), UTM CM 86 (H = 4.4 mm).

Fig. 9. *Agardhiella dabovici* GITTENBERGER 1975.
Paratype SMF 239645, Montenegro, cave Velika jama (= Velajama, Sokopećina) at southern side of mount Sokol (= „Soko“) near Dupilo (= W of Virpazar), UTM CM 48 (H = 4.1, D = 1.7 mm).

Fig. 10. *Agardhiella stenostoma* (FLACH 1890).
Holotype SMF 4597, “Dalmatien” (H = 4.1, D = 1.4 mm).

Fig. 11. *Agardhiella zoltanorum* n. sp.
Holotype HNHM 95900, Albania, Periferi Dibrë, S of Zall-Reç (= 5 km S of the bridge of river Drin i Zi), limestone rocks, 510 m alt., UTM DM 43 (H = 4.37, D = 2.18 mm).

Fig. 12. *Agardhiella extravaganta* n. sp.
Holotype HNHM 96786, Albania, Periferi Shkodër, app. 18 km upstream from embankment dam at Koman, at the left side in the valley of Liquen i Komanit, limestone rocks, debris, 170 m alt., UTM DM 07 (H = 4.56, D = 2.37 mm).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