

Two limestone 'islands' in central northern Greece, six new clausiliid taxa,
three kinds of microarmature (Gastropoda, Pulmonata, Clausiliidae)

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Two isolated limestone outcrops in northern Greece were searched for terrestrial molluscs. Seven taxa of clausiliids were recorded, six of them new to science: *Montenegrina dennisi* spec. nov., *M. dennisi protruda* subspec. nov., *M. janinensis maasseni* subspec. nov., *Macedonica pindica* spec. nov., *M. pindica bellula* subspec. nov., *Idyla castalia yeruni* subspec. nov. The microarmature of the clausilium is described for a representative of each of the three genera involved.

Key words: Gastropoda, Pulmonata, Clausiliidae, *Montenegrina*, *Macedonica*, *Idyla*, microarmature, Greece.

INTRODUCTION

Guided by geological maps, kindly revealed for malacological use by Mr. W. Reenema, who explained what might refer to calcareous areas, the author visited some isolated limestone hills in central northern Greece, Makedonia, prefecture of Grevena. During a first visit in 2000, he was accompanied by Mr. D. Uit de Weerd, who was responsible for most of the planning then. At that time the limestone cliffs W and SW of Grevena, near Aetia and Zakas, dominating the landscape from far away, were investigated. The following year, the same localities and some much lower limestone outcrops more to the north were visited with Mr. W.J.M. Maassen. It turned out that these limestone islands, situated in an isolating sea of other types of soil, probably had never before been investigated or even visited by malacologists. This conclusion was drawn from the fact that six of the seven clausiliid taxa that were recorded turned out to be new to science. These taxa are described here. The seventh clausiliid belongs to *Siciliaria* Vest, 1867, and cannot be identified reliably.

Solem (1972) coined the term 'microarmature' for the microscopic denticles in the apertural region of the shells in various groups of terrestrial snails. These microdenticles of unknown function are clearly oriented in a particular direction; they have a frontal and lateral borders. Later authors hardly ever tried to exploit the microarmature in systematic studies and nothing is known about it in clausiliids. While making SEM photographs of the clausilial blades, it turned out that there are conspicuous differences between the species of different genera also in the ultrastructure of the clausilium. Therefore, the microarmature on a particular part of the clausilial blade is described in species of the three genera here, mainly to call attention for a neglected potential source of information. There may be differences between different places of the clausilium, especially in density, size, and orientation of the denticles. There is a microarmature on all plicae and lamellae, and in between, in the apertural region of the clausiliid shells studied, but within the scope of this paper this was not investigated further.

Abbreviations: GM, E. Gittenberger & W.J.M. Maassen leg.; GU, E. Gittenberger & D.

Uit de Weerd leg.; H, shell height; NO, colln H. Nordsieck, Aarbergen-Rückershausen, Germany; rkm, distance in km, measured along the road; RMNH, National Museum of Natural History (formerly Rijksmuseum van Natuurlijke Historie), Leiden, The Netherlands; SU, colln P. Subai, Achen, Germany; W, shell width.

SYSTEMATICS

Alopiinae, Cochlodinini

Genus *Macedonica* O. Boettger, 1877

Microarmature (figs 20-23). — In *Macedonica pindica* bellula subspec. nov. the microarmature of the clausilial blade was studied. It consists of rather broad denticles which are not composed of smaller entities; their frontal edges have two straight sides, making an obtuse angle.

Macedonica pindica spec. nov.

Description. — Shell very slender spindle-shaped, with 10 $\frac{1}{4}$ -12 $\frac{3}{4}$ flattened whorls, separated by an indented suture; last whorl vaguely flattened obliquely, without any keels or furrow. Bluish-grey or brownish because of a patchy, whitish, surface layer covering more or less completely the brown ground-colour of the shell. Columellaris prominent, flaring about horizontally into the aperture. Subcolumellaris hidden behind the apertural lip, only its lower end visible, in very oblique view. Palatal plicae centre dorsolateral; with a prominent principalis, an upper palatal plica measuring about half its length, a basalis of intermediate length, and sometimes an obsolete plica suturalis. The columellaris reaches nearly $\frac{1}{4}$ whorl deeper inside than the spiralis. Parietalis moderately prominent, about as far as its own length away from the spiralis. Clausilial plate notched; with a narrow, long, basal lobe and a much less protruding, broad palatal one.

Differentiation. — *Macedonica macedonica* (Rossmässler, 1839) is similar in shape and colour, differing most clearly by a more 'complete' clausilial apparatus with somewhat longer folds, i.e. by the frequent presence of one or two, short, palatal plicae in between the upper palatalis and the basalis, a more prominent plica suturalis, and a lamella parietalis reaching as far inside as the spiralis approaches the aperture. Its clausilial blade has two lobes curved in opposite directions and separated by a narrow deep notch; the lobes are irregular in outline and reach about equally far (positioned as in fig. 20). Also in *M. pindica* the clausilial blade has a conspicuous, more or less angled notch, but here the narrow inner lobe reaches much further than the broad outer one, which is more gradually curved in front (fig. 20).

Note. — The populations of the two main limestone regions in the research area are clearly differentiated, so that two subspecies can be distinguished.

Macedonica pindica pindica subspec. nov. (figs 1, 2)

Material (holotype and paratypes).— Macedonia, nomos Grevena: 14 km SW of Grevena, limestone cliffs 1.5 km SE of Zakas, after 2.5 rkm along road to Spileo, N-slope, 900 m alt., UTM EK2429, GM (NO/3; RMNH 82022/30; SU/3); do., GU (RMNH 94943/holotype, 94944/19).

Differentiation. — Shell with 10 $\frac{3}{4}$ -12 $\frac{3}{4}$ rather patchy, bluish grey whorls, irregularly

sculptured with growth-lines that vary in prominence; not transparent and no spiral microsculpture discernible. Sometimes with a plica suturalis.

H 20.3-26.0 mm; W 5.0-5.4 mm.

Derivatio nominis: the epithet *pindica* refers to the occurrence in the Pindos mountains.

Macedonica pindica bellula subsp. nov. (figs 3, 4, 20-23)

Material (holotype and paratypes).— Macedonia, nomos Grevena: 19 km W of Grevena, on rocks along path to Spilea toon Nymphoon, between river and mountain, 2.3 rkm before Aetia (along the road from Anavrita to Aetia), W-slope, 1000 m alt., UTM EK1735, GM (NO/2; RMNH 82015/14; SU/2); do., GU (RMNH 94946/holotype, 94945/7).

Differentiation. — Clearly different from *M. p. pindica* by the conspicuous, sharp, white, radial riblets, contrasting with the more brownish background colour; the shells are also thinner and somewhat transparent, so that very fine spiral lines are discernible. Without a plica suturalis.

With 10 ¼-11 whorls slightly smaller than the nominate subspecies: H 19.9-22.0 mm; W 4.8-5.2 mm.

Derivatio nominis. — The epithet *bellula* refers to the attractiveness of the shell.

Alopiinae, Montenegrinini

Genus *Montenegrina* O. Boettger, 1877

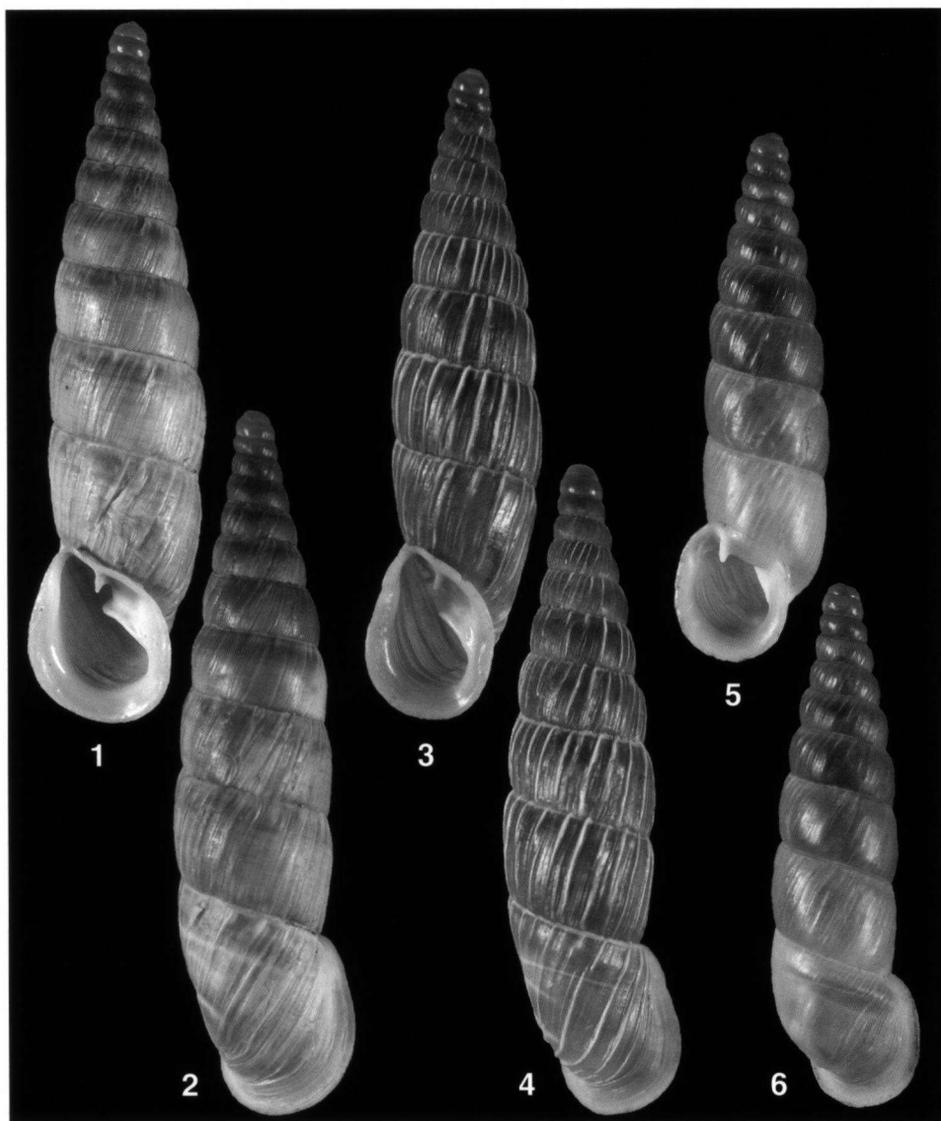
Microarmature (figs 16-19). — In *Montenegrina dennisii protruda* subsp. nov. the microarmature of the clausilial blade was studied. It consists of broad denticles with more or less irregular, straight fronts; at large magnifications (fig. 19) they make the impression of being composed of smaller entities that are grown together, resulting in the irregularity of the fronts and the longitudinally grooved surface.

Montenegrina janinensis maasseni subsp. nov. (figs 5, 6)

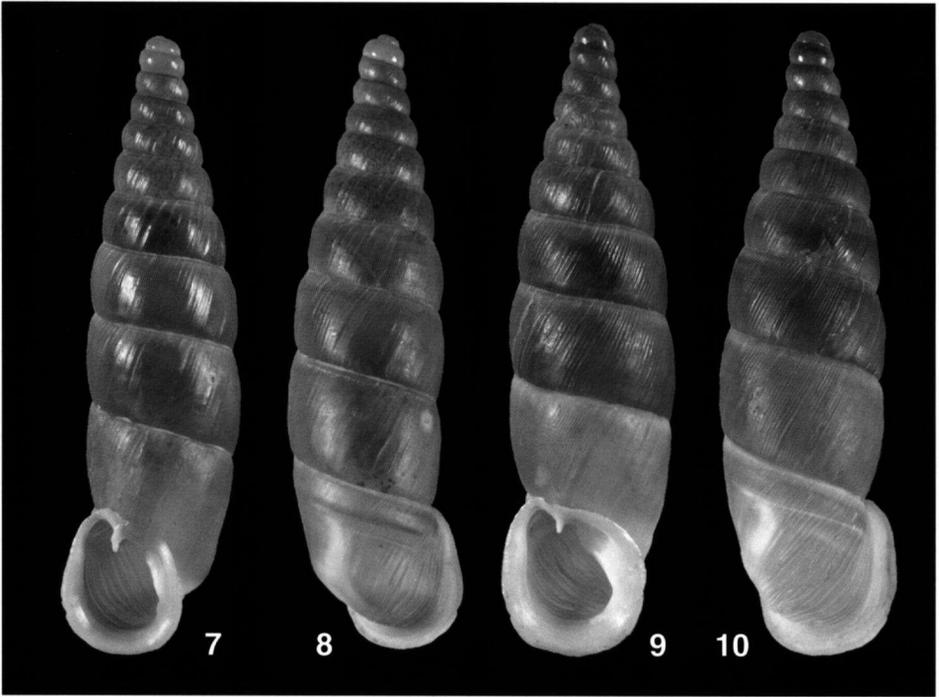
Material (holotype and paratypes).— Macedonia, nomos Grevena, 14 km SW of Grevena, rocks near the ancient Portitsa bridge, 4 km SE of Zakas, 625 m alt., UTM EK2327 (NO/2; RMNH 94949/holotype, 82024/28; SU/2).

Description.— Shell with 9 ¾-11 whorls, very slender, fusiform; the last two to three whorls about equal in width, pale greyish to yellowish brown. Upper whorls convex and in most specimens provided with irregularly spaced, coarse but not very prominent radial ribs, only few of which may be partly somewhat accentuated by a white callus. On the lower whorls the convexity decreases slightly and the sculpture becomes more obsolete. With a narrow, inconspicuous, whitish, sutural line. The last quarter of the body whorl has several, more or less irregular, prominent, partly whitish wrinkles, separated by interstices that are broader. Outside, the region between the upper palatal plica (showing through) and the suture is inflated, whereas the cervical part right below that plica is flattened. More basally, the shell is broadly rounded, without any true keel.

There is a broad, white, strongly reflected, not clearly thickened peristome; at the parietal side this is attached to the penultimate whorl, from the position of the parietalis



Figs 1-6. Alopiinae. 1, 2, *Macedonica pindica pindica* subsp. nov., Macedonia, nomos Grevena, 14 km SW of Grevena, limestone cliffs 1.5 km SE of Zakas, after 2.5 rkm along road to Spileo, N-slope, 900 m alt., UTM EK2429, GU (RMNH 94943/holotype); actual height 21.3 mm. 3, 4, *Macedonica pindica bellula* subsp. nov., Macedonia, nomos Grevena, 19 km W of Grevena, on rocks along path to Spilea toon Nymphoon, between river and mountain, 2.3 rkm before Aetia (along the road from Anavrita to Aetia), W-slope, 1000 m alt., UTM EK1735, GU (RMNH 94946/holotype); actual height 19.8 mm. 5, 6, *Montenegrina janinensis maasseni* subsp. nov., Macedonia, nomos Grevena, 14 km SW of Grevena, rocks near the ancient Portitsa bridge, 4 km SE of Zakas, 625 m alt., UTM EK2327 (RMNH 94949/holotype); actual height 16.0 mm. Photographs by J. Goud, NNM Leiden.



Figs 7-10. *Montenegrina dennisi* spec. nov. 7, 8, *M. d. dennisi* subsp. nov., Macedonia, nomos Grevena, 14 km SW of Grevena, limestone cliffs 1.5 km SE of Zakas, after 2.5 rkm along road to Spileo, N-slope, 900 m alt., UTM EK2429, GU (RMNH 94939/holotype); actual height 18.7 mm. 9, 10, *M. d. protruda* subsp. nov., Macedonia, nomos Grevena, 19 km W of Grevena, on rocks along path to Spilea toon Nymphoon, between river and mountain, 2.3 rkm before Aetia (along the road from Anavrita to Aetia), W-slope, 1000 m alt., UTM EK1735, GU (RMNH 94942/holotype); actual height 19.0 mm. Photographs by J. Goud, NNM Leiden.

towards the columellar corner. Lunella situated dorsally, usually connected to the broad but low and rather short basalis, sulcalis very short and inconspicuous; without a sub-claustralis. Upper palatal plica narrower and higher than the basalis, not always clearly connected to the lunella.

Subcolumellaris hardly visible in frontal view, ending just before the apertural lip. Columellaris low to very low in frontal view. Clausilial blade thick, distally narrowed, elongated and thickened. Parietalis and spiralis running parallel to each other over a short distance.

H 14.5-18.6 mm; W 3.6-4.1 mm.

Differentiation.— *Montenegrina janinensis janinensis* (Mousson, 1859) is most similar, but can be distinguished easily by the dorsolateral position of the lunella, which is also somewhat shorter and broader. The geographically close *M. dennisi* differs by larger, less slender shells, which have either a more obsolete sculpture, or narrowly spaced, fine riblets on nearly the entire shell.

Derivatio nominis. — Named after Mr. Wim J. M. Maassen, my companion on the

second trip to the nomos Grevena, also in appreciation of many years of joint fascination for malacology.

Montenegrina dennisi spec. nov.

Differentiation. — Close to the locality where *Montenegrina janinensis maasseni* was found, but at a higher altitude, a congeneric species occurs, with larger, less slender shells, that are about equally similar to shells of more than one *Montenegrina* species from northern Greece. In size, shape, clausilial apparatus and colour they resemble *M. rugilabris* (Mousson, 1859), which can be distinguished by the thickened apertural lip and the more prominent basalis, which is not connected with the lunella.

Note. — The populations of the two main limestone regions in the research area are clearly differentiated, so that two subspecies can be distinguished.

Montenegrina dennisi dennisi subspec. nov. (figs 7, 8)

Material (holotype and paratypes).— Macedonia, nomos Grevena: 14 km SW of Grevena, limestone cliffs 1.5 km SE of Zakas, after 2.5 rkm along road to Spileo, N-slope, 900 m alt., UTM EK2429, GM (NO/3; RMNH 82021/30; SU/3); do., GU (RMNH 94939/holotype, 94940/50); isolated limestone rocks at the west-side of Spileo 3.25 km S of Zakas, SSW-slope, 930 m alt., UTM EK2328, GM (NO/3; RMNH 82027/32; SU/3).

Description. — Shell yellowish brown, slender, fusiform, with 9-11 whorls, the last two of which about equal in width. Upper whorls convex, with irregular radial growth-lines or obsolete riblets, not accentuated by any callus. The penultimate and in particular the last whorl are somewhat more flattened. With a narrow, inconspicuous, whitish, sutural line, which may be partly absent. Last quarter of the body whorl with several, more or less irregular, prominent, partly whitish riblets, separated by interstices that are broader to about equally broad. Outside, the region between the the position of the upper palatal plica (showing through when present) and the suture is inflated, whereas the cervical part right below that plica is flattened. More basally, the shell is rounded, without any true keel.

There is a broad, white, strongly reflected, not clearly thickened peristome, at the parietal side attached to the penultimate whorl, from the position of the parietalis towards the columellar corner. Lunella situated dorsally, more or less vaguely connected to the low and short basalis, sulcalis very short but relatively prominent; without a sub-claustralis. Upper palatal plica absent to more or less obsolete, not to vaguely connected to the lunella. Subcolumellaris hardly to not visible in frontal view, but broadly flaring inside (very clearly seen in oblique view). Columellaris very low in frontal view, largely hidden behind the columellar rim. Clausilial blade thick, distally narrowed, elongated and thickened, with a slightly twisted tip, in situ pointing in between the basalis and the sulcalis. Parietalis and spiralis running parallel to each other over a short distance.

H 15.7-21.2 mm; W 4.3-5.2 mm.

Derivatio nominis. — Named after Dennis Uit de Weerd, my companion during the first trip to the research area.

Montenegrina dennisi protruda subsp. nov. (figs 9, 10, 16-19)

Material (holotype and paratypes).— Macedonia, nomos Grevena: 19 km W of Grevena, on rocks along path to Spilea toon Nymphoon, between river and mountain, 2.3 rkm before Aetia (along the road from Anavrita to Aetia), W-slope, 1000 m alt., UTM EK1735, GM (NO/3; RMNH 82016/19; SU/3); do., GU (RMNH 94942/holotype, 94941/21); 19 km W of Grevena, isolated limestone hill 1.75 km E of Aetia, E-slope, 940 m alt., UTM EK1735, GM (RMNH 82017/7).

Differentiation.— As compared to the nominate subspecies, the shells are darker, more bluish brown in colour, with a continuous apertural lip, protruding for c. 0.4 mm at the parietal side. The sculpture is more regular, with fine, narrowly spaced, radial riblets covering most of the shell. The upper palatal plica is more prominent, the sulcalis is obsolete or absent, and the tip of the clausilial blade is not twisted. There are 9-10 whorls.

The dimensions are similar to those of the nominate subspecies: H 16.0-20.6 mm; W 4.8-5.4 mm.

Derivatio nominis: *protruda* refers to the protruding apertural border.

Mentissoideinae, Acrotomini

Genus *Idyla* H. & A. Adams, 1855, subgenus *Idyla* s. str.

Microarmature (figs 24-27). — In *Idyla castalia yeruni* subsp. nov. the microarmature of the clausilial blade was studied. It consists of relatively narrow denticles, with frontal edges that have two long sides, placed at right or acute angles.

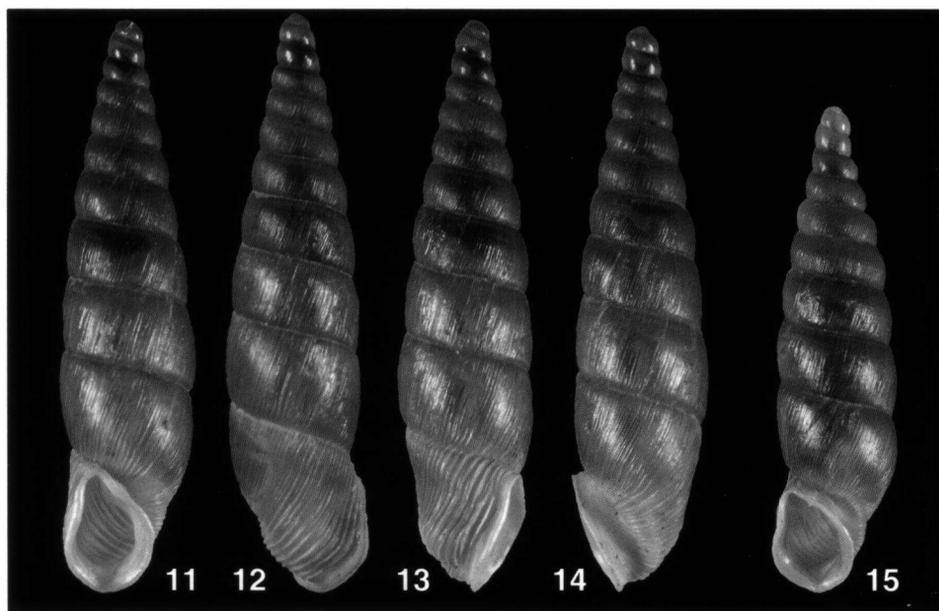
Idyla castalia yeruni subsp. nov. (figs 11-15, 24-27)

Clausilia (Oligoptychia) castalia var. *pirostoma* O. Boettger, 1880: 51 ("Corfu?"). Not Westerlund, 1871; not O. Boettger, 1877.

Idyla (Idyla) castalia crenilabris; Zilch, 1976: 214, pl. 18 fig. 38 (lectotype of *Clausilia (Oligoptychia) castalia* var. *pirostoma*). Not O. Boettger, 1885.

Material (holotype and paratypes).— Macedonia, nomos Grevena: 14 km SW of Grevena, limestone cliffs 1.5 km SE of Zakas, after 2.5 rkm along road to Spileo, N-slope, 900 m alt., UTM EK2429, GM (NO/4; RMNH 82020/60; SU/4); do., GU (RMNH 94947/35); 19 km W of Grevena, on rocks along path to Spilea toon Nymphoon, between river and mountain, 2.3 rkm before Aetia (along the road from Anavrita to Aetia), western slope, 1000 m alt., UTM EK1735, GM (RMNH 82014/9); 25 km W of Grevena, small limestone outcrop, 1.25 km SW of Dotsiko, S-slope, 1400 m alt., UTM EK1039 (NO/3; RMNH 94948/holotype, 82012/51; SU/3); do., N-slope (RMNH 82013/14).

Description. — Shell slender fusiform, yellowish brown, somewhat transparent, with 9½ -10¼ whorls, separated by an indented suture; upper whorls moderately convex, lower ones clearly flattened. With at most locally an inconspicuous, whitish, narrow, sutural line. Very finely ribbed or striated, except for the last quarter of the body whorl where prominent, sharp ribs are present; two or three such ribs, partly or entirely with whitish crests, accentuate the distinct, transverse thickening running a little behind the apertural lip, next to an indentation of the palatal wall. Aperture pear-shaped, strongly protruding (0.3-0.4 mm), with a basal groove that is largely filled by a callus shortly behind the lip. Apertural lip continuous, rather narrow but strongly reflected and thickened by a white callus. Shell base with a very conspicuous groove, that can be followed for more than half a whorl, separating a broad dorsal from a narrower basal keel.

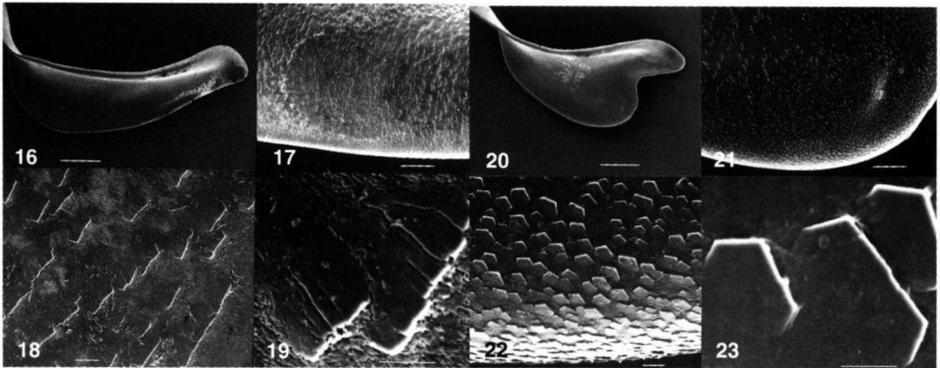


Figs 11-15. *Idyla castalia yeruni* subspec. nov. 11-14, Macedonia, nomos Grevena, 25 km W of Grevena, small limestone outcrop, 1.25 km SW of Dotsiko, S-slope, 1400 m alt., UTM EK1039 (RMNH 94948/holotype); actual height 12.7 mm. 15, 14 km SW of Grevena, limestone cliffs 1.5 km SE of Zakas, after 2.5 rkm along road to Spileo, N-slope, 900 m alt., UTM EK2429, GM (RMNH 82020); actual height 10.8 mm. Photographs by J. Goud, NNM Leiden.

Parietalis short, low to moderately prominent in front, inwards quickly decreasing in size and ending at least about its own length away from the short lamella fulcrans, which is accompanied by an equally short, often less prominent lamella parallela; a lamella inserta, running from next to the fulcrans to in between the inner end of the columellaris and the columellar rim, is more or less obsolete to absent. The back-part of the parietalis might in fact be homologous with the lamella spiralis, since there is a vague, obtuse angle separating it from the frontal part, which would then be the parietalis proper. There may be a short, weak plica suturalis. Lunella dorsal, white, clearly discernible only on the lower part of the palatal wall (not to be confused with the clausilial border shining through the shell wall), connected with the columellar rim or nearly so. There is a prominent to very prominent white upper palatal denticle.

H 10.7-13.4 mm; W 2.8-3.3 mm.

Differentiation. — Shells of *I. castalia castalia* (Roth, 1856) are larger and have a sculpture of narrowly spaced, low riblets on the cervical part of the shell. *I. castalia crenilabris* (O. Boettger, 1885) and *I. castalia herae* Sajó, 1968, have larger, darker brown shells, sculptured with more prominent riblets that are locally accentuated by a white callus, resulting in a characteristic pattern of white streaks. *I. castalia herae* is very similar to *I. castalia crenilabris* and considered identical to it by Nordsieck (1973: 180); in the latter subspecies only, fully grown shells have some small plicae on the apertural lip, in the lower palatal half. Shells of *I. castalia boschi* Nordsieck, 1973, are about as high as those of *I. c. yeruni* but clearly less slender (broader) and the radial riblets are even more prominent than in *I. c. crenilabris*.



Figs 16-19. *Montenegrogrina dennisi protruda* subsp. nov., Macedonia, nomos Grevena, 19 km W of Grevena, on rocks along path to Spileia toon Nymphoon, between river and mountain, 2.3 rkm before Aetia (along the road from Anavrita to Aetia), W-slope, 1000 m alt., UTM EK1735, GM. 16, clausilial blade; 17, detail the lower border on fig. 16 (above the scale bar); 18, detail of fig. 17; 19, microdenticles. Scale bars 0.5 mm, 0.1 mm, 10 μ m, and 5 μ m, respectively.

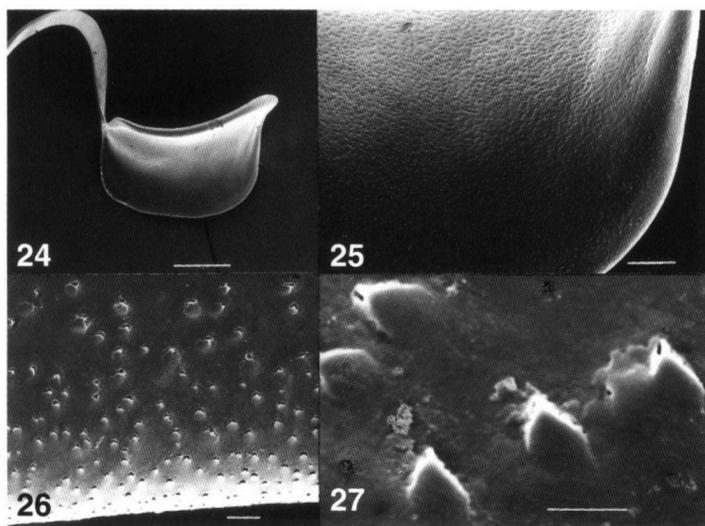
Figs 20-23. *Macedonica pindica bellula* subsp. nov., Macedonia, nomos Grevena, 19 km W of Grevena, on rocks along path to Spileia toon Nymphoon, between river and mountain, 2.3 rkm before Aetia (along the road from Anavrita to Aetia), W-slope, 1000 m alt., UTM EK1735, GM. 20, clausilial blade; 21, detail near the wide curvature of the lower border; 22, detail of fig. 21; 23, microdenticles. Scale bars 0.5 mm, 0.1 mm, 10 μ m, and 5 μ m, respectively. SEM-photographs by A. Gittenberger, NNM Leiden.

Nordsieck (in litt., 2002) called my attention for the fact that the poorly known *Clausilia unidentata* Küster, 1861, also belongs to the polytypic *I. castalia*. Because of its distribution, Mt Dhirfis in Evia (= Evvoia, = Euboea), it is highly improbable that this nominal taxon is identical to the subspecies described here. Küster (1861: 322, pl. 36 figs 28-30) described and illustrated a shell of c. 12 mm, rubiginous in colour, with a conspicuous, white, sutural line, without a columellaris and without a clausilium. Apart from the dimensions, and taking into account that the clausilium got simply lost, this is clearly different from *I. castalia yeruni*.

Distribution. — The subspecies of *Idyla castalia* are restricted to certain mountain ranges, where they occur at high altitudes, apparently not below 900 m altitude. Since the highest parts of several mountainous regions in Greece and Bulgaria have not yet been thoroughly explored, the distributional pattern summarized here is probably incomplete. In Greece, *I. castalia castalia* is known from the Parnassos Mts, *I. castalia crenilabris* from Mt Ossa, *I. castalia herae* from the Olimbos and the Vermion Mts, maybe *I. castalia unidentata* from Mt Dhirfis in Evia, and *I. castalia yeruni* from the mountainous area W of Grevena. From the Pirin Mts in S Bulgaria, *I. castalia boschi* was described.

Remarks.— In contrast to the findings regarding *Montenegrogrina dennisi* and *Macedonica pindica*, the shells of *Idyla castalia* from the two separate limestone cliffs (and from even a third one) cannot be distinguished from each other.

The fact that the form *pirostoma*, described from "Corfu?" by O. Boettger (1880: 51), belongs to *I. castalia yeruni*, suggests that the area W of Grevena might have been visited by a malacologist before. Otherwise, the subspecies occurs also outside the range where it is reported from here.



Figs 24-27. *Idyla (I.) castalia yeruni* subsp. nov., Macedonia, nomos Grevena, 25 km W of Grevena, small limestone outcrop, 1.25 km SW of Dotsiko, S-slope, 1400 m alt., UTM EK1039. 24, clausilial blade; 25, detail below the basal tip; 26, detail near the lower border; 27, microdenticles. Scale bars 0.5 mm, 0.1 mm, 10 μ m, and 5 μ m, respectively. SEM-photographs by A. Gittenberger, NNM Leiden.

Derivatio nominis.— The epithet *yeruni* is based on a phonetic spelling of the first name of Jeroen Goud, in appreciation of good-fellowship in malacology and the many photographs he made over the years.

ACKNOWLEDGEMENTS

On the basis of a more limited material, Mr. H. Nordsieck gave me his opinion on the various taxa described above, which is greatly appreciated. It does not mean that he has any responsibility for any possible mistakes in this paper. I am also grateful to Mr. W. Reenema who explained the geological maps, and to Messrs. A. Gittenberger, who made the SEM photographs, and J. Goud, who made the other photographs.

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