



COLUMELLA STRUCTURE IN SOME SNAIL SPECIES (GASTROPODA: PULMONATA)

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ABSTRACT: Three types of columella structure have been distinguished in shells of selected snail species (*Laciniaria plicata* (Drap.), *Chondrula tridens* (O. F. Müll.), *Cepaea vindobonensis* (Fér.), *Helix lutescens* (Rossm.), *Viviparus contectus* (Millet), *V. viviparus* (L.), *Helicella obvia* (Menke) and *Planorbarius corneus* (L.)); they are correlated with the way of coiling, growth and convexity of whorls.

KEY WORDS: snails, shell structure, columella

INTRODUCTION

The columella of a typical, coiled snail shell is formed by internal walls of particular shell whorls which may adjoin along the shell axis. The columella terminates at the umbilicus just near the shell aperture; the umbilicus is open or closed. The literature data on the columella structure are very scanty, limited to defining it and explanation of its basic structure.

According to some authors, a narrow, massive and solid columella results from the whorls adjoining each other completely (ANKEL 1926, GEYER 1927,

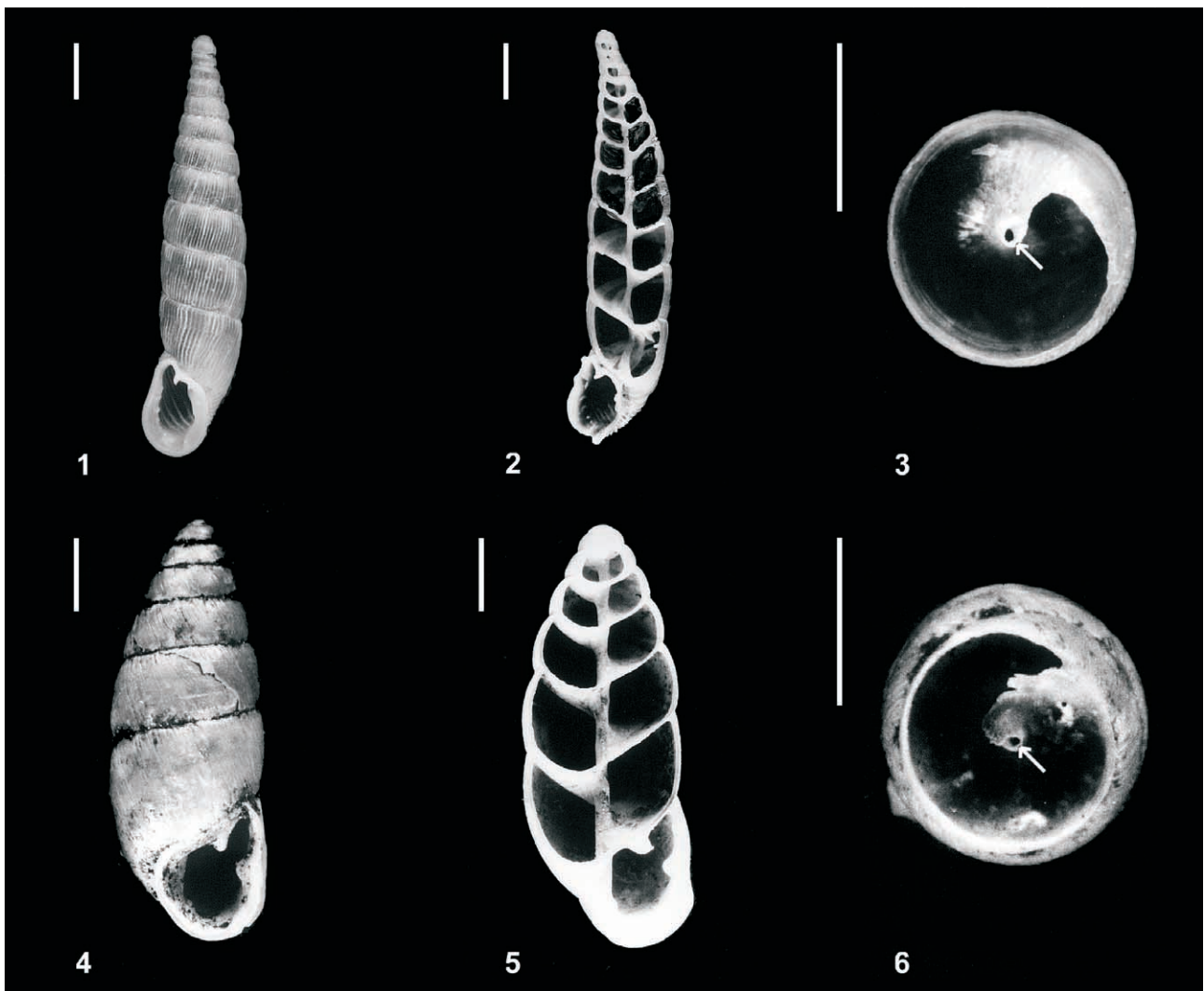
BOETTGER 1944). Loosely coiled whorls do not touch each other and as a result the columella is empty (ANKEL 1926, GEYER 1927, BOETTGER 1944, PIECHOCKI 1979, URBAŃSKI 1989).

The analysis of the structure of columella in *Lymnaea stagnalis* (Linnaeus, 1758) revealed that even a narrow and massive columella could be empty (JACKIEWICZ 1999); this encouraged us to pay a closer attention to columellae in taxa of different shell morphology in order to find out which shell features determine the columella structure.

MATERIAL AND METHODS

Shells of the following species were used in the study: *Laciniaria plicata* (Draparnaud, 1801), *Chondrula tridens* (O. F. Müller, 1774), *Cepaea vindobonensis* (Férussac, 1821), *Helix lutescens* (Rossmässler, 1837), *Viviparus contectus* (Millet, 1813), *V. viviparus* (Linnaeus, 1758), *Helicella obvia* (Menke, 1828) and *Planorbarius corneus* (Linnaeus, 1758).

The snails were collected in the Wielkopolska region in different years. The columella height was measured between the shell apex and the upper aperture margin, its width was measured in the widest part. The cross-sections of the shells were made and the photographs taken by Mr. PRZEMYSŁAW DEGÓRSKI.



Figs 1–6. *Laciniaria plicata* (1–3); *Chondrula tridens* (4–6): 1, 4 – shell; 2, 5 – columella along the shell axis; 3, 6 – shell cross-section with columellar lumen indicated with arrow; scale bars – 2 mm

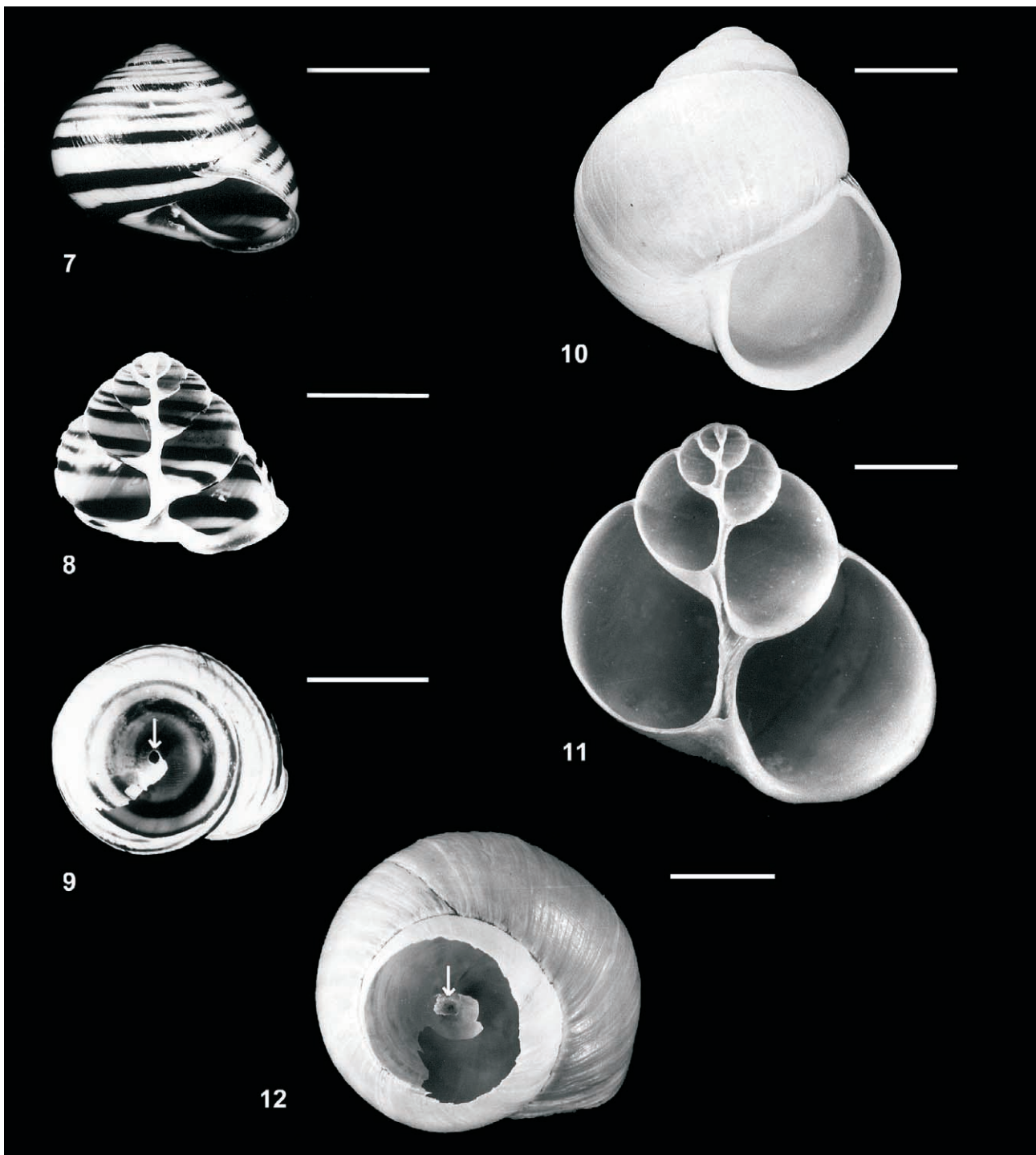
RESULTS AND DISCUSSION

In *L. plicata* (Figs 1–3), the columella is very narrow (Table 1), slowly widening towards its basal end. It

runs straight along the shell axis. The columellar lumen is very small.

Table 1. Measurements of columella in selected snail shells

Species	Height [mm]	Width [mm]	Height to width ratio	Whorl shape	Type of columella
<i>Laciniaria plicata</i>	14	0.25	0.018	flat	straight
<i>Chondrula tridens</i>	8	0.3	0.037	flat	straight
<i>Cepaea vindobonensis</i>	13	1.5	0.116	flat	straight
<i>Helix lutescens</i>	22	1	0.045	convex	zigzag
<i>Viviparus coniectus</i>	23	2	0.087	convex	zigzag
<i>Viviparus viviparus</i>	18	2	0.111	convex	zigzag
<i>Helicella obvia</i>	7	2	0.286	flat	conical
<i>Planorbarius corneus</i>	–	–	–	–	–



Figs 7–12. *Cepaea vindobonensis* (7–9); *Helix lutescens* (10–12): 7, 10 – shell; 8, 11 – columella along the shell axis; 9, 12 – shell cross-sections with columellar lumen indicated with arrow; scale bars – 10 mm

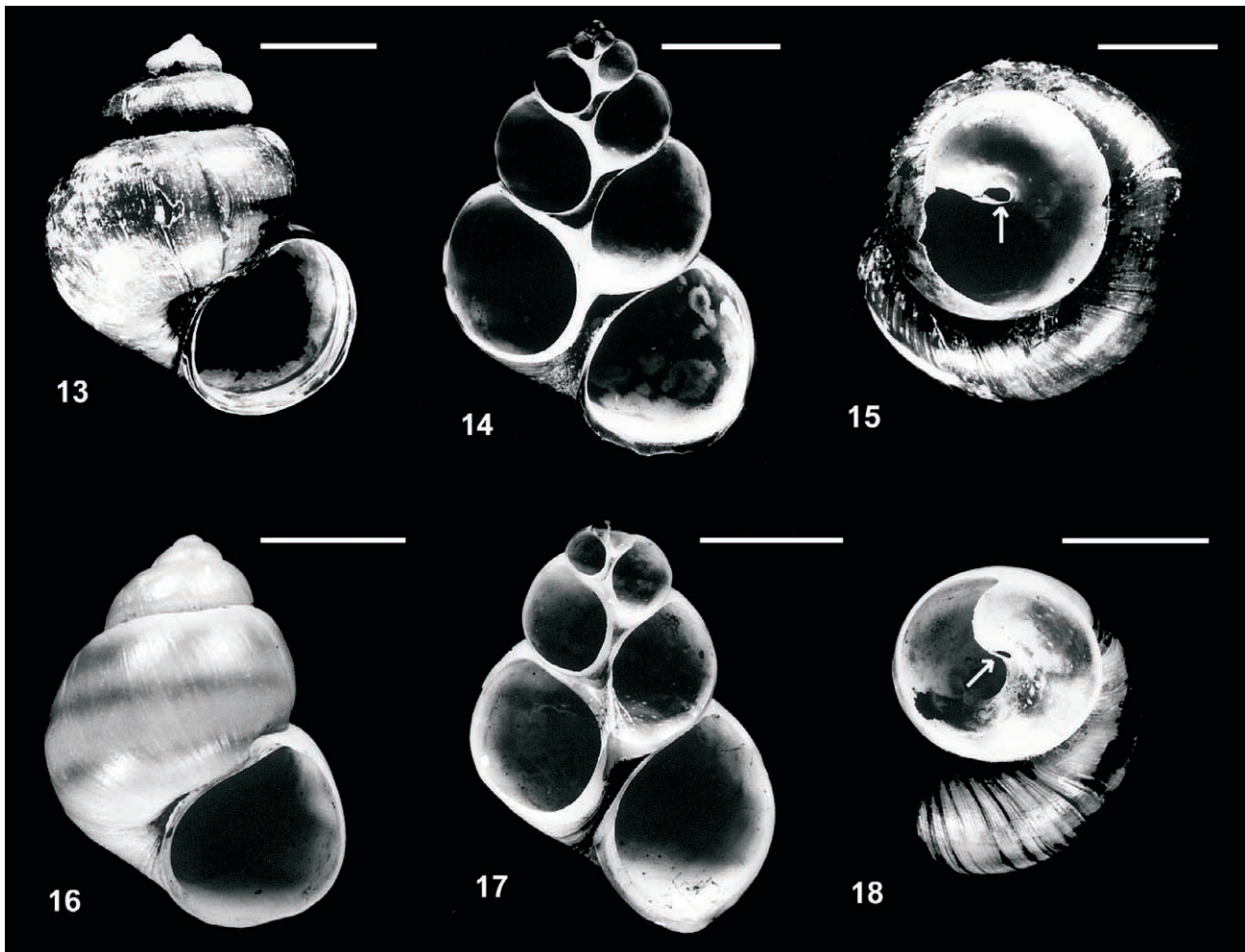
Likewise, in *Ch. tridens* (Figs 4–6), the columella is thin (Table 1) and its lumen very narrow. It is straight and of almost the same width along its whole length.

The columella of *C. vindobonensis* (Figs 7–9) is straight, relatively massive and thick (Table 1). Its lumen is also fairly wide.

Although *H. lutescens* (Figs 10–12) is one of the biggest European land snails, its columella is thinner

than that in the smaller *C. vindobonensis* (Table 1), and has a narrow lumen. However, in *H. lutescens* the columella is not straight, like in the above mentioned species, but makes soft zigzags.

In *V. contectus* (Figs 13–15) the columella is wide (Table 1). Its lumen is relatively big, slightly elongated in shape. The zigzag-like shape is even more pronounced than in *H. lutescens* (Fig. 11). In closely re-



Figs 13–18. *Viviparus contectus* (13–15); *Viviparus viviparus* (16–18): 13, 16 – shell; 14, 17 – columella along the shell axis; 15, 18 – shell cross-sections with columellar lumen indicated with arrow; scale bars – 10 mm

lated *V. viviparus* (Figs 16–18), the columella is also rather thick (Table 1) and zigzag-like, but more massive. The whorl walls forming it are thick, leaving a very narrow slit-like lumen.

The inner whorl walls in *Helicella obvia* (Figs 19–21) do not adjoin along the shell axis. Consequently, the columella assumes the shape of a high but narrow cone with a very spacious lumen (Table 1).

In several gastropod species, such as *Planorbarius corneus* (Figs 22–24), the whorls are coiled in one plane, the body whorl surrounding all the previous whorls. This shell structure requires a separate analysis.

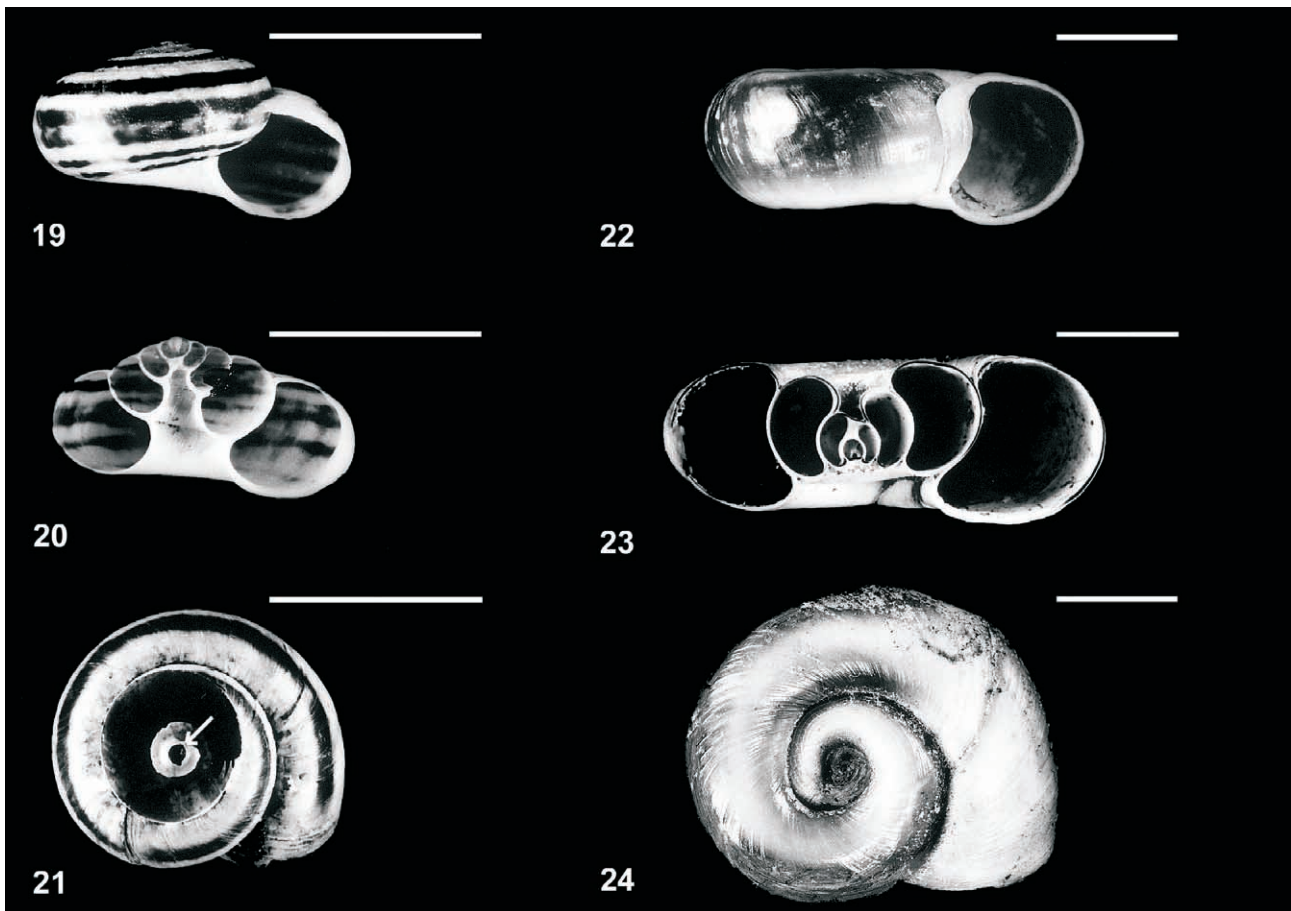
The structure of columella is much diversified. Three types of the structure can be recognised among the studied species. The first – a straight, thin

columella with a very narrow lumen – is characteristic of *Laciniaria plicata* (Fig. 2), *Chondrula tridens* (Fig. 5) and *Cepaea vindobonensis* (Fig. 8). Despite the different shape, their shells share the slightly convex, gradually increasing whorls.

The second type – a zigzag-like, thin columella with a narrow lumen, is found in *Helix lutescens* (Fig. 11), *Viviparus contectus* (Fig. 14) and *V. viviparus* (Fig. 17), whose common character is very convex and quickly increasing whorls.

In *Helicella obvia* (Fig. 20), with its conical columella with a spacious lumen (the third type) the inner whorl walls do not adjoin along the shell axis.

It seems that the main factors determining the form of columella are: the way of coiling, convexity and increase rate of the whorls.



Figs 19–24. *Helicella obvia* (19–21); *Planorbarius corneus* (22–24): 19, 22 – shell; 20, 23 – columella along the shell axis; 21, 24 – shell cross-sections (21 – columellar lumen indicated with arrow); scale bars – 10 mm

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