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Structure of lymnaeid shell columella (Gastropoda: Pulmonata)

With 1 table and 33 figures

MARIA JACKIEWICZ

Abstract. A uniform type of columella structure is characteristic of lymnaeid shells. However, there is large variability in the columella width and the size of its lumen between particular species.

Kurzfassung. **Struktur der Columella der Schale der Lymnaeidae (Gastropoda: Pulmonata).** – Für die Schale der Lymnaeidae ist ein einheitlicher Bautypus der Columella kennzeichnend. Jedoch existiert hinsichtlich der Weite der Columella und der Größe ihres Lumens zwischen einzelnen Arten eine große Variabilität.

Key words. Lymnaeidae, shell structure, columella.

Introduction

Papers concerning gastropod columella structure are very scarce. It is usually explained how columella is built as well as it is stated that it creates a shell symmetry axis (ANKEL 1926, GEYER 1927, BOETTGER 1944, PIECHOCKI 1979, URBAŃSKI 1989).

With the aim to enlarge our knowledge on this aspect of gastropod shell structure detailed studies on the structure of *Lymnaea* (*Lymnaea*) *stagnalis* (JACKIEWICZ 1999) and some other land and freshwater gastropod species (JACKIEWICZ & KORALEWSKA-BATURA 2000) have been undertaken. Three different types of the columella structure were discovered among those species, namely: straight, zigzag and cone-shaped.

The shell columella organisation is dependent on the way of whorl coiling and increasing as well as on whorl convexity (JACKIEWICZ & KORALEWSKA-BATURA l.c.).

The lymnaeid shell structure is characterized by relatively large variability. These shells may be turriform, ovate or ovately lengthened. Their whorls increase evenly or the last one may be strongly expanded. The shell whorl convexity is various (JACKIEWICZ 1998).

Taking into account this lymnaeid shell variability, the study of the columella structure in all eleven European lymnaeid species seemed useful and advisable.

Material and methods

The studies were carried out on the following lymnaeid species: *Omphiscola glabra* (O.F. MÜLLER, 1774), *Lymnaea* (*Galba*) *truncatula* (O.F. MÜLLER, 1774), *Lymnaea* (*Radix*) *peregra* (O.F. MÜLLER, 1774), *Lymnaea* (*Radix*) *auricularia* (LINNAEUS, 1758), *Lymnaea* (*Myxas*) *glu-*

Author's address:
Prof. Dr. hab. Maria Jackiewicz, Department of Animal Ecology and Taxonomy, Institute of Environmental Biology, Adam Mickiewicz University, Szamarzewskiego 91A, 60-569 Poznań (Poland)

Tab. 1: Columella characters of the investigated lymnaeid species.

No.	Species	Columella height (mm)	Columella width (mm)	Columella width:height ratio	Columellar lumen
1.	*Omphiscola glabra*	12	0.50	1:24	large
2.	*Lymnaea truncatula*	8	0.50	1:16	large
3.	*Lymnaea peregra* f. *typica*	18	1.00	1:18	very small
4.	*Lymnaea auricularia*	20	0.30	1:67	very small
5.	*Lymnaea glutinosa*	8	0.25	1:32	very small
6.	*Lymnaea palustris*	20	0.60	1:33	very small
7.	*Lymnaea turricula*	19	0.60	1:32	large
8.	*Lymnaea occulta*	15	0.80	1:19	large
9.	*Lymnaea vulnerata*	16	0.60	1:27	large
10.	*Lymnaea corvus*	29	0.40	1:73	very small
11.	*Lymnaea stagnalis*	33	0.40	1:83	very small

tinosa (O.F. MÜLLER, 1774), *Lymnaea* (*Stagnicola*) *palustris* (O.F. MÜLLER, 1774), *Lymnaea* (*Stagnicola*) *turricula* (HELD, 1836), *Lymnaea* (*Stagnicola*) *occulta* (JACKIEWICZ, 1959), *Lymnaea* (*Lymnaea*) *vulnerata* KÜSTER, 1862, *Lymnaea* (*Lymnaea*) *corvus* (GMELIN, 1791) and *Lymnaea* (*Lymnaea*) *stagnalis* (LINNAEUS, 1758).

Omphiscola glabra and *Lymnaea* (*Lymnaea*) *vulnerata* originated from Germany. All other species were collected in Poland.

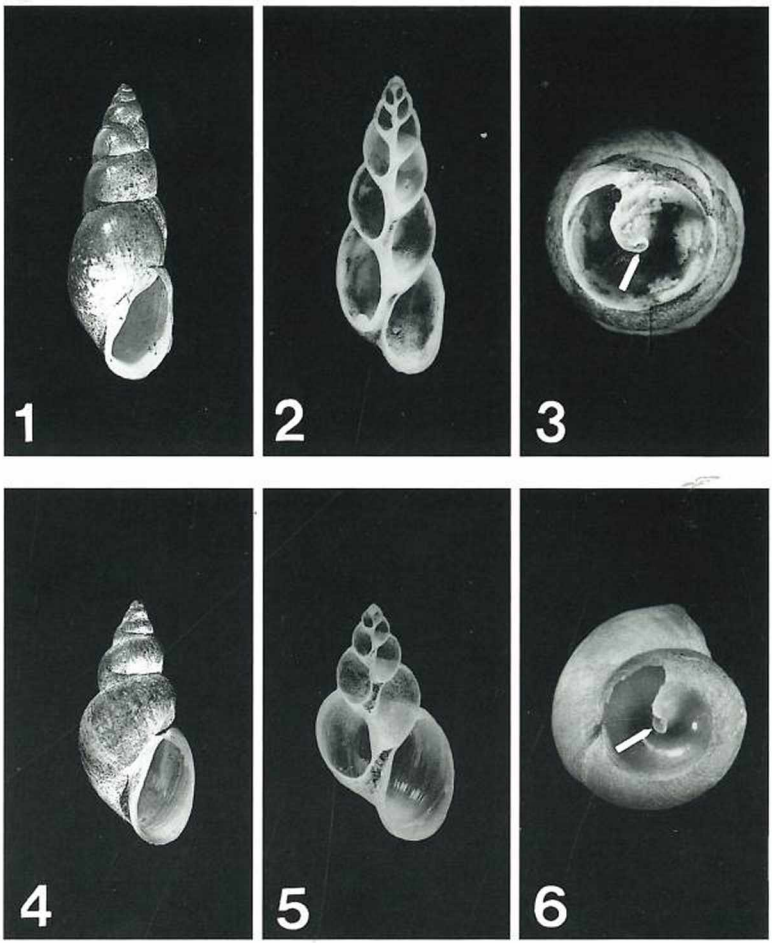
The height of columella was measured directly between the shell apex and the opening of the columella (umbilicus). The columellar width was measured in the penultimate whorl.

Results and discussion

Omphiscola glabra shell columella (Figs 1–3, Table 1) is wide, only slightly widened at the end. Its lumen is large. The columella runs in a softly zigzag along the shell axis.

Similarly, the shell columella of *Lymnaea* (*Galba*) *truncatula* (Figs 4–6, Table 1) is also wide, however, it is much more widened in the terminal part. Its lumen is also large and it runs in a zigzag.

Lymnaea (*Radix*) *peregra* f. *typica* (Figs 7–9, Table 1) has a wide columella, especially at its end. It contains small lumen with a soft zigzag shape.



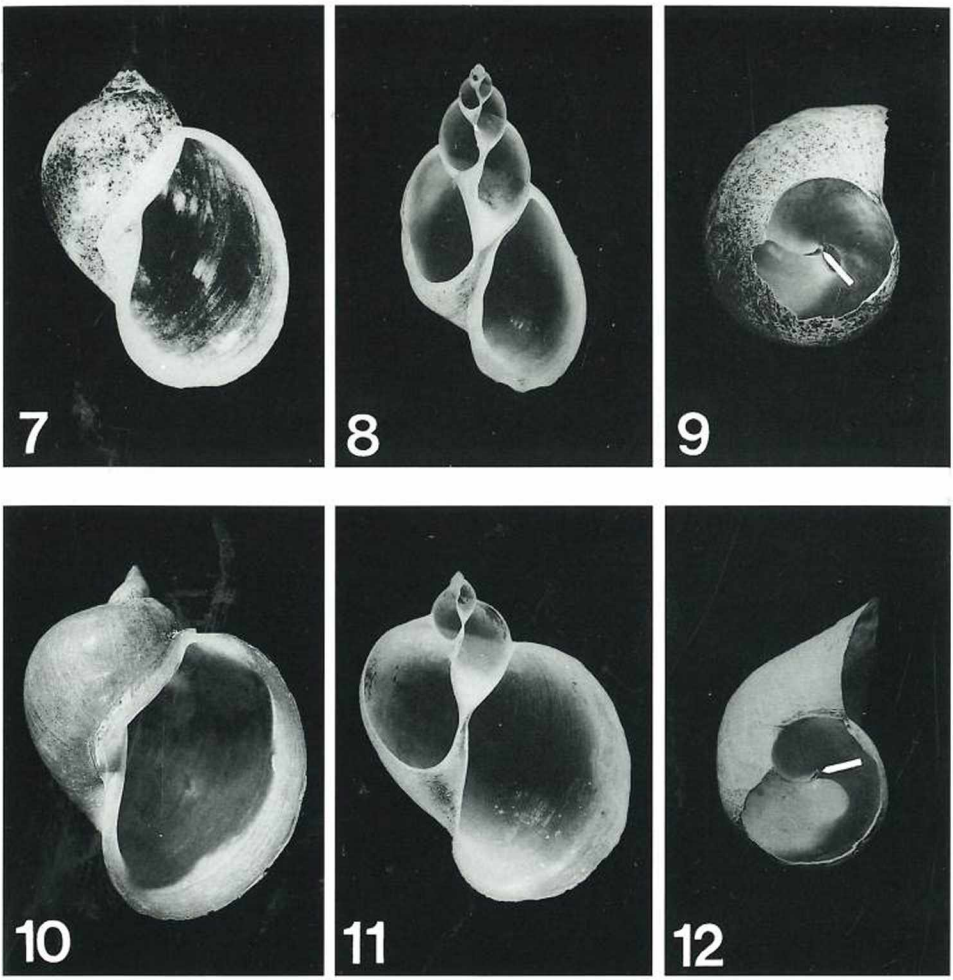
Figs 1–6: *Omphiscola glabra* (1–3); *Lymnaea (Galba) truncatula* (4–6): 1,4 – shell morphology, 3×; 2,5 – columella along the shell axis, 3×; 3,6 – shell cross-section with columellar lumen showed by an arrow, 6×.

In the shell of *Lymnaea* (*Radix*) *auricularia* (Figs 10–12, Table 1), there is a narrow columella almost along its whole length.

The columella of *Lymnaea* (*Myxas*) *glutinosa* (Figs 13–15, Table 1) is very narrow. In the body whorl, which creates almost the whole shell, it is s-shaped (Fig. 14). The proximal shell whorls lie almost in one plane around the apical part of the columella. Its lumen is very small (Fig. 15).

In *Lymnaea* (*Stagnicola*) *palustris* (Figs 16–18, Table 1), the shell columella is rather narrow slowly widened towards the end. Its lumen is very small and the shape is softly zigzag.

As in the above species, the shell columella of *Lymnaea* (*Stagnicola*) *turricula* (Figs 19–21, Table 1) is also rather narrow and progressively widened towards the shell bottom. On the other hand, columellar lumen is relatively large. It runs in a soft zigzag.

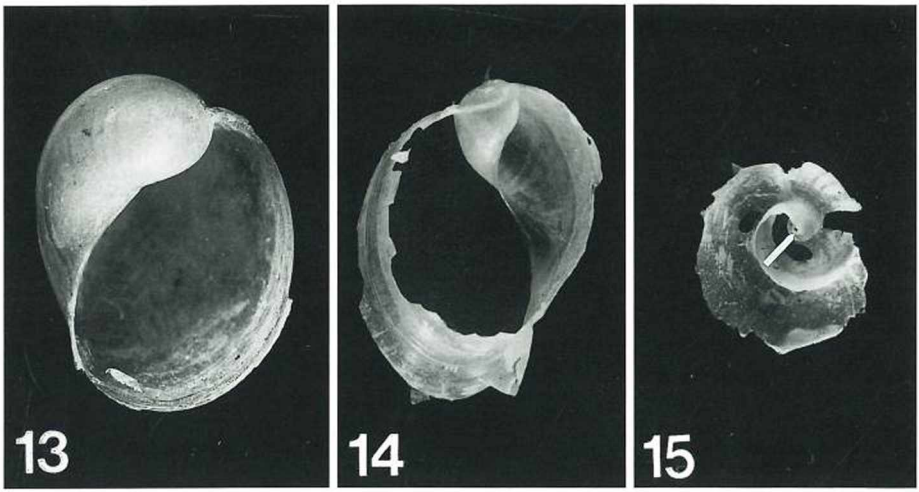


Figs 7–12: *Lymnaea* (*Radix*) *peregra* f. *typica* (7–9); *Lymnaea* (*Radix*) *auricularia* (10–12): 7,10 – shell morphology, 2×; 8,11 – columella along the shell axis, 2×; 9,12 – shell cross-section with columellar lumen showed by an arrow, 3×.

In *Lymnaea* (*Stagnicola*) *occulta* (Figs 22–24, Table 1), the shell columella is wider than in the above two related species. It progressively becomes wider towards the end. Its lumen is large and runs in a zigzag.

The columella of *Lymnaea* (*Lymnaea*) *vulnerata* (Figs 25–27, Table 1) is slightly narrower than in the previous species and it is only slightly widened at the end. The lumen is relatively small. It runs in a soft zigzag.

The shell of *Lymnaea* (*Lymnaea*) *corvus* (Figs 28–30, Table 1) is characterized by a especially narrow columella, only slightly widened towards the end. Its lumen is very narrow and of a very strongly zigzag shape.



Figs 13–15: *Lymnaea* (*Myxas*) *glutinosa*: 13 – shell morphology, 5×; 14 – columella along the shell axis, 5×; 15 – shell cross-section with columellar lumen showed by an arrow, 6×.

The shell columella of *Lymnaea* (*Lymnaea*) *stagnalis* (Figs 31–33, Table 1, JACKIEWICZ 1999) is also very narrow and only slightly widened towards the end. Its lumen is very narrow and of a strongly zigzag shape.

The columella of all studied lymnaeid species runs in a zigzag along the shell axis, therefore may be classified as the zigzag columella (JACKIEWICZ & KORALEWSKA-BATURA 2000). However, this zigzag shape is different in particular species. The columella running along the shell axis may give smaller or larger arcs. The smallest ones have been found in *O. glabra* (Figs 1–3). The whorls of this species shell are relatively little convex and almost evenly coiled. The large arcs are created in the columella of *L. corvus* (Figs 28–30) and *L. stagnalis* (Figs 31–33). The shells of these two species are characterized by the most convex whorls and the body whorl is the largest one.

Taking into account the increasing arc of the columella coiling, the lymnaeid species may be arranged in the following order: *O. glabra, L. vulnerata, L. palustris, L. occulta, L. turricula, L. truncatula, L. peregra, L. auricularia, L. glutinosa, L. corvus, L. stagnalis*.

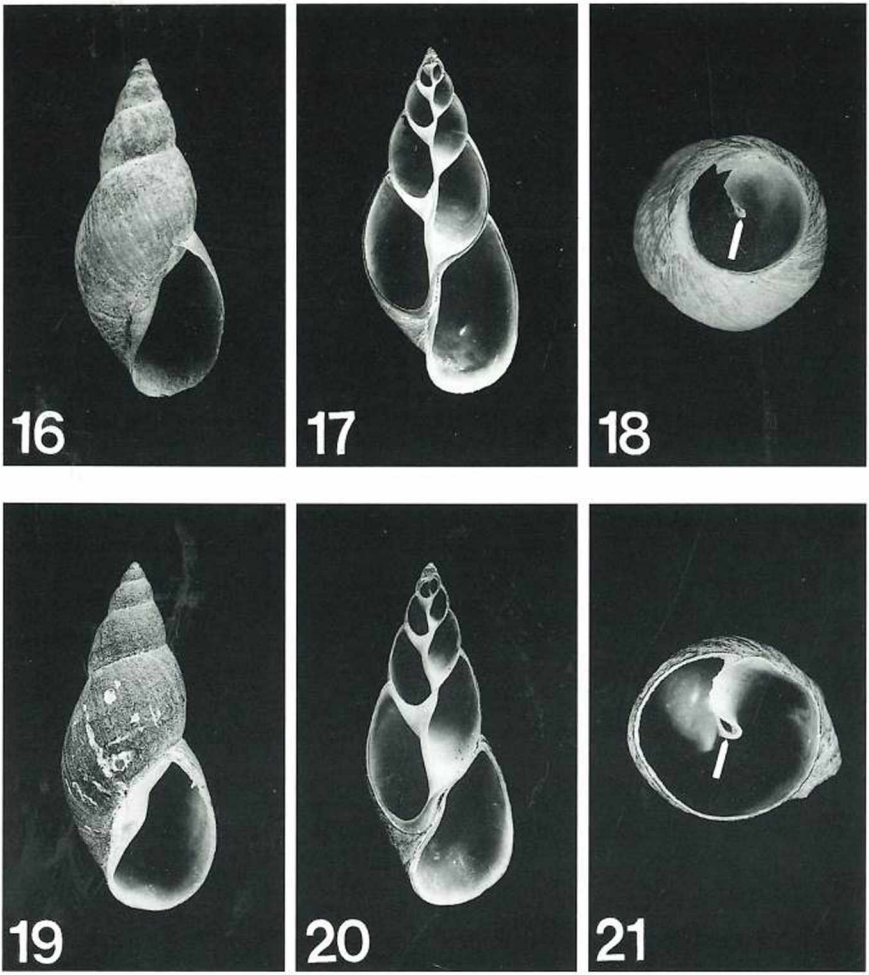
The width of the lymnaeid shell columella is different. Also its lumen size may be varied (Table 1).

The narrow columella occur in *L. auricularia, L. glutinosa, L. corvus* and *L. stagnalis*. These species are also characterized by a narrow lumen of their columella.

A rather wide columella with a relatively large lumen occurs in the shells of *L. turricula* and *L. vulnerata*. *L. palustris* and *L. peregra* f. *typica* also contain relatively wide columella, but their lumens are very small.

A rather wide columella also occurs in the following species: *O. glabra, L. truncatula* and *L. occulta*. The last two species are characterized by exceptionally large lumen of their shell columella.

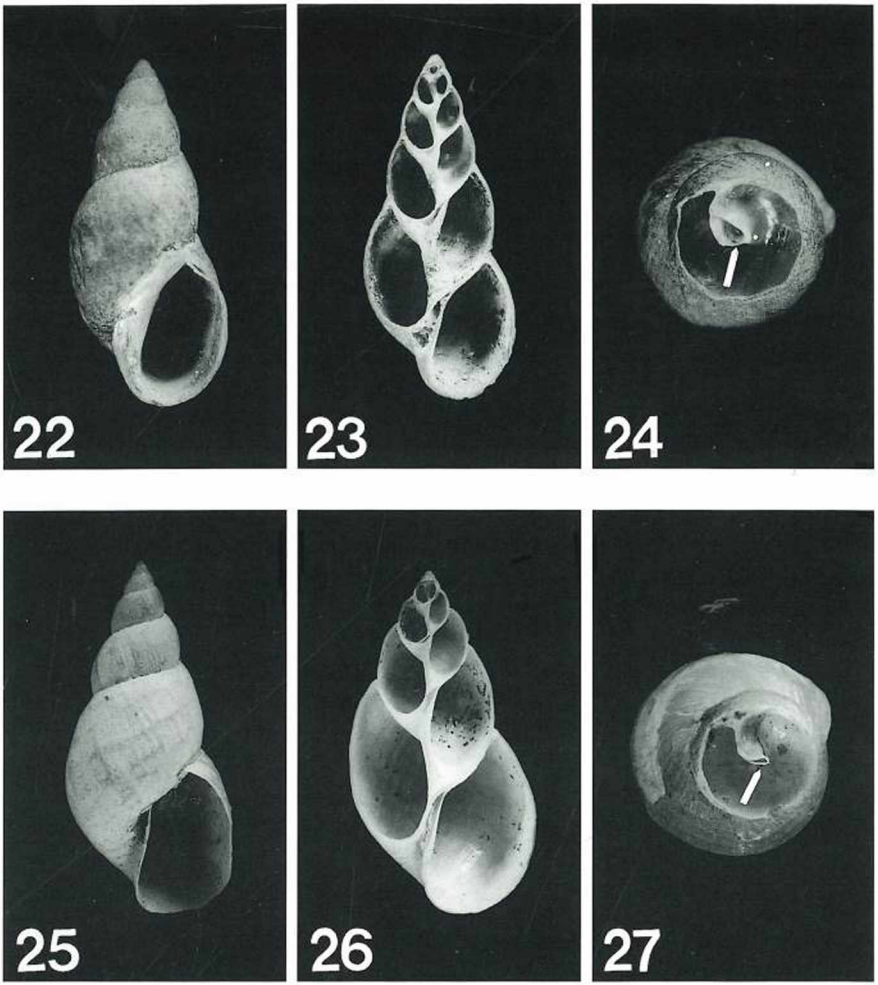
Data presented in the Table 1 suggest that the columellar shape is correlated with the whorl convexity and the way of their coiling. On the other hand, the size of columellar lumen de-



Figs 16–21: *Lymnaea* (*Stagnicola*) *palustris* (16–18); *Lymnaea* (*Stagnicola*) *turricula* (19–21): 16,19 – shell morphology, 2×; 17,20 – columella along the shell axis, 2×; 18,21 – shell cross-section with columellar lumen showed by an arrow, 4×.

pends on the relation between particular whorls. The more compactly they are coiled, e.g. in *L. auricularia* (Figs 10–12) and *L. stagnalis* (Figs 31–33), the smaller lumen they contain. However, if the inner walls of the shell whorls coiled round the shell axis leave larger space the columellar lumen is larger, as in *L. truncatula* (Figs 4–6) and *L. occulta* (Figs 22–24).

It should be stressed that the shells of the large lymnaeid species contain, as a rule, narrow, strongly lamellar columella with a small lumen like in *L. auricularia*, *L. corvus* and *L. stagnalis*. The columella of such a construction is undoubtedly more resistant and protects against mechanical damages in a better way.



Figs 22–27: *Lymnaea* (*Stagnicola*) *occulta* (22–24); *Lymnaea* (*Lymnaea*) *vulnerata* (25–27): 22,25 – shell morphology, 3×; 23,26 – columella along the shell axis, 3×; 24,27 – shell cross-section with columellar lumen showed by an arrow, 4×.

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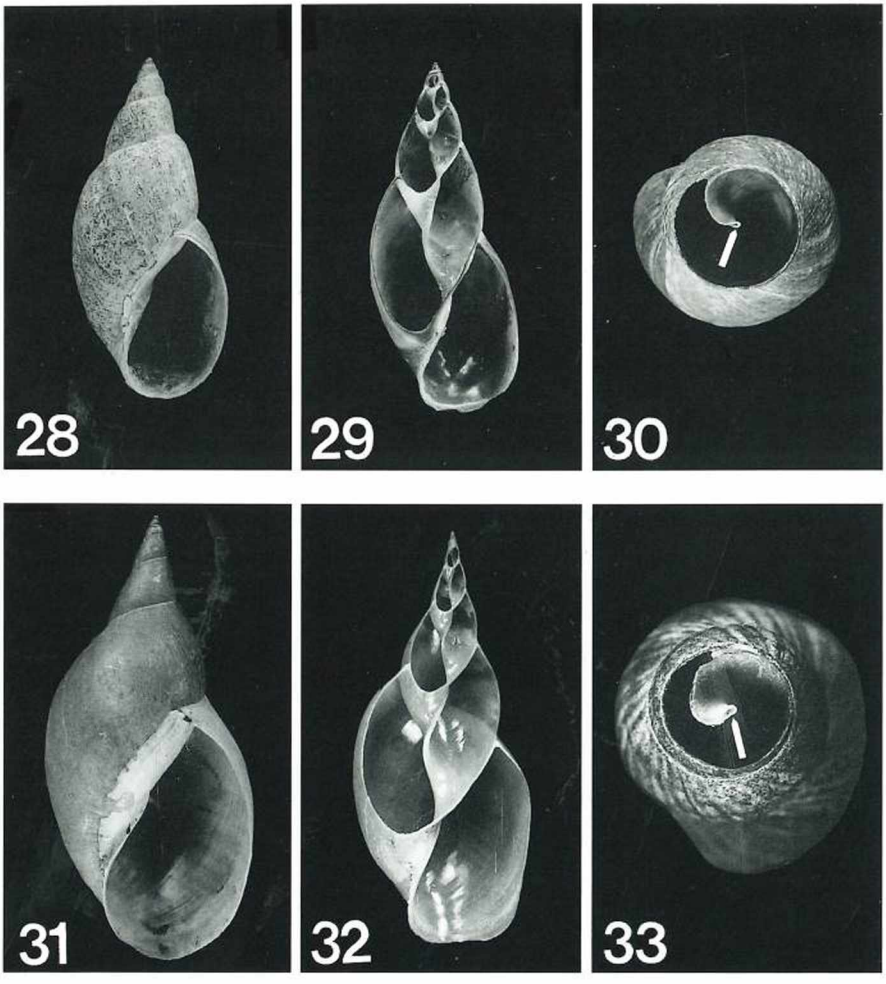

Figs 28–33: *Lymnaea* (*Lymnaea*) *corvus* (28–30); *Lymnaea* (*Lymnaea*) *stagnalis* (31–33): 28, 31 – shell morphology, 1.5×; 29,32 – columella along the shell axis, 1.5×; 30,33 – shell cross-section with columellar lumen showed by an arrow, 3×.

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