

Lymnaea cousini Jousseaume, 1887, from Ecuador (Gastropoda: Lymnaeidae)

W Lobato Paraense

Departamento de Malacologia, Instituto Oswaldo Cruz, Av. Brasil 4365, 21045-900 Rio de Janeiro, RJ, Brasil

A description is given of the shell, renal organ, reproductive system and radula of topotypic specimens of Lymnaea cousini Jousseaume, 1887. A diagnosis between it and four other lymnaeids which also occur in South America and were previously studied by the author (L. columella, L. diaphana, L. viatrix and L. rupestris) is presented.

Key words: *Lymnaea cousini* - *Lymnaea columella* - *Lymnaea diaphana* - *Lymnaea viatrix* - *Lymnaea rupestris* - morphology - taxonomy - Ecuador

Among the molluscs collected by Auguste Cousin in Ecuador there is a species described and figured by Jousseaume (1887) under the name of *Lymnaea cousini*:

"Testa ovato-conica, tenuiscula, malleata, subtilissime striata, interdum lineis elevatis circumdata, corneo-fusca; spira conica, acuta; sutura impressa, subexcavata; anfracti 4 convexi; ultimus ventricosus, apertura ovalis, columella alba, margo dexter tenuis, acutus, vix reflexus.

Dimensions: long., 10 à 14 mm; gr.diam., 6 à 10 mm; p.diam., 5 à 6 mm; ouverture, long., 7 à 10 mm; larg., 4 à 6 mm.

Coquille ovale à spire conique; son test mince, fragile, luisant et subtransparent, est ornée de stries longitudinales fines, serrées, et de petites côtes circulaires, peu régulières, très espacées, à peine saillantes et lisses. Sa couleur est d'un corné fauve qui prend près du péristome et au sommet une légère teinte rougeâtre. La spire est formée de quatre tours convexes et arrondis, séparés par une suture profonde; leur développement s'effectue avec rapidité surtout le dernier tour qui forme à lui seul plus des 7/8 de la coquille. Les tours embryonnaires lisses forment à l'extrémité de la coquille un petit sommet aigu. Le tour suivant est légèrement strié et le dernier est orné de stries et de cordons qui, par leur entrecroisement et leur disposition, produisent de petites facettes à la surface de la coquille. L'ouverture de forme ovale, est recouverte, chez les individus très adultes, d'une légère croute crétacée, luisante et blanche; le péristome présente un bord externe, mince,

tranchant et légèrement déjeté en dehors, surtout à la partie antérieure, alors que postérieurement il est presque droit. Le bord columellaire assez épais et blanchâtre, décrit une courbe et forme en pénétrant dans l'ouverture un léger bourrelet; il est relié à l'extrémité postérieure du bord externe par une couche d'enduit blanchâtre assez large surtout au niveau de l'ombilic qu'elle obture presque complètement; à ce niveau existe un large sillon que limite en dedans le bord columellaire.

Habitat. Cette espèce, peu variable quant à sa forme, la coloration et les ornements, présente au point de vue de la taille de très grandes différences. Elle m'a été envoyée par M Cousin, qui l'a recueillie à Chanchu-Yacu, près de Chillogallo, canton de Quito."

On April 23, 1965, I visited the above-mentioned type locality, about 10 km southwest of Quito, collecting from a pond a sample of this lymnaeid which was abundant among water-cresses.

MATERIALS AND METHODS

This study is based on 24 shells and 10 dissected specimens. Each of the latter was previously killed by gradual immersion in water heated to 70°C, with the aperture upward, so carefully as to minimize its retracting back to the shell. After 15 sec the snail was completely plunged for 20 additional sec and then transferred to water at room temperature. The animal (under water) was drawn from the shell with a forceps applied to the cephalopedal mass and fixed in slightly modified Railliet-Henry's fluid (distilled water 930 ml, sodium chloride 6 g, formalin 50 ml, glacial acetic acid 20 ml). The radulae were separated from the buccal mass by digestion for 12 hr in a solution of NaOH at 56°C. They were then rinsed in tap water and mounted in a drop of glycerin on a micro-

scopic slide, with the dorsal (toothed) surface upwards as in the living animal. Measurements were made on camera lucida drawings.

Voucher specimens were deposited at the malacological collections of Instituto Oswaldo Cruz (no. 1112), Museum of Zoology-University of Michigan, and Natural History Museum-London.

DESCRIPTION

The largest shell (Fig. 1) is 8.5 mm long and 6.0 mm wide, and has five whorls; spire length 3 mm, aperture length 6 mm, aperture width 4 mm. The following ratios were calculated from 20 specimens, 6.6-8.5 mm long (means \pm SD): shell width/shell length = 0.54-0.65 (0.59 ± 0.03); spire length/shell length = 0.31-0.38 (0.35 ± 0.02); aperture length/shell length = 0.61-0.69 (0.65 ± 0.02); aperture length/spire length = 1.59-2.23 (1.88 ± 0.18). Thus the shell tends to be one and a half times as long as it is wide, and its aperture tends to be two thirds as long as the shell or twice as long as the spire.

A description of the qualitative shell characters would be superfluous, since the specimens of the present sample agree perfectly with Jousseume's, whose original figure is reproduced in this paper (Fig. 2).

The cephalopedal mass is yellowish gray. The melanic pigmentation of the mantle is distributed into discrete flecks over the roof of the hypopeplar cavity and tends to diffuse on the rest of the mantle roof.

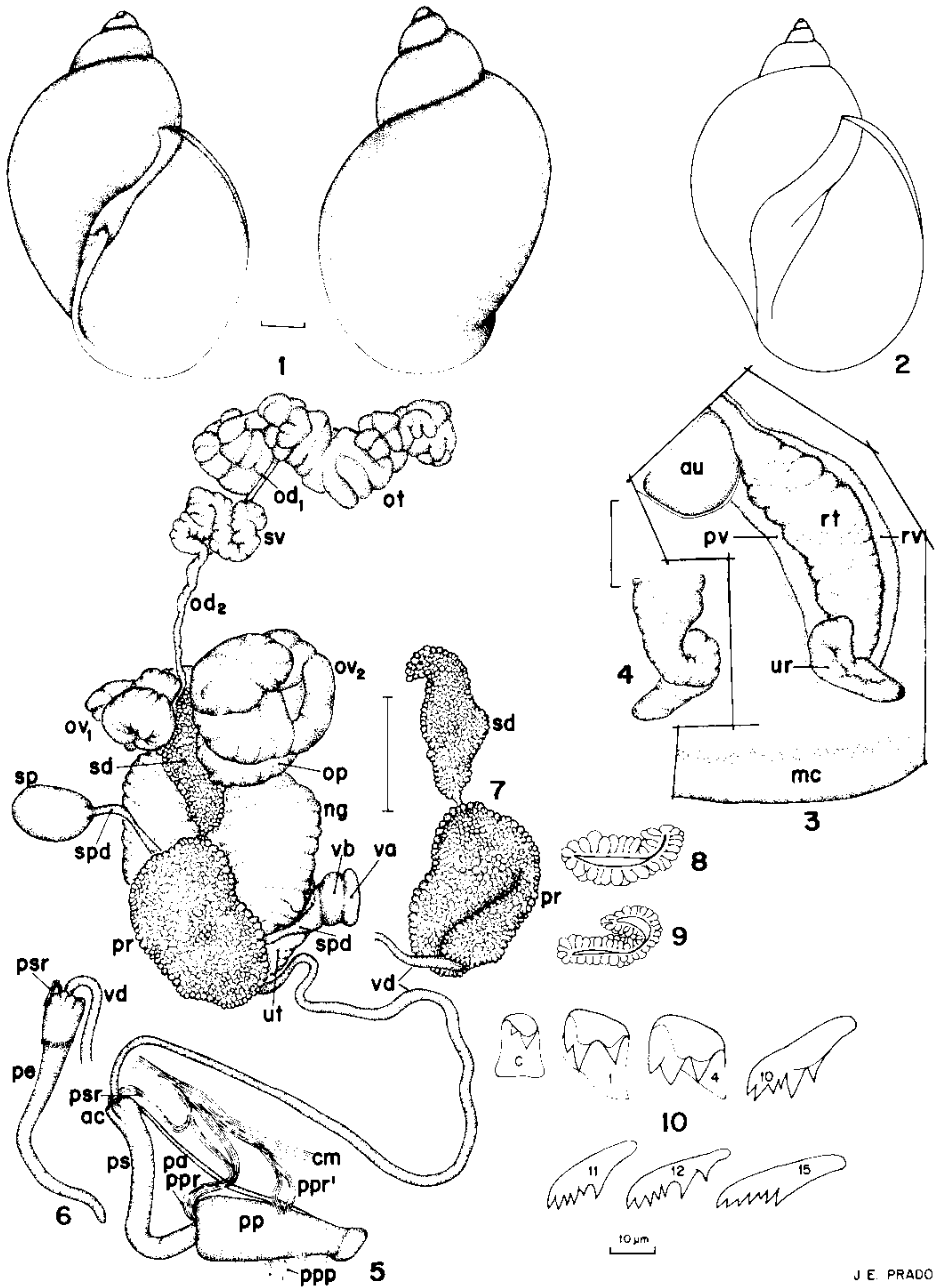
The renal tube (Fig. 3, rt) extends straightly from the right side of the pericardial region toward the mantle collar (mc), bordered by the renal vein (rv) on the right and the pulmonary vein (pv) on the left. On reaching the septum between the pulmonary and hypopeplar cavities, just behind the osphradium, it comes back upon itself and, after a short course, bends sharply cephalad and rightward between the first loop and the pulmonary-hypopeplar septum, forming a ureter (ur) which tapers to a subterminal meatus behind the pneumostome. Fig. 4 shows a dorsal view of the terminal portion of the renal tube.

The reproductive system is shown in Figs 5-9. The ovotestis (ot) has a ginger-like appearance, composed of acini pressed against each other around a collecting canal which continues into the ovispermiduct. The latter has a very short smooth-walled proximal segment (od_1) followed by a bosselated swelling, the seminal vesicle (sv), and then narrows cephalad into a distal segment (od_2) which empties into the carrefour.

The albumen gland (not figured) has no special characteristics, and covers the carrefour and the origins of the oviduct and ovispermiduct.

The oviduct arises ventrally from the carrefour as a tube of bosselated wall. It follows a convolute course (ov_1) around the region of the carrefour, between the albumen and nidamental glands, so that its distal portion (ov_2) gets in touch with the proximal portion. Near its distal end, at a point hidden by its terminal folds, the oviduct is connected with a wrinkle-walled sac, the oviducal pouch (op), which projects from its right side and with which it communicates through a narrow orifice. Then the oviduct proceeds cephalad, continuing into the nidamental gland (ng). As usual with lymnaeids, the nidamental gland is convex dorsally and flattened ventrally, and its outer surface is crossed by numerous parallel grooves that give it a striated appearance. Its ventral surface has a shallow longitudinal depression, coincident with the raphe, over which the distal portion of the spermiduct and the proximal portion of the prostate run. The nidamental gland narrows suddenly into a smooth-walled uterus (ut), which bends to the right and continues into a short vagina (va). The vagina has a bulbous appearance due to a local thickening of the wall musculature forming a sphincter or sphincter-like structure. The spermathecal body (sp) varies in shape from more or less elongated to globoid (egg-shaped in Fig. 5), depending on the amount of its contents and its degree of contraction on fixation. The spermathecal duct (spd) is uniformly thin and about thrice as long as the body.

The spermiduct (sd) emerges from the carrefour, beside the oviducal origin, showing no diverticulum or lateral pouch at its beginning (Fig. 7, sd). It runs distalward as a ribbon of granular surface appressed to the ventral side of the nidamental gland, and suddenly diminishes in caliber to merge into the prostate (pr). The prostate is about half as bulky as the nidamental gland, and has the same granular appearance as the spermiduct. Its dorsal surface, appressed to the ventral side of the distal half of the nidamental gland and to the uterus, is flattened on its proximal half, and then shows a fissure formed by the folding of its left margin. As a result, the prostate lumen, initially slit-like, gradually takes on a J-shaped appearance in cross-section (Figs 8, 9). Some specimens, however, show a lengthwise fissure. The fissured distal end of the prostate shows ventrally two rounded protuberances, from whose convergence the vas deferens (vd) arises. The penis sheath (ps) is somewhat swollen at the proximal end owing to the presence of a circlet of minute knobs corresponding to inner apical chambers (ac) communicating with the sheath lumen; it is regularly cylindrical and about one and a half times as long as the prepuce (pp). As the penis sheath is



J. E. PRADO

Lymnaea cousini from Chanchu-Yacu, near Chillo Gallo, Ecuador (type locality). Fig. 1: shell. Fig. 2: copy of Joussemaume's original figure. Fig. 3: renal region. Fig. 4: ureter, dorsal view. Fig. 5: reproductive system (albumen gland removed). Fig. 6: penis. Fig. 7: spermiduct and prostate, dorsal view. Fig. 8: cross-section through middle of prostate. Fig. 9: cross-section through distal portion of prostate. Fig. 10: radular teeth; small numbers indicate position in transverse row (c = central, 1, 4 = laterals, 10, 11, 12, 15 = marginals). ac = apical chamber, au = auricle, cm = columellar muscle, mc = mantle collar, ng = nidamental gland, od₁ = proximal segment of ovispermiduct, od₂ = distal segment of ovispermiduct, op = oviducal pouch, ot = ovotestis, ov₁ = proximal portion of oviduct, ov₂ = distal portion of oviduct, pa = penial artery, pe = penis, pp = prepuce, ppp = protractor muscles of prepuce, ppr = retractor muscle of prepuce, ppr' = smaller retractor muscles of prepuce, pr = prostate, ps = penis sheath, psr = retractor muscle of penis sheath, pv = pulmonary vein, rt = renal tube, rv = renal vein, sd = spermiduct, sp = spermathecal body, spd = spermathecal duct, sv = seminal vesicle, ur = ureter, ut = uterus, va = vagina, vb = vaginal bulb, vd = vas deferens. Bar = 1 mm, except Fig. 6. Fig. 2 out of scale.

frequently more or less deeply intussuscepted into the prepuce, an accurate measurement of the lengths of the two organs, in such cases, is only possible in longitudinal section. The penis (Fig. 6) is about as long as the sheath, tapering to a slender point where the penis duct opens terminally. The prepuce is at least twice as wide as the penis sheath in the examined specimens; this proportion is artificially increased if the prepuce is fixed in a contracted state or is dilated by an intromittent penis sheath. The inner surface of the prepuce shows a series of circular folds, the caudalmost of which surrounds the penis sheath opening as a thickened ridge, the sarcobellum. The extrinsic muscles of the penial complex are usually two main retractors, two smaller retractors and two smaller protractors. The main retractors arise side by side from the columellar muscle (cm). One of them, the penis sheath retractor (psr), is inserted into the head of the penis sheath, and the other, the prepuce retractor (ppr), into the junction of the penis sheath with the prepuce. Not infrequently does the former give off a slip that merges in the latter. These two main retractors may be fused at their origin, splitting at a variable distance from their insertion. The smaller extrinsic muscles are inserted into the preputial wall. A group of retractors (ppr') arise from a branch of the columellar muscle, and a group of protractors (ppp) originate on the right wall of the head. A branch of the cephalic artery, the penial artery (pa), runs along the prepuce and penis sheath to reach the head of the latter.

The radula of the largest specimen has 71 transverse rows of teeth, with the formula 24-1-24 (6 laterals, 2 intermediates, 16 marginals). The central tooth has a small cusp and a minute accessory cusp high on its left. The laterals are tricuspid. Radular teeth are shown in Fig. 10.

REMARKS

So far the only anatomical observation on *Lymnaea cousini* was made by Hubendick (1951), who showed in his Fig. 183 the penial complex and the vaginal region of the single specimen he had the opportunity to examine. The vagina is slim and tapering, without the bulbous swelling described above (Fig. 5, vb), and the penial complex closely resembles the one represented in Fig. 5 of this paper. The prepuce is said to have "dark spots", which quite probably resulted from accumulation of pigment in the tissues of the infected snail (Hubendick's specimen had its internal organs destroyed by trematode larvae), as observed by Agersborg (1924).

L. cousini is considered by Hubendick (1951) identical with *L. ubaquensis* Piaget, 1914 (from

lake Ubaque, Cundinamarca province, Colombia), and with *L. bogotensis* Pilsbry, 1935 (from Bogotá). His specimen of Fig. 183 (*L. ubaquensis*) proceeds from Valdivia, Chile, and a shell from "Ecuador" is shown in his Fig. 327b.

There follows a comparison between *L. cousini* and the four South American lymnaeid species I have studied so far: *viatrix*, *rupestris*, *columella* and *diaphana* (see Paraense, 1976, 1982, 1983, 1984, respectively).

The shell of *cousini* is more broadly conic than in the other species. Its aperture is wider than in *viatrix*, *columella* and *diaphana*, and comparable to that of *rupestris*; it is about twice as long as the spire, as well as in *viatrix*, *columella* and *rupestris*, the same length to a little longer in *diaphana*. The body whorl is more convex than in *viatrix*, *columella* and *diaphana*, similar to that of *rupestris*. The suture is well-marked, as in *viatrix*, *columella* and *diaphana*, deeply channelled in *rupestris*, giving the latter's spire a loosely wound appearance. It must be emphasized that shell polymorphism is a common occurrence among gastropods, so that significant variation may occur in the mentioned characters.

The following anatomic differences are noteworthy.

Kidney: similar to that of *columella*, with two distinct flexures in the ureter (Figs 3, ur, 4); in the other three species the ureter is straight. - Ovotestis: the projection of its image (Fig. 5, ot) occupies about half the area of the nidamental gland; the proportion is about 1:1 in *viatrix*, *diaphana* and *rupestris*, and 1/3 to 1/7 in *columella*. - Vagina: with a bulbous swelling, absent in the other four. - Spermiduct: narrower than the prostate, as in *viatrix*, *diaphana* and *rupestris*; about the same width as the prostate in *columella*. - Prostate: proximal half flattened, distal half with an oblique dorsal fissure (some specimens show a lengthwise fissure); a longitudinal fissure is present in *viatrix* and *diaphana*, and none at all in *columella* and *rupestris*. - Penis sheath: longer than the prepuce; shorter in *viatrix*, about as long in *rupestris*, as long to shorter in *diaphana*, much shorter in *columella*. - Radula: lateral teeth tricuspid, as in *columella* and *diaphana*; predominantly bicuspid in *viatrix* and *rupestris*.

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