

## *Radix skutaris* n. sp., a new species from Montenegro (Gastropoda: Lymnaeidae)

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### > Abstract

We report on the distinguishing features of some *Radix* species of Southern Europe, and we point out that a *Radix* sp. can not be determined by considering either their shells or anatomic criteria alone, only both arguments taken together are suitable to determine a *Radix* sp. in doubtful cases. In addition we describe *Radix skutaris* n. sp., an endemic species, which lives in the ancient or long-lived lake Skadar (Montenegro).

### > Kurzfassung

***Radix scutaris* n. sp., eine neue Art aus Montenegro (Gastropoda: Lymnaeidae).** – Wir stellen die Unterscheidungsmerkmale einiger *Radix*-Arten von Südeuropa vor und weisen darauf hin, dass eine *Radix*-Art weder nach dem Gehäuse noch anatomisch allein bestimmt werden kann, nur beide Argumente zusammen sind geeignet eine *Radix* im Zweifelsfall zu determinieren. Zusätzlich beschreiben wir *Radix skutaris* n. sp., eine endemische Art, die in dem Langzeitsee Skutari (Montenegro) lebt.

### > Key words

*Radix skutaris* n. sp., ancient lakes, Skadar lake, Montenegro.

## Introduction

When HUBENDICK (1953) published his results of anatomical and conchological studies of recent Lymnaeidae of the world, he accepted only *Radix auricularia* (Linnaeus, 1758) and *Radix peregra* (O. F. Müller, 1774) as being good species that live in Europe. While JACKIEWICZ (1959) studied the anatomy of the *Stagnicola* spp. of Poland and described her *Stagnicola occulta*, she could show that *Stagnicola* spp. can be distinguished by the proportion of the praepatium to the phallotheca and by the number of prostate folds, but concerning the *Radix* spp. of Central Europe (JACKIEWICZ, 1998), however, these features proved insufficient, and she agreed with Hubendick's two-species concept.

GLÖER et al. (1978) already accepted *R. peregra*<sup>1</sup> (Draparnaud, 1801) as a good species and in addition

FALKNER (1990: 138) pointed out that *R. ampla* (Hartmann, 1821) was distinct from *R. auricularia*. In the course of DNA analyses BARGUES et al. (2002) corroborated the newer species concept in the genus *Radix* and revealed that there is another *Radix* species, *Radix lagotis* (Schrank, 1813), which lives in Central Europe, too, and PFENNINGER et al. (2006) could show that there are two other species, MOTU3 (molecularly defined operational taxonomic unit, here named as *Radix* sp2) from France and one from Poland, closely related with *Radix relicta* and *R. pinteri* (Clade 6). Thus we need to know the conchological and anatomical features by which the *Radix* species can be distinguished.

With this paper the authors intended to provide the decisive features that allow a determination of distinct *Radix* species from Southern Europe, a part of which

<sup>1</sup> In 1978 the names of *R. ovata* and *R. peregra* have been used in the opposite sense by GLÖER et al. (1978) and JACKIEWICZ (1998). By using the present-day nomenclature this means *R. balthica* (= *ovata* sensu Glöer & al., = *peregra* sensu Jackiewicz) and *R. labiata* (= *peregra* sensu Glöer et al.).

**Tab. 1.** The distinguishing features of the *Radix* spp. from S-Europe.

Species name	aperture ear-shaped	upper margin of aperture (frontal view)	upper margin of aperture (apical view)	juveniles look like the adults	bursa duct	Freckles on foot and prp
<i>R. auricularia</i>	yes	90° or > 90°	straight	no	very long	yes
<i>R. ampla</i>	yes	> 90°	straight	yes	short	no
<i>R. labiata</i>	no	small curved	straight	yes	short	no
<i>R. relictata</i>	yes	60°	straight	yes	short	no
<i>R. pinteri</i>	yes	> 90°	slightly sinuated	yes	short	no
<i>R. skutaris</i>	yes	60°	sinuated	yes	long	no
<i>Radix sp1</i>	no	small curved	sinuated	yes	very long	no
<i>Radix sp2</i>	yes	90°	straight	yes	short	no

**Tab. 2.** Species list of the freshwater gastropods which live associated with *R. skutaris*, with the zoogeographical range of the species. – **hol** = holarctic, **pal** = palaeartic, **euras** = European-W-Asiatic, **E-med** = East Mediterranean, **eu-si** = European-Sibirian, **din** = Dinaric, **SE-alp** = South-East-alpine, **mon** = Montenegro, **end** = endemic.

<i>Theodoxus fluviatilis</i> (Linnaeus, 1758)	eur	<i>Radix auricularia</i> (Linnaeus, 1758)	pal
<i>Viviparus mamillatus</i> Küster, 1852	din	<i>Radix balthica</i> (Linnaeus, 1758)	pal
<i>Amphimelania holandrii</i> (C. Pfeiffer, 1828)	SEalp	<i>Radix skutaris</i> n. sp.	eur
<i>Bithynia skadarskii</i> Glöer & Pešić, 2007	end	<i>Lymnaea stagnalis</i> (Linnaeus, 1758)	hol
<i>Bithynia radomani</i> Glöer & Pešić, 2007	din	<i>Planorbis corneus</i> (Linnaeus, 1758)	eu-si
<i>Bithynia zeta</i> Glöer & Pešić, 2007	end	<i>Planorbis planorbis</i> (Linnaeus, 1758)	hol
<i>Radomaniola curta curta</i> (Küster, 1852)	mon	<i>Gyraulus meier-brooki</i> Glöer & Pešić, 2007	end
<i>Pyrgula annulata</i> (Linnaeus, 1767)	SEalp	<i>Gyraulus piscinarum</i> Bourguignat, 1852	E-med
<i>Valvata montenegrina</i> Glöer & Pešić, 2008	mon?	<i>Hippeutis complanatus</i> (Linnaeus, 1758)	eu-si
<i>Stagnicola</i> sp.	end?	<i>Segmentina nitida</i> (O. F. Müller, 1774)	pal

has often been confused with *Radix auricularia* and *R. peregra*. In addition, we provide the new description of *Radix skutaris* n. sp., a species that lives in the Skadar Lake, Montenegro, hitherto overlooked.

## Material and methods

The snails were collected with a sieve and were put into 75% ethanol. The dissections and measurements of the genital organs and the shells were carried out using a Zeiss stereo microscope with an eyepiece micrometer; the photographs were made with a Leica R8 digital camera system. The type material is stored in the Zoological Museum of Hamburg (ZMH).

We considered two species, which have not been described as yet (here named as *Radix* sp1, *Radix* sp2), but they are very suitable to illustrate the problems of determination. DNA sequences of both species have been analysed (sp1: PFENNINGER et al. 2006, sp2: ALBRECHT et al. in press) and showed the distinctness from the other species under discussion.

## Results

If we compare the anatomy of some similar *Radix* spp. from S-Europe known so far, we can arrange these species into two groups: (i) species with a long bursa duct like *Radix auricularia* (Fig. 1.2, 1.4, 1.5) and (ii) species with a short bursa duct like *Radix labiata* (Fig. 1.1, 1.3, 1.6–8). Regarding the shell shape, it seems to be that *R. ampla* and *R. auricularia* are closely related species, but the bursa ducts are distinct, and BARGUES et al. (2002: 94, fig. 1) could show that *R. ampla* is closer to *R. labiata* than to *R. auricularia*.

On the other hand the species under discussion can be divided by means of the aperture into two other groups: (i) aperture ear-shaped, like *R. auricularia* (Fig. 1.1–4, 1.7–8), and (ii) aperture not ear-shaped, like *R. labiata* (Fig. 1.5–6).

In addition, a very important feature may not be overlooked, the shell shape of the juveniles. While the appearance of juveniles of *R. auricularia* is different from the adults' (Fig. 4.2, 4.5), the juveniles of all other *Radix* spp. mentioned above, have shell shapes that are equal to the adults' (e.g. *Radix skutaris*, Fig.



**Fig. 1.** The *Radix* species under discussion. **1:** *Radix ampla* (Wallersee, Austria), **2:** *R. auricularia* (Vier- und Marschlande, Hamburg), **3:** *Radix* sp2 (France), **4:** *R. skutaris* n. sp. (Skadar Lake, Montenegro), **5:** *Radix* sp1 (Greece), **6:** *R. labiata* (Strogn-Quelle, Buch am Buchrain, Bavaria), **7:** *R. pinteri* (Lake Prespa), **8:** *R. relicta* (Lake Ohrid).



**Fig. 2.** Virpazar, Skadar Lake (Montenegro), the type locality of *Radix skutaris* n. sp. (Photo: D. Stešević).

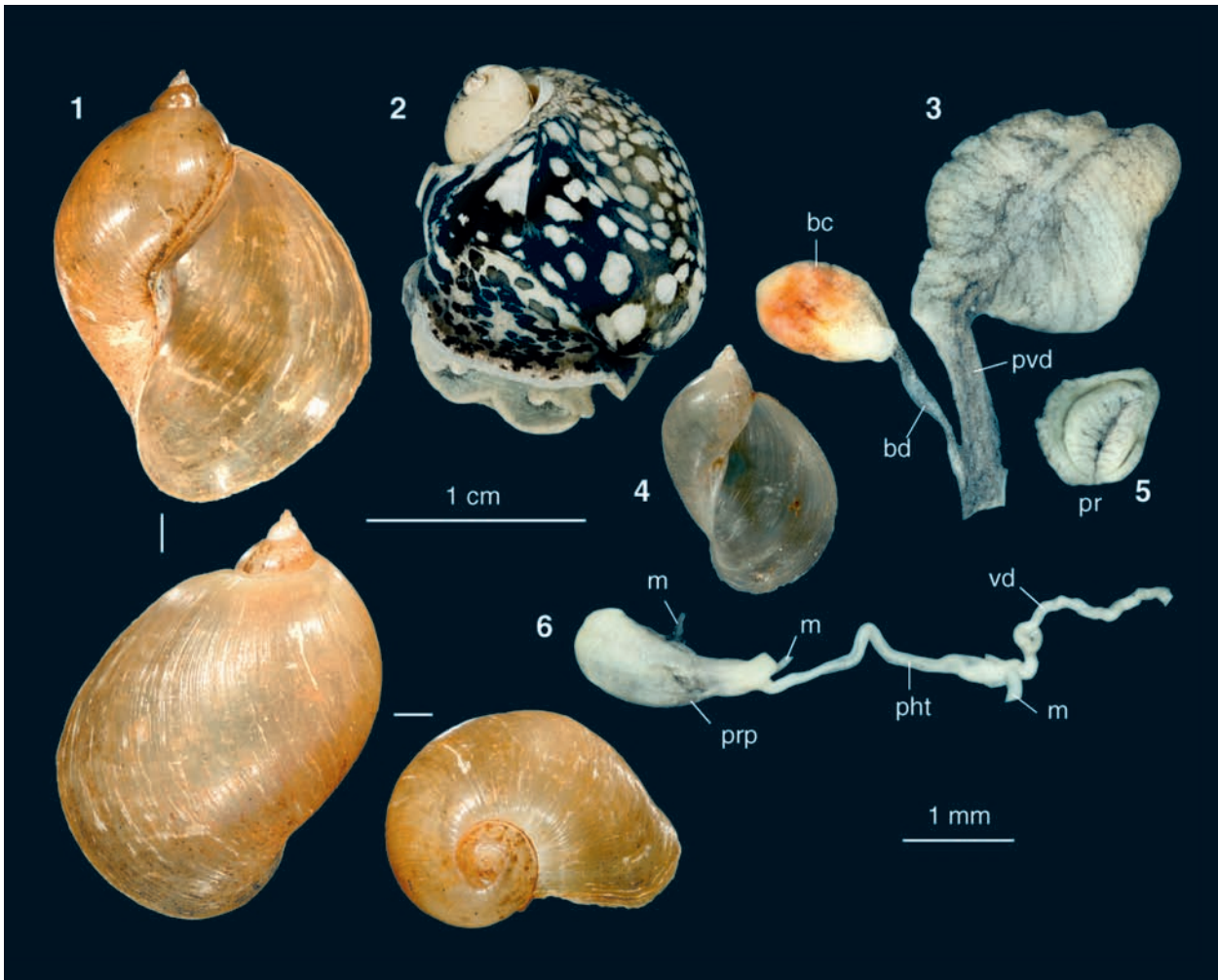
4.1, 4.2). In addition only *R. auricularia* bears “freckles” on the foot (Fig. 4.4) and on the dorsal part of the preputium.

### Genus *Radix* Montfort, 1810

**Type species:** *Radix auricularia* (Linnaeus, 1758)

#### *Radix skutaris* n. sp.

**Material examined:** 24 ex. (Virpazar, loc. typ.), 24 ex. (Karuč), 2 ex. (Vranjina), 4 ex. (Tanki Rt), 1 ex. (island Grmožur).



**Fig. 3.** *Radix skutaris* n. sp. – 1: shell, 2: mantle pigmentation; 3: female copulatory organ; 4: juvenile shell, 5: fold of prostate gland, 6: male copulatory organ; – bc = bursa copulatrix, bd = bursa duct, m = muscle, pr = prostate gland, pht = phallosome, prp = praeputium, pvd = provaginal duct, vd = vas deferens.

**Holotype:** Shell 24 mm high, 16 mm wide. Zoologisches Museum Hamburg, ZMH 51202.

**Paratypes:** ZMH 51203, the rest in the collection of P. GLÖER.

**Locus typicus:** Skadar Lake, Virpazar (19° 6.5' N, 42° 15.25' E).

**Habitat:** Lives in emergent (*Scirpus lacuster*, *Phragmites communis*) and floating (*Nymphaea alba*, *Nuphar luteum*) vegetation in the littoral zone in Skadar Lake. Associated species see tab. 2.

**Derivation of name:** “*skutaris*” after the German name of the Skadar lake: Skutari See.

**Description:** The Shell is glossy, yellowish horn-coloured with 4 whorls enlarging rapidly, the spire short and pointed, the aperture is very large with an angle of 60° at the top. The inner lip is folded at the columella, with a fold only weakly sinuated. Shell height 15.0–24.0 mm, width 10.0–16.0 mm. Upper margin of the aperture from apical view appears sinuated (Fig. 3).

**Anatomy:** The proportion of praeputium to phallosome is variable, the bursa copulatrix is oval, the bursa

duct is thin and not as long as in *R. auricularia* (Fig. 3.3). The prostate gland bears one fold (Fig. 3.5) like all *Radix* spp. do.

**Distribution:** Among more than hundred samples collected in different waters of Montenegro no *R. skutaris* could be found. Thus we daresay that *R. skutaris* n. sp. lives endemically in the Skadar Lake.

### Differential diagnosis

*Radix skutaris* n. sp. can be confused only with juveniles of *R. auricularia* (Fig. 4.2), but the spire of the former is shorter than the latter one's. The body whorl of *R. auricularia* is more swollen than in *R. skutaris*. The shells of the adults are different in the angle at the top of the aperture. *R. auricularia* has “freckles” on its foot and preputium, *R. skutaris* has not. The bursa duct is a little shorter in *R. skutaris* n. sp. than in *R. auricularia* (Figs. 1.2 vs. 1.4).

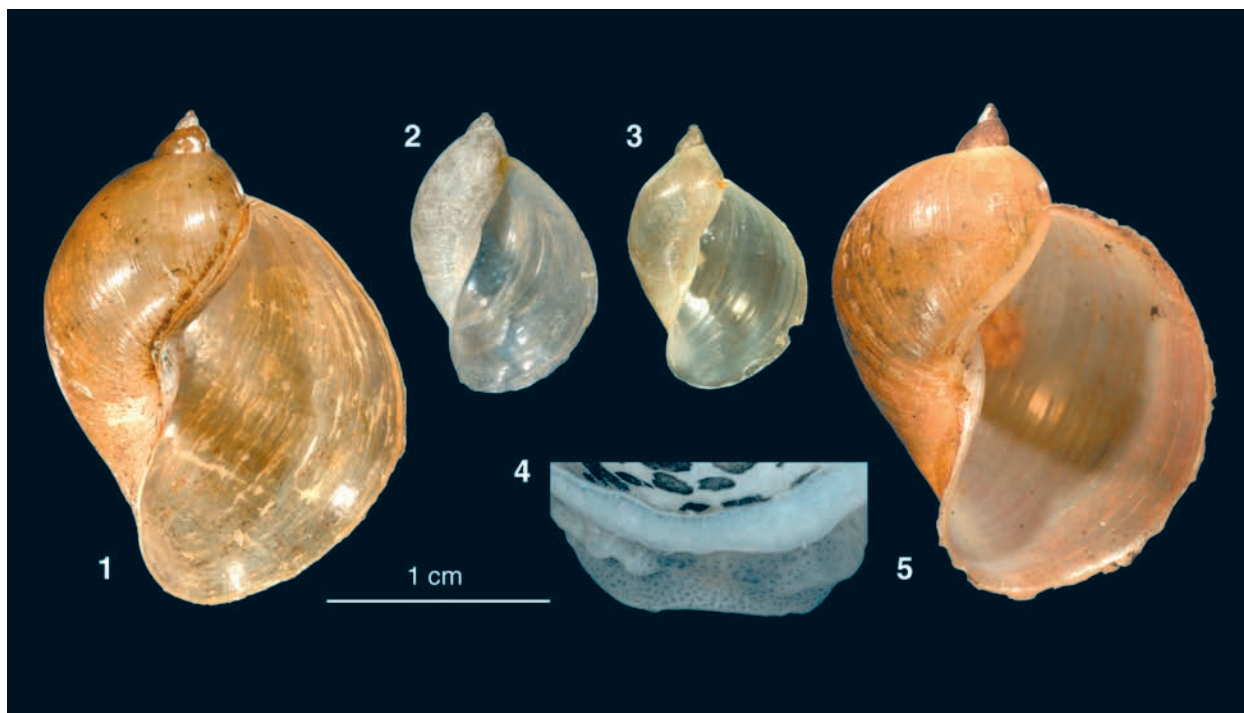


Fig. 4. 1: *R. skutaris*, adult, 2: *R. skutaris*, juv; 3: *R. auricularia*, juv., 4: freckles on the foot, 5: *R. auricularia*, adult.

## Discussion

In former times the molluscs were predominantly determined only by the shells. Thus endemic species like *Radix* sp1 or *R. skutaris* have not been recognised as being good species that live endemically in ancient lakes. But modern methods like the comparison of DNA sequences showed us (BARGUES et al. 2002, PFENNINGER et al. 2006, sp2: ALBRECHT et al. in press) that we have to study the species more thoroughly. At least one stable feature suffices to recognise two taxa as being good species, because this shows their genetic distinctness. This means there is no gene flow between the species, if they live sympatrically like *Radix skutaris* and *R. auricularia* do, this fits in with the biological species definition.

The mollusc fauna of the Skadar Lake is still poorly investigated in general, only recently an attempt has been made by the authors to add to the present knowledge. A phenomenon persistent in the study of Mediterranean freshwater molluscs was the adoption of a Central European taxonomic framework, which potentially leaves distinct taxa unrecognised. Thus the number of species of a check list depends not only on the actual diversity, but also on the thoroughness of the investigation as well as on the taxonomical expertise. Because most *Radix* species under discussion occur in ancient lakes of the Balkans, it is interesting to note that every ancient lake inhabits an endemic *Radix* species, often associated by a widespread *Radix* sp., e. g. *R. auricularia*.

## Conclusion

Summarising, we can state that *Radix* species of S-Europe cannot be determined by investigating either only the shells or the anatomy, each by itself, because the shell of *Radix* sp1 looks similar to *R. labiata*, the anatomy of which, however, is similar to *R. auricularia*'s. On the other hand the shell of *Radix* sp2 (MOTU3) looks similar to *R. auricularia*'s but the anatomy corresponds to *R. labiata*, this means that neither similar shell shapes nor similar anatomy reflect the relationship of species within the genus *Radix*. Thus we can state that resemblances between *Radix* spp. are converging developments, however. So *Radix* species can only be determined by means of the shells in connection with their anatomy, and in doubt the juveniles have to be included within the consideration.

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## References

- ALBRECHT, CH., WOLF, CH., GLÖER, P. & WILKE, TH. (in press): How related are sister species in ancient lakes? The freshwater gastropod genus *Radix* in Balkan lakes. – *Hydrobiologia*.
- BARGUES, M. D., VIGO, M., HORAK, P., DVORAK, J., PATZNER, R. A., POINTIER, J. P., JACKIEWICZ, M., MEIER-BROOK, C. & MAS-COMA, S. (2002): European Lymnaeidae (Mollusca: Gastropoda), intermediate hosts of trematodiasis, based on nuclear ribosomal DNA ITS-2 sequences. – *Infection, Genetics and Evolution* **1** [2001]: 85–107.
- FALKNER, G. (1990): Binnenmollusken. In: FECHTER, R. & FALKNER, G.: Weichtiere. Europäische Meeres- und Binnenmollusken. – *STEINBACHS Naturführer* **10**: 112–280.
- GLÖER, P. & PEŠIĆ, V. (2008): The freshwater gastropods of the Skadar Lake with the description of *Valvata montenegrina* n. sp. (Mollusca, Gastropoda, Valvatidae). In: PAVIĆEVIĆ, D. & PERREAU, M. (Eds.): *Advances in the studies of the subterranean and epigeal fauna of the Balkan Peninsula. Volume dedicated to the memory of Guido Nonveller*. Monography, Institute for Nature Conservation of Serbia. 341–348.
- GLÖER, P., MEIER-BROOK, C. & OSTERMANN, O. (1978): Süßwassermollusken. 1st edition. 73 pp.
- HUBENDICK, B. (1953): Recent Lymnaeidae. Their variation, morphology, taxonomy, nomenclature, and distribution. – *Kungliga Svenska Vetenskapsakademiens Handlingar*, Ser. 4, **3**(1): 1–223.
- JACKIEWICZ, M. (1959): Badania nad zmiennością i stanowiskiem systematycznym *Galba palustris* O. F. MÜLL. (Investigations on the variability and systematic position of *Galba palustris* O. F. MÜLLER.) – *Poznańskie Towarzystwo Przyjaciół Nauk*, Wyd. mat.-przr., *Prace Kom. Biol.* **19** (3): 89–187, 25 pl., 1 map.
- JACKIEWICZ, M. (1998): European species of the family Lymnaeidae (Gastropoda: Pulmonata: Basommatophora). – *Genus, International journal of invertebrate taxonomy* **9**(1): 1–93.
- PFENNINGER, M., CORDELLIER, M. & STREIT, B. (2006): Comparing the efficacy of morphologic and DNA-based taxonomy in the freshwater gastropod genus *Radix* (Basommatophora, Pulmonata). – *BMC Evolutionary Biology* (open access: <http://www.biomedcentral.com/147-2148/6/100>): 14 pp.