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SOME TAXONOMIC NOTES ON *HORATIA* SPP. OF THE BALKANS WITH THE DESIGNATION OF THE NEOTYPE OF *HORATIA KNORRI* SCHÜTT, 1961 (GASTROPODA: HYDROBIIDAE)

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ABSTRACT: The shell variation of *Horatia klecakiana* Bourguignat was studied based on large samples of at least 620 specimens from Bourguignat's collection. To find the type locality Ribaric, we studied old maps of Bourguignat's time and found that the valley of the Cetina river with the type locality of *H. klecakiana* had been flooded by lake Peruća in 1958. *Horatia knorri* Schütt is an enigmatic species because the holotype does not correspond to the original description. Thus we designate one of the depicted paratypes as the neotype.

KEY WORDS: Bosnia and Herzegovina; Croatia; *Horatia klecakiana*; *Horatia knorri*; neotype

INTRODUCTION

This genus *Horatia* was defined by BOURGUIGNAT (1887), as well as by RADOMAN (1983) and BODON et al. (2001), as a species with a valvatoid shell, a prominent body whorl and a short spire.

BOURGUIGNAT (1887) described *Horatia klecakiana* from Ribaric; in the same paper he described eight new *Horatia* spp. from the same region: *H. obtusa* (loc. typ.: "vit dans la sorgente de la Cettina"), *H. fontinalis* (loc. typ.: "Ervac, dans la "sorgente" de la Cettina"), *H. albanica* (loc. typ.: "dans la "sorgente" de la Cettina"), *H. letourneuxi* (loc. typ.: "Fontaine du moulin à Ervac"), *H. palustris* (loc. typ.: "entre Verlika et Ribaric, et dans une fontaine près d'Ervac"), *H. verlikana* (loc. typ.: "Marais entre Verlika et Ribaric"), *H. obliqua* (loc. typ.: "près d'Ervac"), and *H. praeclara* (loc. typ.: "dans la fontaine du moulin d'Ervac").

BINDER (1957), followed by ANT (1962), lumped all these species under the name *H. klecakiana*. SCHÜTT (1961) listed *H. klecakiana* from the region of Ribaric and pointed out the high constancy of its shell form.

ANT (1962) presented 28 drawings of *Horatia* spp. from Bourguignat's collection and drawings of BINDER (1957: p. 60) and added a photo of "*Horatia klecakiana*", collected by Schütt in Ombla spring near Dubrovnic. This specimen is very different from *H. klecakiana* and was described as *Horatia knorri* Schütt, 1961 and later SCHÜTT (2000) depicted it as *Orientalina troglobia* (Bole, 1961).

SZAROWSKA & FALNIOWSKI (2014) studied "*Horatia klecakiana*" from the spring Studenci, N of Kučiće, in the Cetina valley, Croatia, collected in 2011, about 60 km downstream from the type locality and FALNIOWSKI et al. (2021) studied *H. klecakiana* from the Cetina valley, near the type locality.

The type locality of *H. klecakiana* was identified by RADOMAN (1983: p. 52) as "Vrijovac spring in the source area of the Cetina river, spread also in numer-

ous springs in the Cetina river drainage area and in addition the species occurs in the surroundings of the Livno town", but BOURGUIGNAT (1887: p. 50) originally described the type locality as "sorgente près de Ribaric, dans la vallée de la Cettina".

This paper is intended to redefine the identity of the genus *Horatia* as well as to redefine the type locality of *H. klecakiana* in addition to the designation of a neotype of *H. knorri* Schütt, 1961.

MATERIAL AND METHODS

We borrowed the syntypes of *H. klecakiana* and some other *Horatia* spp. synonymised with *H. klecakiana,* of which large samples exist, from Bourguignat's collection (Muséum d' Histoire Naturelle Genève, MHNG) to study the intra-specific variation of *H. klecakiana* from different sampling sites in the valley of Cetina river (Table 1).

The newly collected specimen from Livno was collected by JASMINKO MULAOMEROVIĆ, on April 25, 2021, coordinates of the sampling site: 43°49'56.0"N, 17°00'29.3"E, 780 m a.s.l. (Figs 1–2). Duman is the name for the spring of the river Bistrica, which is located in the lowest part of a large rocky cliff formed at the contact of Lower Cretaceous limestone and Eocene flysch (BOŽIĆEVIĆ 1964–1965). It consists of six caves, four of which are fossil. The water flows from two caves and serves to supply the city of Livno with drinking water, and one part is drained to the mills. Part of the water from the canal overflows. In one such part (Fig. 1) snails were picked up from stones which were richly overgrown with moss on the upper side. Other photos of the habitats of *H. klecakiana* were published by FALNIOWSKI et al. (2021).

The measurements and photos of the shells were taken using a stereo microscope (Leica M205 C) with a digital camera (Leica DMC5400). All photos, except *H. macedonica,* are published for the first time.

Table 1. The studied samples of *Horatia* from the Cetina valley, labelled as *Horatia* by BOURGUIGNAT (1887)

Number of specimens	Sampling site	Collection of Bourguignat
150	Ribaric, type locality	MHNG-MOLL-0110602
400	Cetina, spring	MHNG-MOLL-0110604
70	Ervac	MHNG-MOLL-0110601

Figs 1–2. The locality at Livno: 1 – Duman spring; 2 – Small stream below the canal where empty shells of *H. klecakiana* were collected

RESULTS

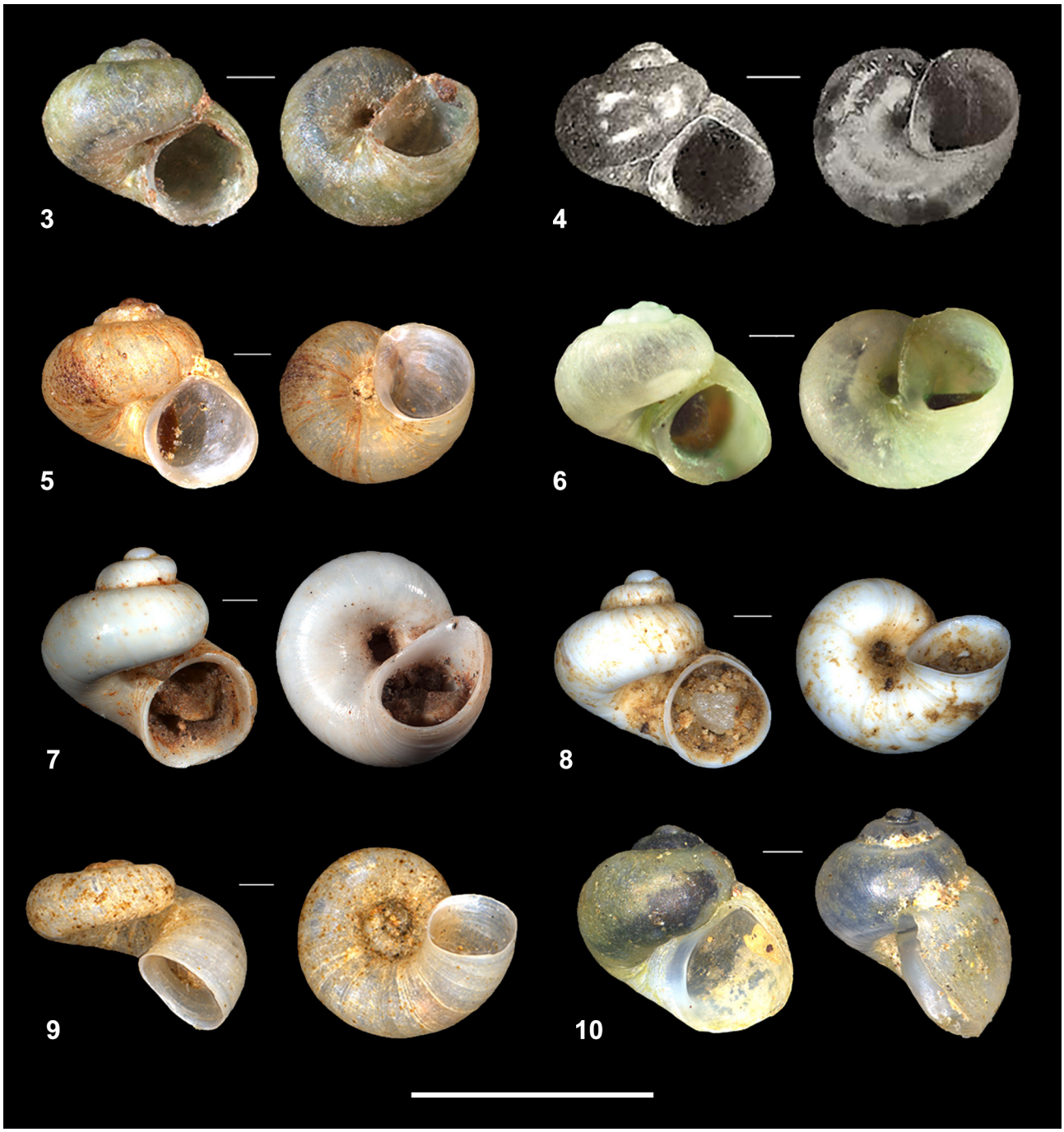
Genus *Horatia* Bourguignat, 1887

Type species: *Horatia klecakiana* Bourguignat, 1887
Figs 3–10

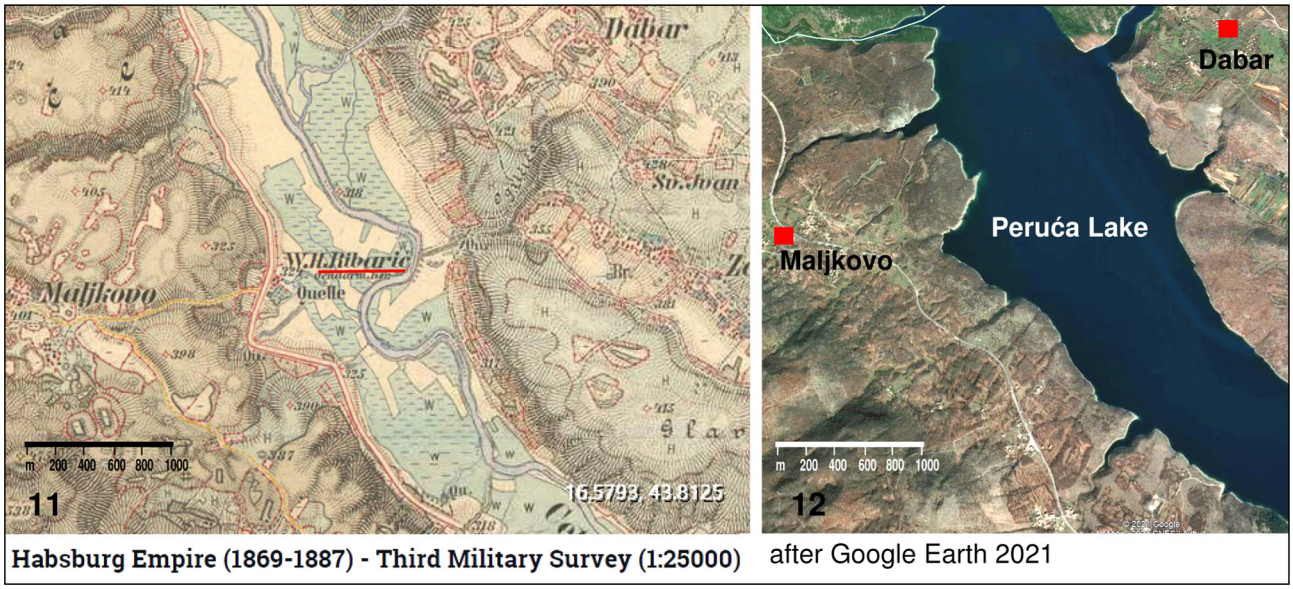
This genus was defined by a valvatoid shell with a prominent body whorl and a short spie (BOURGUIGNAT 1887, RADOMAN 1983, BODON et al. 2001). This corresponds well to most *Horatia* spp. (Figs 3–8, 10) except *H. lucidulus* (Fig. 9) from Bulgaria, which may belong to the genus *Hauffenia* Pollonera, 1898. The recently described species, *H. ozimeci* (Croatia) and *H. stygorumina* (Croatia), look different from the other *Horatia* spp., but *H. ozimeci*

was sequenced (FALNIOWSKI et al. 2021) which revealed that it is a true *Horatia*. Thus the definition of the shell shape of *Horatia* must be expanded. *H. parvula* from Turkey has a slit-like umbilicus and may represent *Pontohoratia* Vinarski, Palatov et Glöer, 2014.

Description. The small shells are depressed conical to conical with 3.5–4 convex whorls. The shells are ivory to greenish. The body whorl is prominent with a triangular rounded aperture. The outer lip is straight and oblique in lateral view. The umbilicus is open and deep. The operculum is reddish.



Figs 3–10. *Horatia* spp. of the Balkans: 3 – *H. klecakiana* (Croatia, syntype, Ribaric, MHNG110602); 4 – *H. macedonica* (Kuščer, 1937) (North Macedonia, after KUŠČER 1937); 5 – *H. novoselensis* Radoman, 1966 (North Macedonia, paratype SMF 186542); 6 – *H. podvisensis* Glöer et Reuselaars, 2020 (North Macedonia, holotype, RMNH.MOL.347636); 7 – *H. ozimeci* Grego et Falniowski in FALNIOWSKI et al. (2021) (Croatia, coll. Grego); 8 – *H. stygorumina* Grego et Rysiewska in FALNIOWSKI et al. (2021) (Croatia, coll. Grego); 9 – *H. lucidulus* Angelov, 1967 (Bulgaria); 10 – *H. parvula* (Naegele, 1894) (Turkey, paratype, SMF142223). Scale bar 1 mm



Figs 11–12. Localities: 11 – Ribaric (underlined in red), type locality of *H. klecakiana* Bourguignat, 1887, the spring (Quelle) is mentioned on the map below Ribaric (JALŽIĆ & PAVLEK 2013); 12 – the same region today: Ribaric was flooded by the artificial lake Peruća in 1958

Horatia klecakiana Bourguignat, 1887
Figs 11–28

1887 *Horatia klecakiana* Bourguignat, 1887: p. 49 [Étude sur les noms génériques...]

Type locality. "provient d'une sorgente près de Ribaric, dans la vallée de la Cettina."

Remarks. Bourguignat mentioned as type locality "provient d'une sorgente près de Ribaric, dans la vallée de la Cettina." This translates to "collected in a spring near Ribaric in the valley of the Cetina". In current maps Ribaric cannot be found but in a map of Bourguignat's time we could find the spring (Quelle) near Ribaric in the valley of the Cetina river, from where Bourguignat described *H. klecakiana* (Figs 11–12). In 1958 this region was flooded. The artificial lake was created by building a dam on the Cetina in 1958, some 25 km downstream. Lake Peruća was the first large reservoir created in karst and the first remote reservoir in the Cetina Hydropower System. The reservoir was impounded in the Cetina canyon upstream of the Hrvatačko Polje (= field) by the construction of the 63 m high Peruća dam (WIKIPEDIA 2021). Thus the type locality was lost.

BOURGUIGNAT (1887) described seven more species from the valley of Cetina (Fig. 13), which were all synonymised with *H. klecakiana* by later authors (for details see GLÖER & REUSELAARS 2020, FALNIOWSKI et al. 2021). As type localities Bourguignat mentioned, in addition to Ribaric, the source of Cetina, spring at Hrvace (= Ervac), and Vrlika (Fig. 13).

Formerly BINDER (1957) and ANT (1962) published drawings of the specimens which BOURGUIGNAT (1887) described as distinct species to show the slight differences with *H. klecakiana* to argue that all these samples from the Cetina valley belonged to *H. klecakiana*. FALNIOWSKI et al. (2021) depicted syntypes of the nine "species" described by BOURGUIGNAT (1887) from the Cetina valley. Because these "syntypes" are selected specimens from larger samples, we borrowed three of the largest samples of Bourguignat's collection and illustrated three specimens from each, which are most different, to confirm the identity of all these samples. All these "species" are conical and have an open and deep umbilicus.

All 470 *Horatia* specimens (Table 1) from Bourguignat's collection outside the type locality we studied are identical with *H. klecakiana* from the type locality (Figs 20–22) and with *H. klacakiana* sensu RADOMAN (Figs 23–25).

FALNIOWSKI et al. (2021) could show by COI sequencing that *H. klecakiana* from numerous sampling sites in the Cetina valley are identical with the sample from spring Studenci, N of Kučiće, in the valley of Cetina, Croatia, 43°26'41.3"N, 16°48'25.5"E, 45 m a.s.l., of which GLÖER & REUSELAARS (2020) believed erroneously that this species was distinct from *H. klecakiana*. Thus *H. klecakiana* is distributed along the entire valley of Cetina and the region of Livno, a sampling site which could also be found in Radoman's diary from 1970th (ANHM 1970).

Horatia knorri Schütt, 1961
Figs 29–36

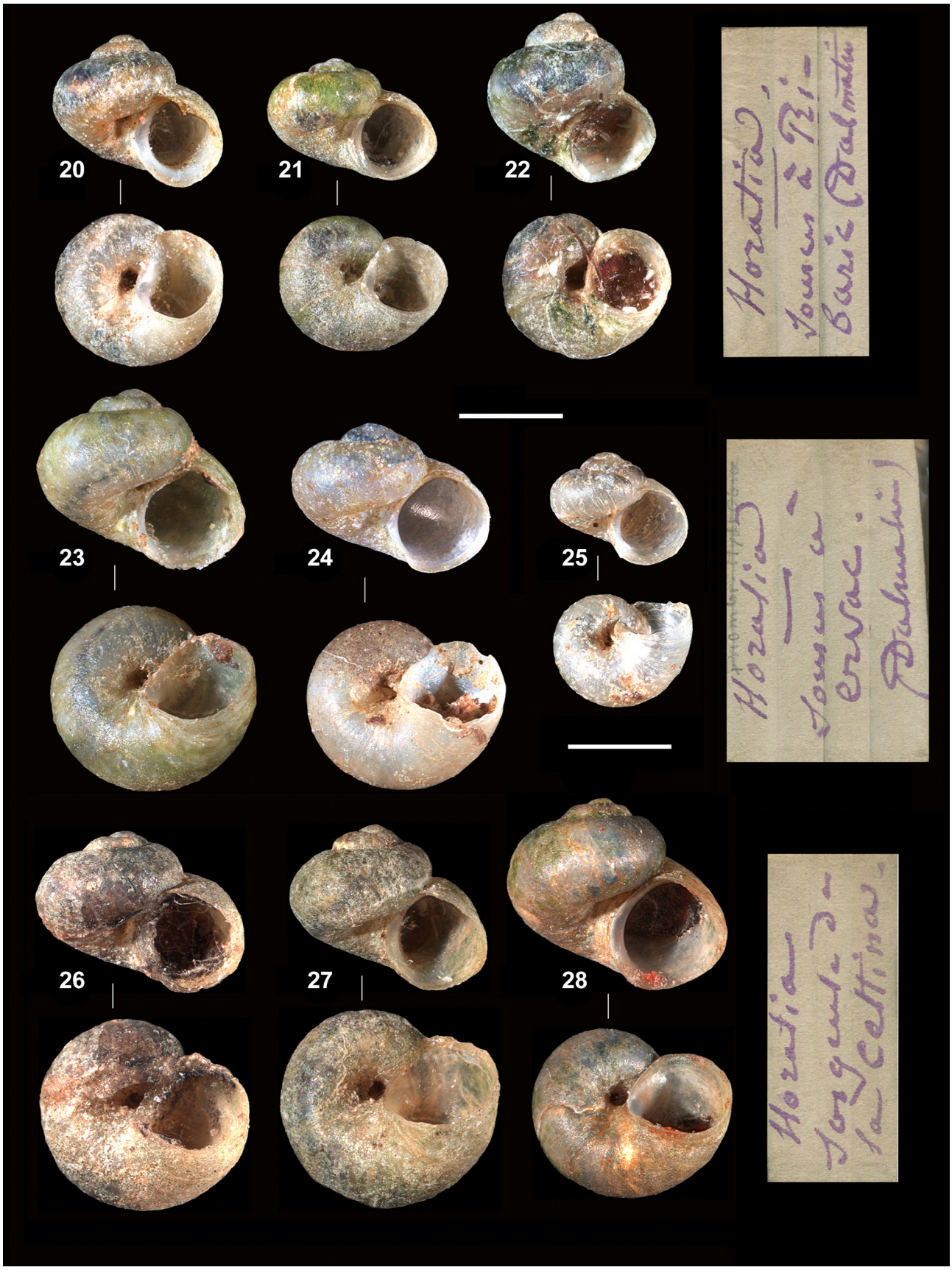
1961 *Horatia knorri* Schütt, 1961: p. 75, fig. 1.

Type locality: "Ombla-Quelle bei Dubrovnik"

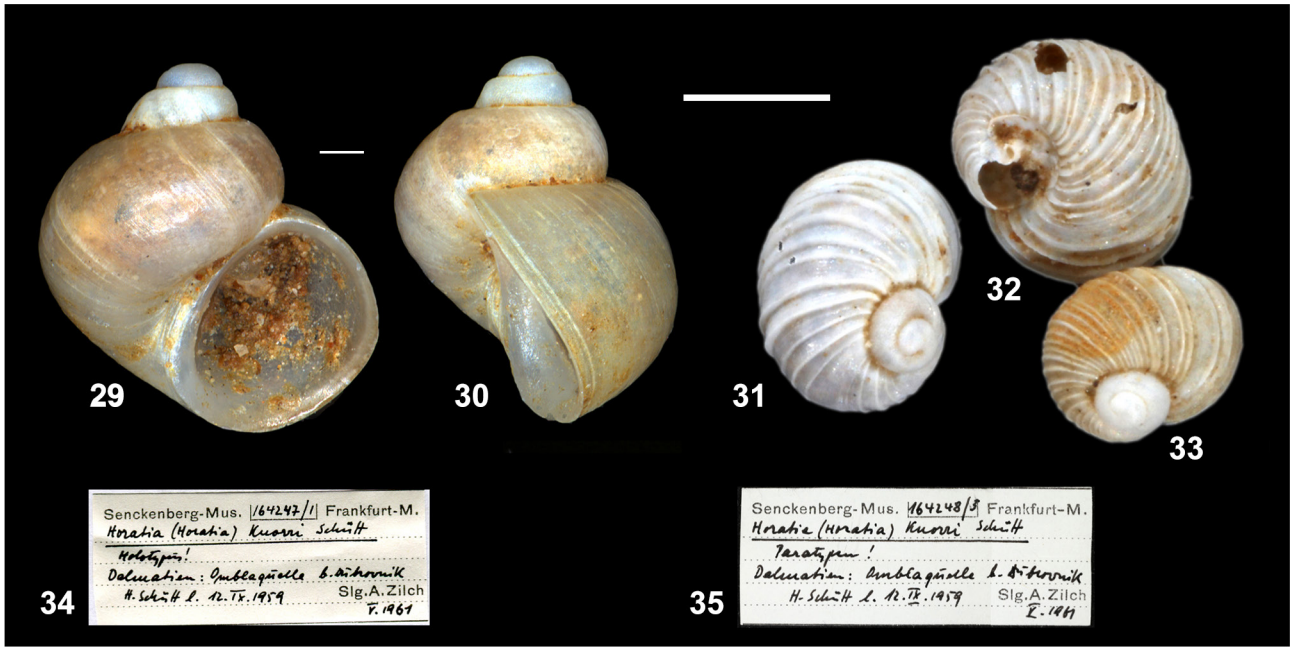
Remarks. Because the holotype of *H. knorri*, deposited in Senckenberg Museum Frankfurt, does not correspond to the original description (Figs 29, 30, 34, 36), it is invalid. Thus we designate a specimen

Fig. 13. Sampling sites: Ribaric (red triangle), Bourguignat's type locality of *H. klecakiana*; Cetina, Radoman's type locality of *H. klecakiana*. Livno (red star), additional locality of *H. klecakiana* mentioned by RADOMAN (1983). Other sites of *H. klecakiana* (red squares, for explanation see text)

Figs 14–19. *H. klecakiana*: 14–15 – syntype of *H. klecakiana*, Bourguignat's collection (Geneva, MNHG-MOLL-0110602) with 16 original labels; 17–19 – *H. klecakiana* from Radoman's collection, Vrijovac spring, Natural History Museum Belgrade, BEO 069). Scale bar 1 mm



Figs 20–28. Variation of *H. klecakiana* from three different sampling sites with original labels: 20–22 – spring near Ribaric (type locality); 23–25 – spring at Ervac (=Hrvace), valley of Cetina river; 26–28 – sorgente de la Cetina (spring of Cetina). Scale bars 1 mm



Figs 29–35. Holotype (29, 30) and paratypes (31–33) of *H. knorri* from SMF with original labels (34, 35). Scale bar 1 mm

Horatia (Horatia) knorri n. sp.

Gehäuse sehr klein, rundlich-kegelförmig, mit schiefer und großer Mündung, weißlich-opak, geritzt durchbohrt. Der Apex ist spitz und glatt, das Gehäuse besteht aus 3½ bis 4 sehr schnell und gleichmäßig zunehmenden Umgängen, die durch tiefe Nähte getrennt sind, so daß der letzte Umgang die Hauptmasse desselben ausmacht. Dennoch gehört diese zu den höher gewundenen Horatien. Mündung rundlich, schwach oval, an der Stelle, wo sie den Nabel bedeckt, jedoch fast gerade, so daß die Mündung am oberen Rande einen annähernd rechten Winkel zeigt, mit schwach verdicktem und umgeschlagenem Spindelrand und zusammenhängendem, manchmal andeutungsweise gelöstem Mundsaum, der sonst scharf, gerade und am Außenrande nicht erweitert ist. In der Profilansicht liegt die Mündung schräg zur Gehäuseachse. Abgesehen von den Embryonalwindungen zeigen die Umgänge, besonders der letzte, eine Rippenskulptur in Form unregelmäßig hoher Anwachsstreifen von unterschiedlicher Dichte.

Abb. 1. *Horatia (Horatia) knorri* n. sp. — Omblaquelle bei Dubrovnik.

Maße: H = D = 1·5 mm; H. Mdg. = Br. Mdg. = 1·0 mm.
Material: Holotypus SMF 164247; Paratypen: SMF 164248, Slg. Schütt und Slg. Schlickum.

Es kommen Exemplare vor, die etwas höher als breit sind, und Exemplare, die etwas breiter als hoch sind.
Ich widme diese Art Herrn Hans Knorr am Museum für Naturkunde in Stuttgart.

Fig. 36. Facsimile of the original description of *H. knorri* (Schütt 1961: 75–76)

from among the paratypes (Fig. 31) as the neotype. This species was already depicted by Hirschfelder (2018) as *H. knorri,* following the original description.

It is enigmatic why the holotype of *H. knorri* does not correspond to the original description, maybe Schütt (1961) confused the sample of the holotype with another sample of paratypes. On the other hand Schütt (2000) depicted his holotype of *H. knorri* (smooth "form") as *Orientalina troglobia* (Bole, 1961) and synonymised *H. knorri* with *O. troglobia*, possibly to correct his mistake?

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REFERENCES

Angelov A. 1967. *Horatia* (*Hauffenia*) *lucidulus* n. sp., ein neuer Vertreter der Molluskenfauna Bulgariens. Archiv für Molluskenkunde 96: 145–148.

ANHM 1970. Diary of Pavle Radoman 1970. Archive Natural History Museum in Belgrade.

Ant H. 1962. Bemerkungen zum Genus *Horatia*. Archiv für Molluskenkunde 91: 71–76.

Binder E. 1957. Note sur le genre *Horatia* Bourguignat. Journal de Conchyliologie 97: 59–62.

BODON M., MANGANELLI G., GIUSTI F. 2001. A survey of the European valvatiform hydrobiid genera, with special reference to *Hauffenia* Pollonera, 1898 (Gastropoda: Hydrobiidae). Malacologia 43: 103–215. https://www.biodiversitylibrary.org/item/47346#page/111/mode/1up

BOLE J. 1961. Nove hidrobide (Gastropoda) iž podzemeljskih voda zahodnega Balkana. (Neue Hydrobiiden (Gastropoda) aus den unterirdischen Gewässern Westbalkans). Biološki Vestnik 9: 59–69.

BOURGUIGNAT J.-R. 1887. Étude sur les noms génériques des petites Paludinidées à opercule spirescent suivi de la description du nouveau genre *Horatia*. V. Tremblay, Paris. https://doi.org/10.5962/bhl.title.10453

BOŽIĆEVIĆ S. 1964–1965. Pećine izvorišta Bistrice u Livnu. Speleolog XII–XIII: 3–10.

FALNIOWSKI A., GREGO J., RYSIEWSKA A., OSIKOWSKI A., HOFMAN S. 2021. Two new stygobiotic species of *Horatia* Bourguignat, 1887 (Hydrobiidae) from Croatia. Subterranean Biology 37: 89–104. https://doi.org/10.3897/subtbiol.37.61573

GLÖER P., REUSELAARS R. 2020. A new *Horatia* spp. from the Balkans (Gastropoda: Hydrobiidae Stimpson, 1865). Ecologica Montenegrina 32: 32–35.

HIRSCHFELDER H.-J. 2018. Neue Molluskennachweise aus der Ombla-Quelle bei Dubrovnik. Mitteilungen der deutschen malakozoologischen Gesellschaft 96: 33–38.

JALŽIĆ B., PAVLEK M. (eds) 2013. Fauna of the Republic of Croatia, Vol. 2. Hrvatsko biospeleološko društvo, Zagreb.

KUŠČER L. 1937. Zur Kenntnis der Molluskenfauna von Südserbien und Montenegro. I. Beitrag. Glasnik Skopskog Nautshnog Drushtva [Bulletin de la Société Scientifique de Skoplje] 17: 101–104.

NAEGELE G. 1894. Einiges aus dem östlichen Kleinasien. Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft 26: 104–107.

POLLONERA C. 1898. Molluschi terrestri e fluviatili dell'Eritrea raccolti dal Generale di Boccard. Bolletino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino 13: 1–13. https://www.biodiversitylibrary.org/page/11257683

RADOMAN P. 1966. Die Gattungen *Pseudamnicola* und *Horatia*. Archiv für Molluskenkunde: 95: 243–253.

RADOMAN P. 1983. Hydrobioidea a superfamily of Prosobranchia (Gastropoda). I. Systematics. Serbian Academy of Sciences and Arts, Monographs 547, Department of Sciences 57: 1–256.

SCHÜTT H. 1961. Das Genus *Horatia* Bourguignat. Archiv für Molluskenkunde 90: 69–77.

SCHÜTT H. 2000. Die Höhlenmollusken der Omblaquelle (The Subterranean Molluscs of the Ombla Spring). Natura Croatica 9: 203–215.

SZAROWSKA M., FALNIOWSKI A. 2014. *Horatia* Bourguignat, 1887: is this genus really phylogenetically very close to *Radomaniola* Szarowska, 2006 (Caenogastropoda: Truncatelloidea)? Folia Malacologica 22: 31–39. https://doi.org/10.12657/folmal.022.003

VINARSKI M. V., PALATOV D. M., GLÖER P. 2014. Revision of '*Horatia*' snails (Mollusca: Gastropoda: Hydrobiidae sensu lato) from South Caucasus with description of two new genera. Journal of Natural History 48: 2237–2253. https://doi.org/10.1080/00222933.2014.917210

WIKIPEDIA 2021. Peruća Lake. Available at https://en.wikipedia.org/wiki/Peru%C4%87a_Lake (aceessed 15 January 2022).

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