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A neritid gastropod name "*Theodoxus dniestroviensis* Put', 1972" is a junior subjective synonym of *Th. fluviatilis* (L., 1758): decision based on the topotypic specimens study

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ABSTRACT. The nominal species name "*Theodoxus dniestroviensis*" was commonly accepted as introduced by Put' in 1972 for neritid snails occurring in the upper part of the Dniester River basin. Currently an earlier publication [Put', 1957] has been found in which this name is established in accordance with the ICZN guidelines, so the dating should be amended to Put', 1957.

The type series of *Theodoxus dniestroviensis* is apparently lost but the samples from the type locality were recently traced in the National Museum of Natural History of the National Academy of Sciences of Ukraine (Kiev). An illustrated comparison of topotypic specimens with other morphotypes of regional river nerites is provided. Given the variation in conchological characteristics observed among the specimens of *Th. fluviatilis*, we consider *Th. dniestroviensis* to range within its intraspecific variability. This makes *Th. dniestroviensis* a junior subjective synonym of *Theodoxus fluviatilis* (Linnaeus, 1758).

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Название брюхоногого моллюска "*Theodoxus dniestroviensis* Put', 1972" является младшим субъективным синонимом *Th. fluviatilis* (L., 1758): решение на основе изучения топотипов

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РЕЗЮМЕ. Номинальное видовое название "*Theodoxus dniestroviensis*" было принято как введенное А.Л. Путём в 1972 г. для пресноводных неритид, обитающих в верхней части бассейна р. Днестр. В настоящее время обнаружена более ранняя публикация [Путь, 1957], в которой это название было установлено в соответствии с рекомендациями МКЗН, поэтому датировку следует изменить на Путь, 1957. Типовая серия *Theodoxus dniestroviensis*, по-видимому, утеряна, но экземпляры из типового местонахождения были недавно найдены в Национальном научно-природоведческом музее Национальной академии наук Украины (Киев). Приведено иллюстрированное сравнение топотипических экземпляров с другими морфотипами речных лунок региона. Учитывая наблюдаемую изменчивость конхологических характеристик среди экземпляров *Th. fluviatilis*, мы считаем, что *Th. dniestroviensis* находится в пределах его внутривидовой изменчивости. Это делает *Th. dniestroviensis* младшим субъективным синонимом *Theodoxus fluviatilis* (Linnaeus, 1758).

Introduction

The nomenclatural status of a nominal name of freshwater neritid species *Theodoxus dniestroviensis* Put', 1972 is unclear so far. The type series of this species, suspected to be stored in the Paleontological Department of the National Museum of Natural History of the National Academy of Sciences of Ukraine, Kiev (NMNH NASU, hereafter), could be traced neither in the catalogue nor in the collection. It is assumed that type specimens are apparently lost and, based on the original description and illustration [Put', 1972], *Th. dniestroviensis* was considered as a possible junior synonym of *Th. fluviatilis* (Linnaeus, 1758) [O. Anistratenko *et al*., 1999; V. Anistratenko *et al*., 2020].

Recently we made an additional search for the type material of *Th. dniestroviensis* in the NMNH NASU and, although no type specimens could be located, the samples of *Theodoxus* from the type locality – were found. The snails were collected by Put' on May 26, 1950 i.e. at the same time and place where the type specimens of *Th. dniestroviensis* were sampled [Put', 1972].

The aim of this paper is to compare the topotypes morphology of *Th. dniestroviensis* with others known morphotypes of *Th. fluviatilis* occurring in the Dniester basin to verify the earlier assumption [O. Anistratenko *et al*., 1999; V. Anistratenko *et al*., 2020] that *Th. dniestroviensis* and *Th. fluviatilis* are conspecific.

Material and Methods

We were able to examine more than 100 shells of *Theodoxus* retrieved in the NMNH NASU collection and originating from the type locality of "*Theodoxus dniestroviensis*". The topotypes studied herein were collected by A.L. Put' on May 26, 1950 from the Dniester River near Rukhotyn village, Khotyn district, Chernivtsi region, Ukraine (Fig. 1, Table 1, locality 1). The samples were taken at the same time and locality where the types of *Th. dniestroviensis* were collected [Put', 1957, 1972], for unknown reasons the shells are labelled as "*Theodoxus fluviatilis*", "*Theodoxus danubialis*" and "*Theodoxus pallasi*" though (Fig. 2). According to the author's statement "…The holotype is stored in dry condition in the collections of the Paleozoology Department of the Institute of Zoology of the Ukrainian SSR Academy of Sciences." [cited after Put', 1972: 82]. For this reason, we assumed the type specimens of *Th. dniestroviensis* to be stored there, but unfortunately they have not been traced in the collection.

Additionally, shells of *Th. fluviatilis* from other points of the Dniester River and its tributaries, namely the Seret, Strypa, and Hnizna rivers (Fig. 1, Table 1, localities 2–6), have been examined. Typical landscapes of the sampling regions are illustrated in Fig. 3.

As a comparative material we used some type series of nominal taxa, later recognized as synonymous with *Th. fluviatilis*, and described from adjacent regions of Ukraine and Moldova (Fig. 1, Table 1, localities 7, 8).

Images of the specimens were taken with a Leica M165C stereomicroscope equipped with a digital camera at the I.I. Schmalhausen Institute of Zoology (IZAN).

Abbreviations used:

IZAN – I.I. Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine, Kiev.

NMNH NASU, PD – National Museum of Natural History of the National Academy of Sciences of Ukraine, Paleontological Department, Kiev; ZIN – Zoological Institute of the Russian Academy of Sciences, St. Petersburg.

Systematic part

Class Gastropoda Cuvier, 1795
Order Cycloneritida Frýda, 1998|Family Neritidae Rafinesque, 1815
Genus *Theodoxus* Montfort, 1810

Type species: *Theodoxus lutetianus* Montfort, 1810 (= *Nerita fluviatilis* Linnaeus, 1758)

Theodoxus dniestroviensis Put', 1957
(Fig. 4 A–D)

Theodoxus dniestroviensis Put', 1957: 98.
Theodoxus dniestroviensis Put', 1972: 80-82, textfig. 5.
Th[*eodoxus*] *dniestroviensis* Put', 1972. – O. Anistratenko *et al*., 1999: 19, fig. 4, *8*.
Th[*eodoxus*] *dniestroviensis* Put', 1972. – V. Anistratenko, O. Anistratenko, 2001: 108.
Theodoxus dniestroviensis Put', 1972. – Vinarski, Kantor, 2016: 155 (in the *Th. fluviatilis* synonymy).
?*Theodoxus dniestroviensis* Put', 1972. – V. Anistratenko *et al*., 2020: 120 (in the *Th. fluviatilis* synonymy).

Type material. The types of *Theodoxus dniestroviensis* should be in the NMNH NASU collection; despite major effort, none of the labelled type specimens could be located. Since the "holotype" of *Theodoxus dniestroviensis* was fixed by the author in 1972, but this nominal species taxon was introduced earlier in 1957, this specimen cannot possess holotype status [ICZN, 1999: Art. 72.4.7 and 73.1.3]. Thus, the entire type series dealt with by the author in both publications should be considered syntypes. To fix the identity of *Th. dniestroviensis* we choose among the syntypes a single illustrated specimen [Put', 1972, textfig. 5] and designate it here as the lectotype (Fig. 4D).

Type locality. Originally given as "the right bank of the Dniester River, Rukhotyn village, Khotyn District, Chernivtsi Region, Ukraine" [Put', 1957, 1972].

Table 1. Examined material of *Theodoxus* from the SW Ukraine. The numbers of localities refer to the text and figures. Coordinates of collecting sites sampled prior to 2009 are given approximately, based on data in museum catalogue cards, labels and corresponding publications.

Табл. 1. Изученный материал по *Theodoxus* из ЮЗ Украины. Номера локалитетов соответствуют текстовым ссылкам и подписям к иллюстрациям. Координаты для местонахождений до 2009 года приведены приблизительно с учетом данных музейных каталогов, этикеток и соответствующих публикаций.

#	Taxon name	Location	Date	Latitude (N)	Longitude (E)	Collector	Collection and lot#
1	*Th. fluviatilis*	Dniester River, Rukhotyn village, Khotyn District, Chernivtsi Region, Ukraine	26 May, 1950	48°31'33.83"	26°12'9.90"	A.L. Put'	NMNH NASU, PD, no number
2	*Th. fluviatilis*	Seret River, Ternopil, Ternopil Region, Ukraine	10.08.2009	49°32'47.21"	25°34'47.45"	Yu.V. Tarasova	IZAN, 614
3	*Th. fluviatilis*	Strypa River, Buchach, Ternopil Region, Ukraine	10.08.2009	49° 3'38.85"	25°24'24.86"	Yu.V. Tarasova	IZAN, 615
4	*Th. fluviatilis*	Hnizna River, Terebovlia, Ternopil Region, Ukraine	10.08.2009	49°18'14.23"	25°41'15.62"	Yu.V. Tarasova	IZAN, 616
5	*Th. fluviatilis*	Dniester River, Halych village, Ivano-Frankivsk District, Ivano-Frankivsk Region, Ukraine	29.04.2012	49º 7'4.59"	24º45' 7.56"	E.V. Degtyarenko	IZAN, 335
6	*Th. fluviatilis*	Dniester River, Monastyrok village, Ivano-Frankivsk District, Kolomyia Region, Ukraine	03.05.2012	48º49'24.39"	25º15'17.27"	E.V. Degtyarenko	IZAN, 333
7	"*Th. obliteratus*"	Dniester River near Rybnitsa, Moldova	no date, ?1902	47°47'26.59"	28°59'25.44"	A.A. Brauner	ZIN, 5912/1
8	"*Th. alboguttatus*"	Odessa, Ukraine	28.12.1902	46°31'40.44"	30°43'18.74"	A.A. Brauner	ZIN, 6051/1
8	"*Th. lacrymans*"	Odessa, Ukraine	28.12.1902	46°31'40.44"	30°43'18.74"	A.A. Brauner	ZIN, 6052/1
8	"*Th. pulcherrimus*"	Odessa, Ukraine	28.12.1902	46°31'40.44"	30°43'18.74"	A.A. Brauner	ZIN, 6053/1

Other material. More than 100 shells labelled as "*Theodoxus fluviatilis*" collected from the type locality by Put' on May 26, 1950 were retrieved in the NMNH NASU depository. The specimens are considered as topotypes of *Theodoxus dniestroviensis* here. Additionally, over hundred individuals of *Th. fluviatilis* from other points of the Dniester River and its tributaries, namely the Seret, Strypa, and Hnizna rivers (localities 2–6) were studied.

Remarks. The species name "*Theodoxus dniestroviensis*" has been considered as established by Put' in 1972 [e.g. O. Anistratenko *et al*., 1999; V. Anistratenko *et al*., 2020]. This dating uncritically relies on the article describing "*Theodoxus dniestroviensis* Put' sp. nova." in detail morphologically and providing a shell photo [Put', 1972: 80-82, textfig. 5]. However, another publication by Put' [1957] was recently found where the nominal name "*Theodoxus dniestroviensis*" was established, and the species description satisfies the ICZN [1999] guidelines applied to species described between 1930 and 1999. In both these publications [Put', 1957, 1972], the author clearly states that the new species name is introduced, lists the same diagnostic features and indicates the same type locality. Thus the name was made nomenclaturally available in 1957, not in 1972 as it was accepted before.

To ascertain the validity of this name, one has to check whether the shells of "*Th. dniestroviensis*" provide unique diagnostic features or their morphology falls within the range of variability of other species of the genus in this or neighboring region. In fact the type locality of "*Th. dniestroviensis*" is situated within the range of *Th. fluviatilis*, the most common and widespread species of neritids in Europe.

The identity of the name *Th. fluviatilis* is determined by its lectotype [O. Anistratenko *et al*., 1999; Anistratenko, 2005] though the species demonstrates a considerable variation in its shell colour pattern and shape [e.g. Zettler, 2008; Glöer, Pešić, 2015]. That is why a large number of nominal taxa are considered as synonyms of *Th. fluviatilis* [see V. Anistratenko *et al*., 2020].

The original description of *Th. dniestroviensis* was based on a relatively few morphological characters. No peculiarities in the size and/or proportions of the shell are mentioned [Put', 1957, 1972] or depicted (Fig. 4D). The diagnosis is focused only on periostracum colouration and number of light spiral stripes on the last whorl of the shell: these can be accounted from 3–10 up to 15 depending on individuals' age [Put', 1957, 1972]. As it is known, these characters are prone to considerable intraspecific variation [Bandel, 2001; Anistratenko *et al*., 2017, 2020; Sands *et al*., 2020] and certainly related to environmental conditions [e.g. Neumann, 1959; Rust, 1997; Zettler, 2007; Glöer, Pešić, 2015].

In general, the great conchological variability

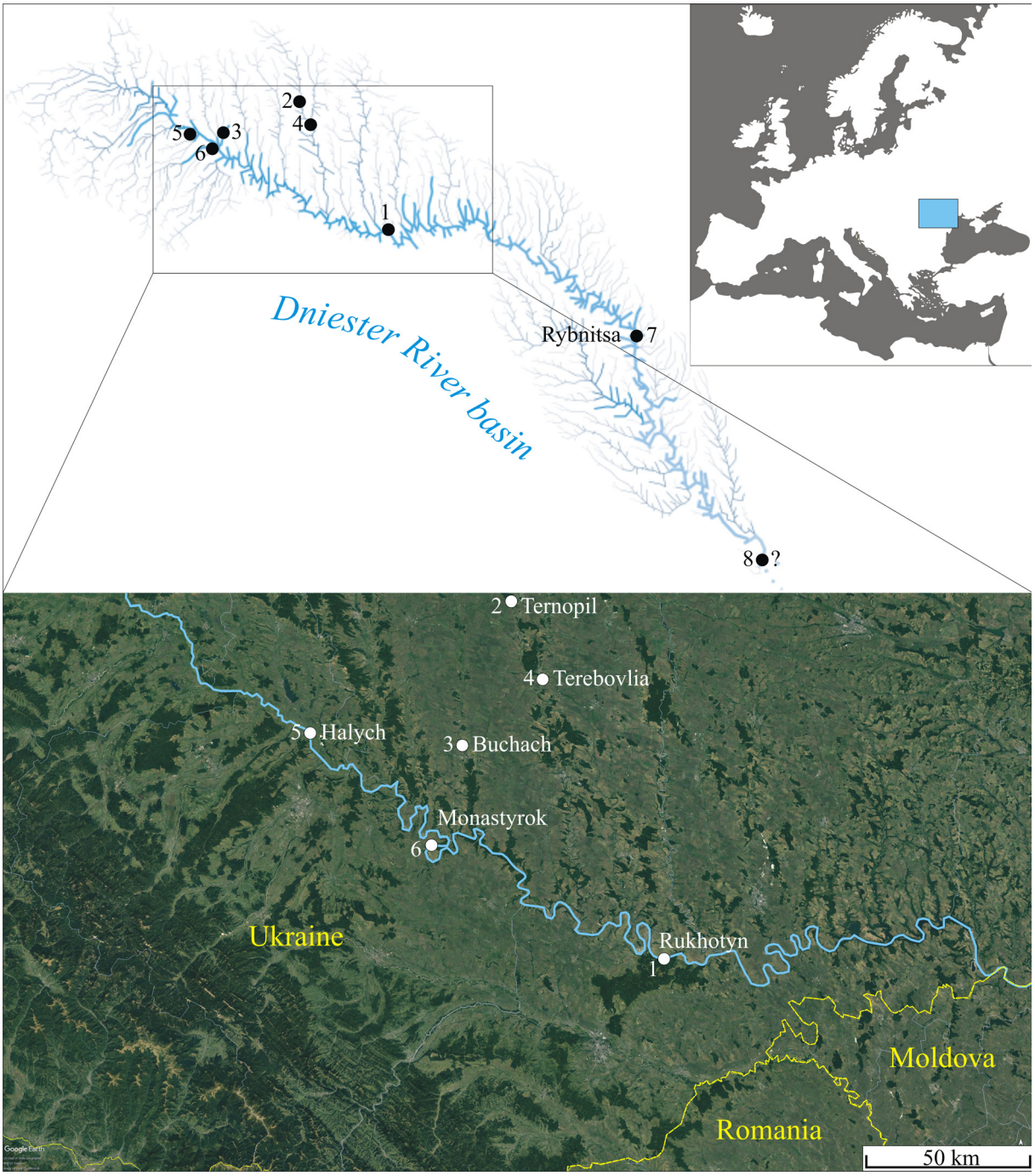

FIG. 1. Map of the study area with indication of sampling points of *Theodoxus*. The numbers of localities correspond to those in the Table 1.

РИС. 1. Карта изученного региона с указанием точек сбора *Theodoxus*. Номера локалитетов соответствуют таковым в Табл. 1.

makes the reliable identification of some *Theodoxus* species difficult and raises debates on their validity. For example, there is no complete consensus on the taxonomy and nomenclature of *Theodoxus* species inhabiting the river basins of the Black Sea region [Anistratenko *et al*., 2017, 2020; Wesselingh *et al*., 2019; Sands *et al*., 2020]. At the same time it is demonstrated that the most widely-distributed in Europe *Th. fluviatilis* comprises many different variations in shell shape and colour pattern [O. Anistratenko *et al*., 1999; V. Anistratenko, O. Anistratenko, 2001; Bandel, 2001; Shubrat, 2007; Zettler, 2008; Glöer, Pešić, 2015].

The distribution range of the nominal species "*Theodoxus dniestroviensis*" is limited by the type locality only [Put', 1957, 1972]. The topotypes of

FIG. 2. Some lots of river nerites collected by A.L. Put' on May 26, 1950 from the Dniester River near Rukhotyn village, the type locality of "*Theodoxus dniestroviensis*" (Fig. 1, locality 1).

РИС. 2. Некоторые пробы лунок, собранные А.Л. Путем 26 мая 1950 года из р. Днестр возле с. Рухотин, типового местонахождения "*Theodoxus dniestroviensis*" (Рис. 1, локалитет 1).

FIG. 3. Selected ecotopes of the Dniester River near Monastyrok village, locality 6 (**A**, **B**) and Halych village, locality 5 (**C**, **D**). Photo E. Degtyarenko.

РИС. 3. Некоторые экотопы р. Днестр возле с. Монастырок, локалитет 6 (**A**, **B**) и с. Галич, локалитет 5 (**C**, **D**). Фото Е. Дегтяренко.

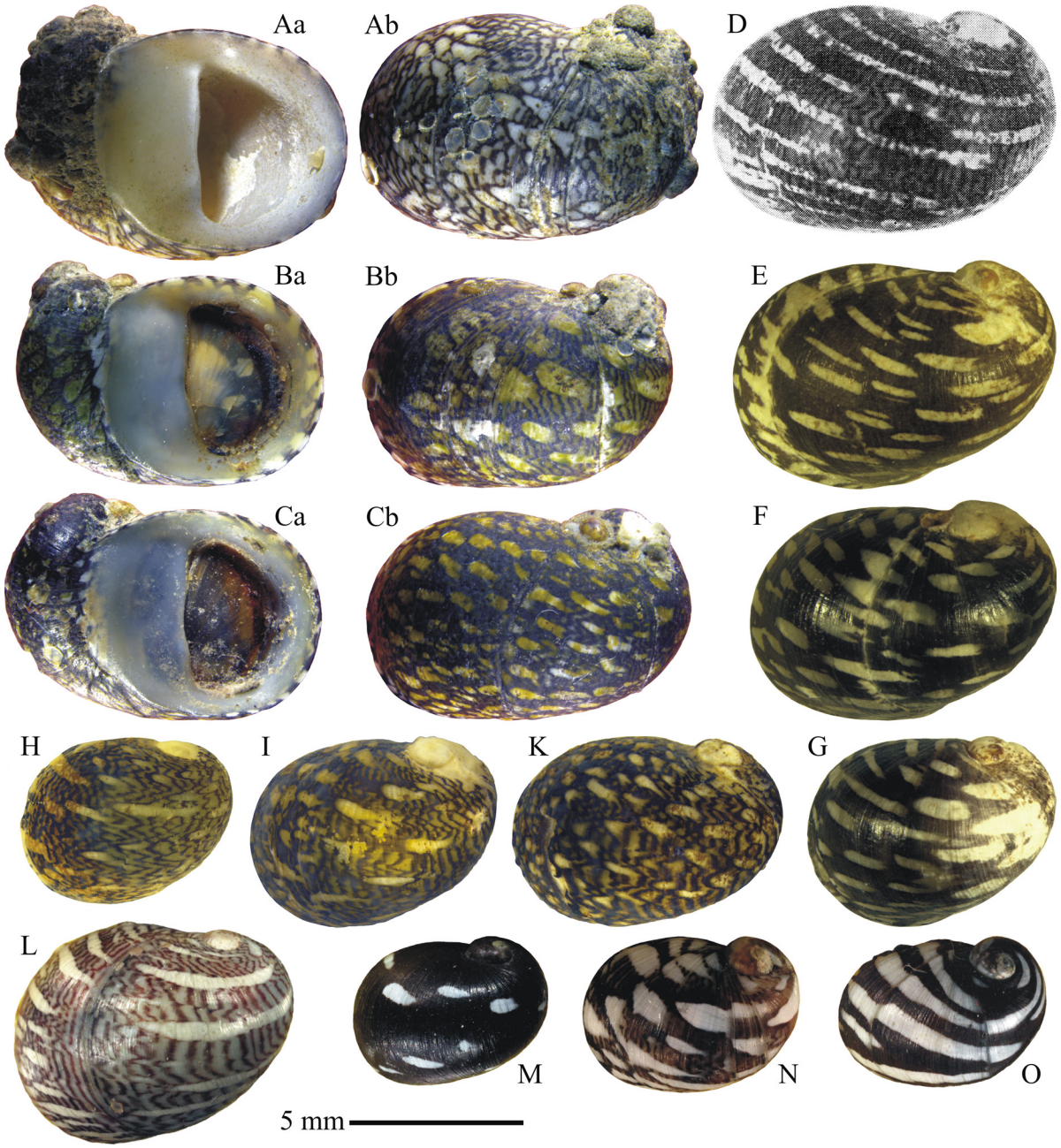

FIG. 4. Shells of *Theodoxus fluviatilis* (Linnaeus, 1758). **A**–**C**. Three topotypes of "*Theodoxus dniestroviensis*", NMNH NASU, PD, no number, locality 1. **D**. Lectotype of *Th. dniestroviensis*, designated here, locality 1, photo reproduced after Put', 1972. **E**. Specimen from Seret River, IZAN #614, locality 2. **F**. Specimen from Hnizna River, IZAN #616, locality 4. **G**. Specimen from Strypa River, IZAN #615, locality 3. **H**, **I**. Specimens from Dniester River, IZAN #333, locality 6. **K**. Specimen from Dniester River, IZAN #335, locality 5. **L**. *Th. obliteratus*-morphotype, ZIN #5912/1, locality 7. **M**. Lectotype of *Th. lacrymans*-morphotype, ZIN #6052/1, locality 8. **N**. Lectotype of *Th. alboguttatus*-morphotype, ZIN #6051/1, locality 8. **O**. Lectotype of *Th. pulcherrimus*-morphotype, ZIN #6053/1, locality 8. **L**–**O**. Reproduced after V. Anistratenko *et al*., 2020.

РИС. 4. *Theodoxus fluviatilis* (Linnaeus, 1758). **A**–**C**. Топотипы "*Theodoxus dniestroviensis*", NMNH NASU, PD, без номера, локалитет 1. **D**. Лектотип *Th. dniestroviensis*, обозначен здесь, локалитет 1, фото воспроизведено по Put', 1972. **E**. Экземпляр из р. Серет, IZAN #614, локалитет 2. **F**. Экземпляр из р. Гнизна, IZAN #616, локалитет 4. **G**. Экземпляр из р. Стрыпа, IZAN #615, локалитет 3. **H**, **I**. Экземпляры из р. Днестр, IZAN #333, локалитет 6. **K**. Экземпляр из р. Днестр, IZAN #335, локалитет 5. **L**. Морфотип *Th. obliteratus*, ZIN #5912/1, локалитет 7. **M**. Лектотип морфотипа *Th. lacrymans*, ZIN #6052/1, локалитет 8. **N**. Лектотип морфотипа *Th. alboguttatus*, ZIN #6051/1, локалитет 8. **O**. Лектотип морфотипа *Th. pulcherrimus*, ZIN #6053/1, локалитет 8. **L**–**O**. Воспроизведены по V. Anistratenko *et al*., 2020.

Th. dniestroviensis show a diversity of pattern (Fig. 4 A–C) that is registered in *Th. fluviatilis* populations in many parts of its range [V. Anistratenko *et al*., 2020; Sands *et al*., 2020]. It should be noted that among all available topotypes no shell exactly corresponding in colouration and pattern to the one depicted in the 1972 paper [Put', 1972: 80-82, textfig. 5] has been found (Fig. 4D). However, we found shells with longitudinal stripes in *Th. fluviatilis* populations from other localities of the Dniester River basin (Fig. 4 E–K). "*Theodoxus dniestroviensis*" in Put's interpretation also shows a clear similarity in pattern to some *Th. fluviatilis* morphotypes earlier described by Lindholm [1908]: about 10–12 stripes are found in *Th. obliteratus*-morphotype (Fig. 4L) and 5–7 stripes in *Th. pulcherrimus*-morphotype (Fig. 4O). A pattern of broken bands forming the spiral rows of large light spots is also commonly registered e.g. in *Th. lacrymans*-morphotype (Fig. 4M) and *Th. alboguttatus*-morphotype (Fig. 4N). It is important to note that the descriptions of *Th. alboguttatus*, *Th. lacrymans*, and *Th. pulcherrimus* morphotypes [Lindholm, 1908] were based on specimens collected near Odessa (Table 1): in the ZIN catalogue these samples are erroneously labelled as "*Black Sea, Odessa*" but these molluscs do not inhabit the Black Sea and are evidently originated from the neighboring limans. Meanwhile, the only shell of Lindholm's *Th. obliteratus*-morphotype, that makes up the type series of this taxon, was collected by A. Brauner in Dniester River near Rybnitsa, Moldova (Table 1), i.e. not far from the type locality of "*Theodoxus dniestroviensis*" at least from the same part of the river basin.

Based on conchological features as well as periostracum colouration and patterning it is hardly possible to distinguish *Th. dniestroviensis* from morphotypes of *Th. fluviatilis* given the variability in colour and patterns among the topotypic material (Fig. 4 A–C). Since the original description contains no other differential characteristics apart the pattern, "*Theodoxus dniestroviensis*" should be interpreted as a local morphotype of the polymorphic species *Th. fluviatilis* (L., 1758) as it was suggested earlier [O. Anistratenko *et al*., 1999]. The present study contributes additional data to the recently published overview of the type series of nominal taxa of the genus *Theodoxus* inhabiting the Ponto-Caspian area [V. Anistratenko *et al*., 2020]. It adds knowledge on the river nerites' variability range as well as sheds more light on understanding how many valid species of this genus exist in a region and what the proper names for them are.

Conclusion

The topotypic specimens of "*Theodoxus dniestroviensis* Put', 1957" fit well to the morphological diversity of *Th. fluviatilis* (L., 1758) inhabiting the Dniester River basin in terms of size, shape and variety of colour patterns. The type locality of "*Th. dniestroviensis*" lies within the distribution range of *Th. fluviatilis*. The available data suggest these taxa should be considered synonyms with the name *Th. fluviatilis* (Linnaeus, 1758) having priority. The formal date of the name "*Theodoxus dniestroviensis*" is amended based on the discovery of an earlier publication by Put' [1957] where this name was made available in the International Code of Zoological Nomenclature sense [ICZN, 1999].

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