

## New data on pond snails (Mollusca: Gastropoda: Lymnaeidae) inhabiting the Ukrainian Transcarpathian: diversity, distribution and ecology

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### Abstract

Fourteen species of the family Lymnaeidae were revealed in the samples taken from lowland and mountainous parts of the Ukrainian Transcarpathian. Five species are regionally new: *Stagnicola corvus*, *Radix parapsilia*, *R. balthica*, *R. ampla* and *R. tumida*; two regionally rare species (*Ladislavella terebra* and *Lymnaea fragilis*) are discovered. The most widespread pond snails appear to be *Lymnaea stagnalis* and *Radix intermedia*, the rarest one – *L. terebra* and *R. parapsilia* found in single locality each. The lowland part of the Ukrainian Transcarpathian maintains more than 4/5 regional fauna of the Lymnaeidae, though a few species occurred in the mountainous locations collected above the 400 m a.s.l. The check-list of species, with appropriate comments on taxonomy, distribution and some ecological characteristics of the lymnaeids found within the studied area is provided. A list of species of aquatic snails and bivalves co-occurring with the Lymnaeidae in the studied area is provided. Relatively high species diversity of malacofauna in the region combined with rarity of some species allow to consider the Transcarpathian as a specific region apparently representing a separate biogeographic unit. There is a need for a further estimate of the regionally rare species in order to clarify their potential conservation status.

**Key words:** Mollusca, Lymnaeidae, biodiversity, distribution, ecology, Transcarpathian, Ukraine.

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## Introduction

The territory of Ukrainian Transcarpathian has a dense network of river systems and is exclusively rich with water bodies of different types. In comparison with any other Ukrainian region this area has an extraordinary water supply: a great amount of large constant waterways, a lot of small rivers, springs, small creeks and peat bogs that are especially numerous in the mountainous part of the region (Gerenchuk 1981).

Some data on the aquatic malacofauna of this region are available from the literature; the authors have often mentioned its specific character (e.g. Zdun 1960; Makogon 1972, 2014; Stadnichenko 1984; Baidashnikov 1985; Gural-Sverlova & Gural 2012; Anistratenko *et al.* 2017). However the published data are somewhat scarce and, in many points, discordant with the currently accepted taxonomy and nomenclature of molluscs. Moreover, the data on distribution of particular species in this area remain rather scant. There is a need to fill this gap by means of new samplings and with taking into account the recently published changes in taxonomy. It is also important to clarify the systematic position and/or taxonomical status of some taxa registered in the region by previous investigators (Stadnichenko 1982; Anistratenko & Stadnichenko 1995). This particularly concerns to aquatic pulmonates of the family Lymnaeidae Rafinesque, 1815. Due to high plasticity of shell traits the systematics of this group is controversial and overloaded by synonyms (see Hubendick 1951). According to different authors the family comprises from around 40 (Hubendick 1951) to several hundreds (Kruglov 2005) living species in the World. The lymnaeid fauna inhabiting the Ukrainian Transcarpathian has also been estimated in different way – from seven species (e.g. Zdun 1960) up to 18 species (e.g. Stadnichenko 2004; Stadnichenko & Gyrin 2011).

In the present paper we provide new data on diversity of gastropod snails of the family Lymnaeidae recently collected in the Ukrainian Transcarpathian. The comments on taxonomy, distribution and ecological remarks of recorded species are provided as well. Additionally the mollusks species co-occurred with pond snails are listed. Presented data may be useful for the more exact biogeographical characterization of the Transcarpathian malacofauna and for assessment of a potential conservation status of some regionally rare species inhabiting this area.

## Material and Methods

The samples used in the present study were collected by Yurii Furyk during the fieldworks in 2015-2018 in different parts of the Transcarpathian Region, Ukraine (Fig. 1, Table 1). Mollusks were hand-picked from the shallow zone of water-bodies mostly from stones or macrophytes and using a hydrobiological net at depths of 0.5-1 m. Samples were immediately fixed with 80% ethanol, and after a couple of days the alcohol was replaced.

Table 1. Examined material from the Ukrainian Transcarpathian. The numbers of localities refer to the text and figures.

No	Locality	Lot# IZAN	Date	N	E	Species
1	Branch of the Uzh River near Onokivtsi village, Uzhgorod district, 125 m a.s.l.	475-5	09.05.2018	48°38'41.73"	022°21'01.15"	<i>Radix intermedia</i> (Lamarck, 1822) <i>Unio pictorum</i> (L., 1758)
2	Uzh River, Uzhgorod city, 107 m a.s.l.	448-44	02.06.2015	48°37'14.69"	022°16'25.72"	<i>R. balthica</i> (L., 1758) <i>Lymnaea stagnalis</i> (L., 1758) <i>Sinanodonta woodiana</i> (Lea, 1834) <i>Unio pictorum</i> (L., 1758)
3	Uzh River Botanical garden in Uzhgorod city, 115 m a.s.l.	446-46	01.07.2015	48°37'04.35"	022°18'23.06"	<i>R. ampla</i> (Hartmann, 1821) <i>R. ampullacea</i> (Rossmässler, 1835) <i>R. auricularia</i> (L., 1758) <i>R. balthica</i> (L., 1758)

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TABLE 1

4	Latorica River, near Chop town, Uzhgorod district, 100 m a.s.l.	448-51	11.05.2017	48°27'21.65"	022°12'26.66"	<i>Galba oblonga</i> (Puton, 1847) <i>R. intermedia</i> (Lamarck, 1822) <i>L. stagnalis</i> (L., 1758) <i>Stagnicola corvus</i> (Gmelin in Linnaeus, 1791) <i>Lithoglyphus naticoides</i> (C. Pfeiffer, 1828) <i>Physa acuta</i> (Draparnaud, 1805) <i>Physa fontinalis</i> (L., 1758) <i>Physa</i> sp. <i>Planorbarius corneus</i> (L., 1758) <i>Segmentina nitida</i> (O.F. Müller, 1774)
5	Floodplain of Latorica River, near Chop town, Uzhgorod district, 101 m a.s.l.	475-4	06.05.2018	48°27'08.30"	022°12'39.72"	<i>L. stagnalis</i> (L., 1758) <i>Viviparus viviparus</i> (L., 1758) <i>Bithynia tentaculata</i> (L., 1758) <i>P. corneus</i> (L., 1758)
6	Stara River, Znyatsovo village, Uzhgorod district, 107 m a.s.l.	448-53	11.05.2017	48°29'26.88"	022°31'33.48"	<i>L. stagnalis</i> (L., 1758) <i>R. intermedia</i> (Lamarck, 1822), <i>V. viviparus</i> (L., 1758) <i>V. sphaeridius</i> (Bourguignat, 1880), <i>Lith. naticoides</i> (C. Pfeiffer, 1828) <i>Ancylus fluviatilis</i> (O.F. Müller, 1774) <i>Unio tumidus</i> (Philipsson in Retzius, 1788) <i>Sphaerium (Nucleocyclus) nucleus</i> (S. Studer, 1820) <i>Sph. corneum</i> (L., 1758) <i>Euglesa (Casertiana)</i> sp.
7	Stagnant pool by the road near Znyatsovo village, Mukacheve district, 108 m a.s.l.	475-2	05.05.2018	48°29'11.21"	022°32'11.68"	<i>L. fragilis</i> (L., 1758) <i>Contectiana contecta</i> (Millet, 1813) <i>Bithynia troschelii</i> (Paasch, 1842) <i>P. corneus</i> (L., 1758) <i>Planorbis planorbis</i> (L., 1758)
8	Roadside canal between Stare Davidkove and Ivanivtsi villages, Mukacheve district, 114 m a.s.l.	475-1	05.05.2018	48°27'49.79"	022°37'53.15"	<i>L. stagnalis</i> (L., 1758) <i>S. corvus</i> (Gmelin in Linnaeus, 1791) <i>Segmentina nitida</i> (O.F. Müller, 1774)
9	Mertse River, Gat village, Berehove district, 109 m a.s.l.	448-68	14.05.2017	48°18'52.26"	022°38'20.41"	<i>L. stagnalis</i> (L., 1758) <i>R. ampullacea</i> (Rossmässler, 1835) <i>R. intermedia</i> (Lamarck, 1822) <i>Bithynia tentaculata</i> (L., 1758) <i>P. corneus</i> (L., 1758) <i>P. planorbis</i> (L., 1758) <i>Ph. acuta</i> (Draparnaud, 1805) <i>Musculium lacustre</i> (O.F. Müller, 1774)
10	Canal Babychka, Zaluzhzhya village, Mukacheve district, 121 m a.s.l.	448-54	11.05.2017	48°21'48.93"	022°51'09.36"	<i>R. parapsilia</i> (Vinarski et Glöer, 2009) <i>R. intermedia</i> (Lamarck, 1822) <i>Anisus spirorbis</i> (L., 1758) <i>A. albus</i> (O.F. Müller, 1774) <i>Sph. corneum</i> (L., 1758) <i>M. lacustre</i> (O.F. Müller, 1774)

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TABLE 1.

11	Pond in the vicinity of Gorbok village, Irshava district, 122 m a.s.l.	448-55	11.05.2017	48°19'25.57"	022°53'30.34"	<i>L. fragilis</i> (L., 1758) <i>R. auricularia</i> (L., 1758)
12	Irshava River, Siltce village, Irshava district, 124 m a.s.l.	448-56	11.05.2017	48°17'13.58"	022°59'50.26"	<i>R. ampla</i> (Hartmann, 1821) <i>R. tumida</i> (Held, 1836) <i>G. truncatula</i> (O.F. Müller, 1774) <i>A. fluviatilis</i> (O.F. Müller, 1774) <i>Physa</i> sp. <i>Sph. corneum</i> (L., 1758)
13	River Synyavka Vicinity of Osiy village, Irshava district, 399 m a.s.l.	448-69	02.06.2017	48°23'15.08"	023°07'49.19"	<i>R. intermedia</i> Lamarck, 1822 <i>Terrestribythinella baidashnikovi</i> Sitnikova, Starobogatov et Anistratenko, 1992 <i>Ancylus fluviatilis</i> (O. F. Müller, 1774)
14	Stream near Bukove village, Vynohradiv district, 197 m a.s.l.	448-67	14.05.2017	48°10'53.52"	023°05'35.64"	<i>G. truncatula</i> (O.F. Müller, 1774) <i>Bythinella</i> sp. <i>Euglesa (Casertiana)</i> sp.
15	Tysa River near Mala Kopanya village, Vynohradiv district, 140 m a.s.l.	448-48	15.09.2016	48°09'50.47"	023°06'33.16"	<i>R. ampla</i> (Hartmann, 1821) <i>R. tumida</i> (Held, 1836) <i>R. balthica</i> (L., 1758) <i>G. truncatula</i> (O.F. Müller, 1774) <i>Cincinna piscinalis</i> (O.F. Müller, 1774)
16	Branch of the Tysa River near Mala Kopanya village, Vynohradiv district, 144 m a.s.l.	448-49	15.09.2016	48°09'52.60"	023°06'43.85"	<i>L. stagnalis</i> (L., 1758) <i>G. truncatula</i> (O.F. Müller, 1774) <i>G. subangulata</i> (Roffiaen, 1868) <i>C. piscinalis</i> (O.F. Müller, 1774) <i>P. corneus</i> (L., 1758)
17	Pool in the vicinity of Sokyrnitsya village, Khust district, 172 m a.s.l.	448-64	13.05.2017	48°07'12.94"	023°21'53.63"	<i>L. stagnalis</i> (L., 1758) <i>L. fragilis</i> (L., 1758) <i>Ladislavella terebra</i> (Westerlund, 1885) <i>A. albus</i> (O.F. Müller, 1774) <i>M. lacustre</i> (O.F. Müller, 1774) <i>Euglesa</i> spp.
18	Aphsitsya River, Grushovo village, Tiachiv district, 242 m a.s.l.	447-76	02.06.2017	47°59'56.68"	023°47'2.54"	<i>R. tumida</i> (Held, 1856) <i>G. oblonga</i> (Puton, 1847)
19	Brusturanka River, Lopukhov village, Tiachiv district, 700 m a.s.l.	448-47	16.07.2015	48°24'21.28"	024°02'20.51"	<i>R. balthica</i> (L., 1758)
20	Stream in the territory of the Carpathian Biosphere Reserve Headquarters, Rakhiv district, 443 m a.s.l.	447-73	06.11.2017	48°01'32.05"	024°09'58.82"	<i>G. truncatula</i> (O.F. Müller, 1774) <i>Terrestribythinella baidashnikovi</i> Sitnikova, Starobogatov et Anistratenko, 1992 <i>Vestia turgida</i> (Rossmässler, 1836) <i>Cochlicopa lubrica</i> (O.F. Müller, 1774) <i>Vallonia pulchella</i> (O.F. Müller, 1774) <i>Vitrea crystallina</i> (O.F. Müller, 1774)

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TABLE 1.

21	Puddle near artificial pond, vicinity of Belin village, Rakhiv district, 497 m a.s.l.	448-61	12.05.2017	48°06'30.16"	024°15'12.89"	<i>R. intermedia</i> (Lamarck, 1822) <i>G. truncatula</i> (O.F.Müller, 1774) <i>A. albus</i> (O.F.Müller, 1774)
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In total, over 250 specimens of pond snails from 21 localities were examined (Table 1). A traditional morphological analysis and measurements of the shell were used for species differentiation. In some doubtful cases a dissection was performed to study the taxonomically significant parts of the reproductive system of the molluscs.



Figure 1. Map showing the localities of samples studied. Details for each sampling point are given in Table 1.

The small-sized shells were photographed with digital camera under Leica M 165 C stereomicroscope. Large shells were photographed with digital camera Panasonic LUMIX DMC-FZ200 or Canon EOS 1100. The MBS-10 stereomicroscope was used for examination of shell morphology and for dissections. Most samples are deposited in the collection of Department of Invertebrate Fauna and Systematics, Schmalhausen Institute of Zoology of NAS of Ukraine, Kiev (IZAN), several voucher specimens are housed in the collection of Laboratory of Macroecology and Biogeography of Invertebrates, Saint-Petersburg State University, Saint-Petersburg, Russia.

Since pond snails occur in various types of the Transcarpathian water-bodies we only select a few images of ecotopes to demonstrate the diversity of environmental conditions where the discussed species have been found (Fig. 2).



**Figure 2.** Selected types of ecotopes inhabited by lymnaeids in Transcarpathian region. A – pond in the vicinity of Gorbok village, Irshava district, locality 11; B – artificial pool in the floodplain of Latorica River, near Chop Town, Uzhgorod district, locality 5; C – canal between Stare Davidkove and Ivanivtsi villages, Mukacheve district, locality 8; D – stream in the territory of Carpathian Biosphere Reserve Headquarters, locality 20.

There is no universal, commonly accepted system of the European lymnaeids. The Western European authors (Jackiewicz 1998; Glöer 2002; Welter-Schultes 2012; Piechocki & Wawrzyniak-Wydrowska 2016) recognize a relatively low number of valid specific taxa (12–15), whereas malacologists of the former USSR use a drastically different system (Kruglov & Starobogatov 1993a, b; Stadnichenko 2004; Kruglov 2005). The molecular-genetic approach has recently become a key tool in the European lymnaeid systematics (Bargues *et al.* 2003, 2006; Schniebs *et al.* 2011, 2013; Vinarski *et al.* 2012b), but some morphologically distinct species still remain not studied genetically that keeps some questions concerning their validity and the taxonomic status unresolved. The taxonomic problems are beyond the scope of our study, and here we generally follow the most recent system of the Ukrainian lymnaeids (Stadnichenko 2004), with taking into consideration the taxonomic publications issued later (e.g. Vinarski & Glöer 2007, 2008; Mezhzherin *et al.* 2008; Schniebs *et al.* 2011, 2013; Welter-Schultes 2012). The generic and subgeneric classification of Lymnaeidae follows Vinarski & Kantor (2016). The distribution data of lymnaeid species listed herein are given after Hubendick (1951), Kruglov & Starobogatov (1993a, b), and Vinarski & Kantor (2016).

## Results and Discussion

Sampling of mollusks in 21 water-bodies of Ukrainian Transcarpathian yielded altogether 14 species of the family Lymnaeidae. Five species are regionally new: *Stagnicola corvus*, *Radix parapsilia*, *R. balthica*, *R. ampla* and *R. tumida*. Additionally two regionally rare species are discovered: *Ladislavella terebra* (locality

17) and *Lymnaea fragilis* (localities 7, 11, 17) (Fig. 1, Table 1). Apart from lymnaeid snails all the samples studied contained a more or less diverse set of other gastropod and bivalve mollusks co-occurred with the lymnaeids, they are also listed in Table 1.

As it appears the lowland part of the Ukrainian Transcarpathian maintains the most rich fauna of the Lymnaeidae. More than 4/5 of all lymnaeid species revealed in valleys of big and small rivers while a few species occurred in the mountainous locations (*Radix intermedia*, *R. balthica* and *Galba truncatula*). More extensive sampling is needed to clarify the pond snails distribution since most of samples studied were collected below the 400 m a.s.l., see Table 1. Below we provide the appropriate comments on distribution and some ecological characteristics of the lymnaeid taxa found within the studied area.

### **Family Lymnaeidae Rafinesque, 1815**

#### **Subfamily Lymnaeinae**

**Type genus:** *Lymnaea* Lamarck, 1799

#### **Genus *Lymnaea* Lamarck, 1799**

**Type species:** *Helix stagnalis* Linnaeus, 1758, by monotypy.

#### ***Lymnaea stagnalis* (Linnaeus, 1758)**

(Fig. 3, A)

**Distribution:** The species is one of the most common and widespread pond snails in the region – we found its populations in eight localities (Table 1). In Ukraine the species is registered in all regions (e.g. Stadnichenko 2004) being recently recorded also in Transcarpathian (Stadnichenko & Gyrin 2011; Anistratenko *et al.* 2017). General distribution covers almost all Eurasia (excepting of southern latitudes) as well as North America (Hubendick 1951; Kruglov 2005).

**Remarks:** In the Transcarpathian region this species inhabits shallow zone of rivers, former riverbeds, natural ponds and lakes; it is associated mostly with macrophytes at depths of 0.5–1.0 m.

#### ***Lymnaea fragilis* (Linnaeus, 1758)**

(Fig. 3, B)

**Distribution:** The species is recorded in the localities 7, 11 and 17 (Table 1). In Ukraine the species is registered in all regions including the Transcarpathian (Stadnichenko 2004; Stadnichenko & Gyrin 2011). General distribution covers Western and Central Europe.

**Remarks:** In the Transcarpathian this species occurs sporadically, inhabits mainly natural and artificial ponds, associated with macrophytes at depths of 0.5–1.0 m.

Though genetic studies (e.g. Mezhzherin *et al.* 2008; Vinarski *et al.* 2012a) did not reveal any reliable genetic traits distinguishing ‘*stagnalis*’ and ‘*fragilis*’ we treat these forms as two conchologically separated “morphospecies”. The proper status of *L. fragilis* is to be clarified by means of the integrative taxonomic approach.

#### **Genus *Stagnicola* Leach in Jeffreys, 1830**

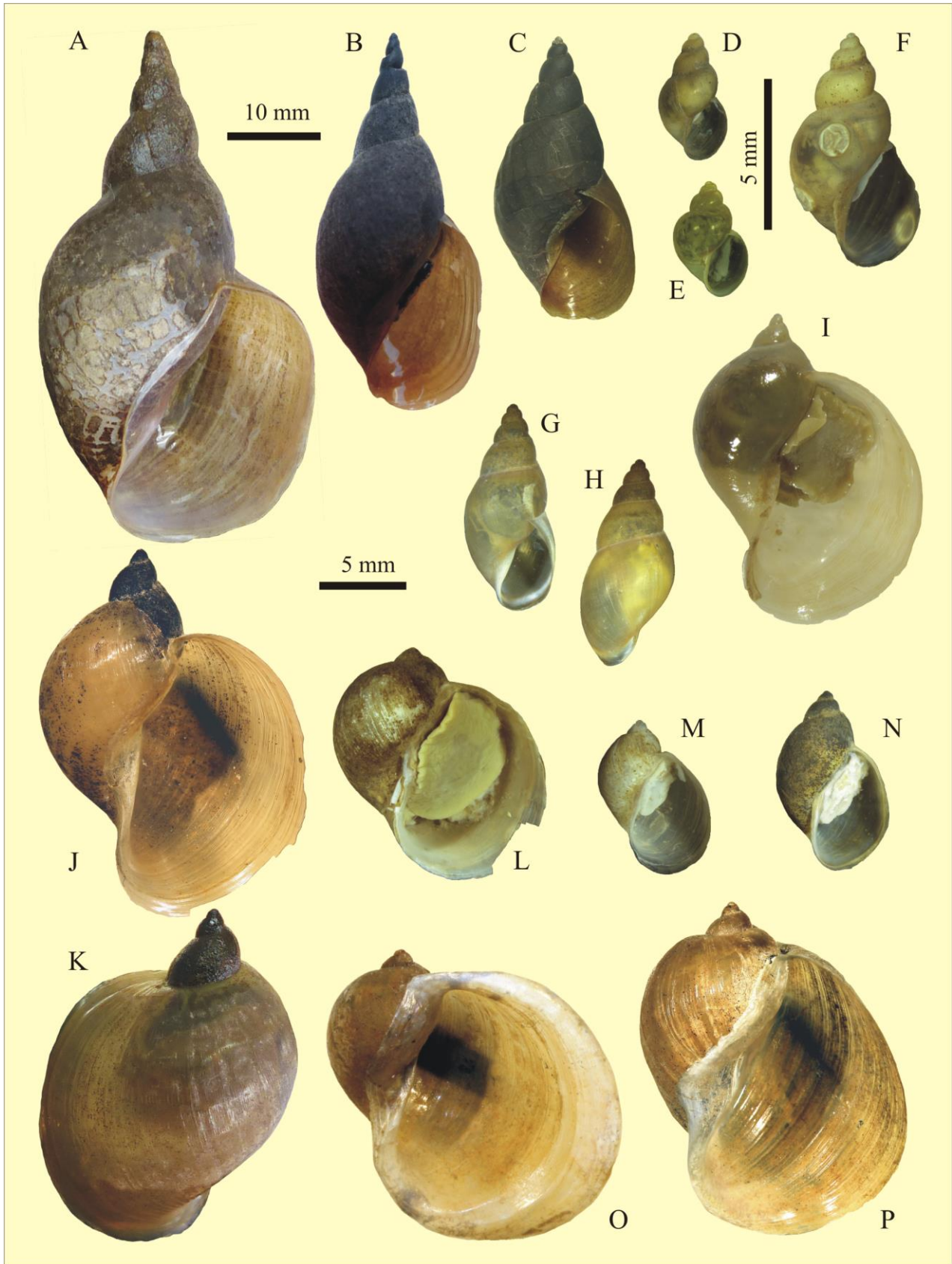
**Type species:** *Buccinum palustre* O.F. Müller, 1774, by monotypy.

#### ***Stagnicola (Corvusiana) corvus* (Gmelin in Linnaeus, 1791)**

(Fig. 3, C)

**Distribution:** The species is recorded for the first time in the region, locality 8 (Table 1). In Ukraine the species inhabits basins of Bug River and Pripjat Polissya zone (Stadnichenko, 2004) was not listed in Transcarpathian though (Stadnichenko & Gyrin 2011). General distribution – Europe, excepting of its northern part (above 56°).

**Remarks:** In the Transcarpathian region this species was found in small roadside canal and is apparently rare though our material is too limited for reliable conclusions on its bionomics in this region.



**Figure 3.** Shells of pond snails found. A – *Lymnaea stagnalis* from locality 16; B – *L. fragilis*, locality 7; C – *Stagnicola corvus*, locality 8; D – *Galba truncatula*, locality 21; E – *G. subangulata*, locality 16; F – *G. oblonga*, locality 4; G, H – *Ladislavella terebra*, loc. 17; I – *Radix auricularia*, locality 3; J, K – *R. parapsilia*, locality 10; L – *R. ampullacea*, locality 3; M – *R. balthica*, locality 2; N – *R. intermedia*, locality 4; O – *R. ampla*, locality 15; P – *R. tumida*, locality 15. Scale bar = 10 mm for A–C and 5 mm for D–P.



**Genus *Galba* Schrank, 1803**

**Type species:** *Buccinum truncatum* O.F. Müller, 1774, by subsequent designation.

***Galba truncatula* (O.F. Müller, 1774)**

(Fig. 3, D)

**Distribution:** One of the most widespread lymnaeid species in the region – we found its populations in six localities (Table 1). In Ukraine the species is registered in all regions including the Transcarpathian (Stadnichenko 2004; Stadnichenko & Gyrin 2011; Anistratenko *et al.* 2017). General distribution covers Eurasia, Northern America, Southern America, Northern and Eastern Africa.

**Remarks:** In the Transcarpathian area this species inhabits hard substrates in shoreline zone of rivers, former riverbeds, streams, ponds and even puddles up to 500 m a.s.l., see Table 1. Sometimes the snails occur here in amphibiotic conditions (Anistratenko *et al.* 2017).

**Taxonomic remarks:** According to the former USSR authors (Kruglov & Starobogatov 1993a; Stadnichenko 2004), the species *Galba truncatula* s. str. should be split into a series of ‘minor’ species that can be distinguished by minute conchological features. Most of these species remain not studied genetically. We found two of them in the studied area and consider them here as morphospecies (see below).

***Galba subangulata* (Roffiaen, 1868)**

(Fig. 3, E)

**Distribution:** The species found at a single locality 16 (Table 1); it has not been recorded from Transcarpathian region so far (Stadnichenko & Gyrin 2011) though some reports of *Galba ventricosa* (Moquin-Tandon, 1855) might be referred to *G. subangulata*. In Ukraine the species is distributed in the Steppe and Forest-Steppe zones (Stadnichenko, 2004). General distribution – Europe, southwest Siberia, and Central Asia.

**Remarks:** In the Transcarpathian the species inhabits hard substrates in shoreline zone of lowland rivers.

**Taxonomic remarks:** This (morpho)species is characterized by ovate-conical shell with a spire shorter than that of *G. truncatula*. The body whorl is visibly inflated.

***Galba oblonga* (Puton, 1847)**

(Fig. 3, F)

**Distribution:** The species is only found in two localities, 4 and 18 (Table 1); it has been recently mentioned by Stadnichenko & Gyrin (2011) as a species rarely occurred in the Transcarpathian. In Ukraine the species is known from the Forest-Steppe and the Carpathian regions (Stadnichenko 2004). General distribution – Europe and Central Asia.

**Remarks:** In the Transcarpathian the species inhabits hard substrates in shoreline zone of lowland rivers up to 250 m a.s.l.

**Taxonomic remarks:** Conchologically this (morpho)species differs from the typical form (*Galba truncatula* s. str.) by the turriculate shell shape and oblong and narrow spire.

**Genus *Ladislavella* B. Dybowski, 1913**

**Type species:** *Ladislavella sorensis* B. Dybowski, 1913 = *Ladislavella terebra* (Westerlund, 1885), by subsequent designation.

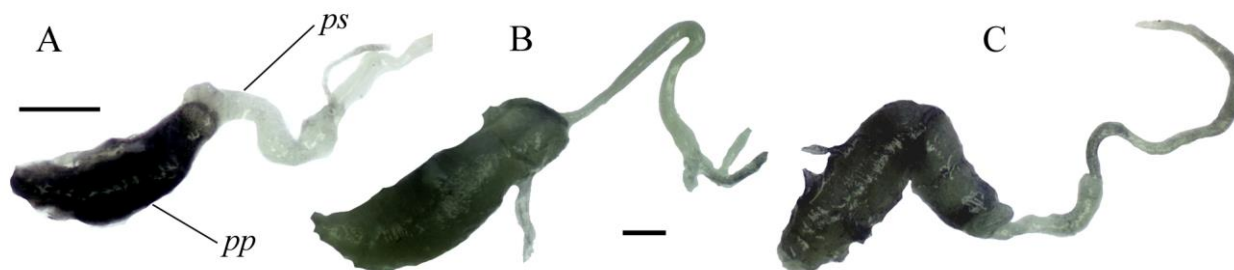
***Ladislavella terebra* (Westerlund, 1885)**

(Fig. 3, G, H; 4, A)

**Distribution:** The species was found at a single locality 17 (Table 1) close to the site in the vicinity Khust settlement where Korniushev (1999) has already recorded the species from an artificial pond. Under the name *Galba occulta* Jackiewicz, 1959 it was earlier mentioned from adjacent Ivano-Frankovsk and Lvov regions (Stadnichenko 1968). Its actual distribution in Ukraine needs to be clarified. General distribution – Northern Palearctic (Eastern Europe to Eastern Siberia).

**Remarks:** In the Transcarpathian the species is found on hard substrate in shallow natural stagnant reservoir.

**Taxonomic remarks:** Recently it was shown (Vinarski & Glöer 2008) that *Galba occulta* Jackiewicz, 1959 is a junior synonym of *Limnaea palustris* var. *terebra* Westerlund, 1885. The most characteristic trait of this species allowing its easy identification is the structure of the copulatory organ (Fig. 4, A). The praeputium is dark pigmented (sometimes almost black), whereas the penis sheath is light coloured, its width is almost the same as the praeputium width (see Korniuschin 1999; Vinarski 2003, 2012 for further details).



**Figure 4.** The copulatory organs of some lymnaeid snails from the Transcarpathian region. A – *Ladislavella terebra*; B – *Radix ampla*; C – *R. tumida*. Scale bars = 1 mm for A and 2 mm for B, C. Abbreviations: *pp* – praeputium, *ps* – penis sheath.

#### Subfamily Amphipepleinae Pini, 1877

**Type genus:** *Amphipeplea* Nilsson, 1822 = *Myxas* Sowerby, 1822

#### Genus *Radix* Montfort, 1810

**Type species:** *Radix auriculatus* Montfort, 1810 = *Radix auricularia* (Linnaeus, 1758)

#### *Radix (Radix) auricularia* (Linnaeus, 1758)

(Fig. 3, I)

**Distribution:** The species is found in 2 localities (Table 1); one of them agrees with recently published record (Stadnichenko 2004; Stadnichenko & Gyrin 2011). In Ukraine the species inhabits all regions (Stadnichenko 2004). General distribution – Palearctic, introduced into North America.

**Remarks:** In the Transcarpathian this species found in rivers, former riverbeds and ponds associating mostly with macrophytes at depths up to 0.5 m.

**Taxonomic remarks:** This species is very well studied. It has many times been characterized in the literature, both conchologically and anatomically (Jackiewicz 1998; Glöer 2002; Kruglov 2005). Our samples of this species correspond with these descriptions.

#### *Radix (Radix) cf. parapsilia* Vinarski et Glöer, 2009

(Fig. 3, J, K)

**Distribution:** The species is found at a single locality 10 (Table 1) and is formally new species for the regional malacofauna since is never mentioned in Transcarpathian. However some records of *L. peregra* (O.F. Müller, 1774) in there as well as in adjacent Ivano-Frankovsk region (Stadnichenko 2004) might be referred to *R. parapsilia*. Distribution of the species in Ukraine needs to be clarified on the basis of more extensive field samplings. General distribution – Northern Eurasia.

**Remarks:** In the Transcarpathian the species is found in shallow zone of canal.

**Taxonomic remarks:** In the Russian literature, this species had been known as *Limnaea (Radix) psilia* (Bourguignat, 1862) (e.g. Kruglov & Starobogatov 1993a; Stadnichenko 2004; Kruglov 2005). Having studied the syntypes of the latter, Vinarski & Glöer (2009) revealed they represent nothing but juvenile individuals of *L. stagnalis*, and a new species name was introduced to replace *L. psilia* sensu Kruglov, 2005

non Bourguignat, 1862. The specimen collected in Western Ukraine differs from the typical *R. auricularia* by its higher spire and less inflated body whorl. Possibly, it is conspecific with *R. parapsilia*, whose type locality is situated in the southwest Siberia (Vinarski & Glöer 2009). However, further study is needed to prove the presence of *R. parapsilia* in the Transcarpathian region.

***Radix (Radix) ampla* (Hartmann, 1821)**

(Fig. 3, O; 4, B)

**Distribution:** The species is new for the Transcarpathian region; found in 3 localities (3, 12, 15 – Table 1). In Ukraine the species is registered (under the name *L. monnardi* (Hartmann, 1844)) from the Forest-Steppe and Polissya zones (Stadnichenko 2004). General distribution – Europe and Siberia.

**Remarks:** In the Transcarpathian this species is found only in rivers among vegetation.

**Taxonomic remarks:** Though some authors (Hubendick 1951; Jackiewicz 1998) rejected the validity of *R. ampla*, the recent works based on either morphology (Glöer 2002; Stadnichenko 2004; Kruglov 2005) or molecular taxonomy (Schniebs *et al.* 2011) have shown it is a biological species. According to Kruglov (2005), *R. ampla* (= *Lymnaea patula* sensu Kruglov) has a rather long penis sheath, and the preaeputium: penis sheath ratio in this species is around 0.75. The proportions of the copulatory apparatus of a single specimen of *R. ampla* dissected during this study correspond well to Kruglov's description (see Fig. 4, B).

***Radix (Peregriana) tumida* (Held, 1836)**

(Fig. 3, P; 4, C)

**Distribution:** The species is new for the Transcarpathian region; found in 3 localities (12, 15, 18 – Table 1). In Ukraine the species registered in all regions (Stadnichenko 2004) though not mentioned in Transcarpathian so far (Stadnichenko & Gyrin 2011). General distribution – Northern Palearctic.

**Remarks:** In the Transcarpathian this species is found only in rivers among vegetation.

**Taxonomic remarks:** From the conchological point of view, *R. tumida* resembles *R. ampla* but differs from the latter by higher spire and less inflated aperture. Besides, Kruglov (2005) reported some differences in the proportions of the copulatory organs of these two snails. As it was stated above, the penis sheath in *R. ampla* is a bit longer than the preputium, whereas in *R. tumida* one may observe an opposite state. According to Kruglov (2005), the praeputium of *R. tumida* is around 1.7 times longer than the penis sheath. The copulatory apparatus of the *R. tumida* species dissected by us has essentially the same proportions (see Fig. 4, C).

***Radix (Peregriana) ampullacea* (Rossmässler, 1835)**

(Fig. 3, L)

**Distribution:** The species is only found in two localities (3 and 9, see Table 1); it was also recently mentioned in Transcarpathian by Stadnichenko (2004). In Ukraine the species inhabits all regions (Stadnichenko 2004). General distribution – Europe and Siberia.

**Remarks:** The Transcarpathian populations of *R. ampullacea* are characterized by low density; this species found here only in rivers at depths up to 0.5 m.

**Taxonomic remarks:** Stadnichenko (2004) and Kruglov (2005) define this species as a close relative to *R. balthica*. The species is characterized by almost spheroid shell and very low spire. The body whorl is strongly inflated (much more inflated as compared with *R. balthica*). The Western European malacologists (Glöer 2002; Schniebs *et al.* 2011; Welter-Schultes 2012) do not recognize *R. ampullacea* as a valid species. Its identity needs to be resolved.

***Radix (Peregriana) balthica* (Linnaeus, 1758)**

(Fig. 3, M)

**Distribution:** The species is new for the Transcarpathian region, found in four localities (Table 1) one of which (19) situated in mountainous area, 700 m a.s.l. In Ukraine the species is registered in different regions, excluding Steppe zone and Carpathians (Stadnichenko 2004). General distribution – Palaearctic.

**Remarks:** *R. balthica* is, probably, the most widespread and common species of the subgenus *Peregriana* in the fauna of Europe. Some populations in the Transcarpathian are characterized by high density; the species found here only in rivers. Since *R. balthica* is recorded also in Iceland (Bolotov *et al.* 2017) this could mean it prefers cold and running water conditions.

**Taxonomic remarks:** Identity of *R. balthica* is based on the neotype (designated and illustrated by Kruglov & Starobogatov, 1983) as well as on numerous descriptions (Glöer 2002; Stadnichenko 2004; Kruglov 2005) and molecular taxonomic studies (Schniebs *et al.* 2011; Bolotov *et al.* 2017).

***Radix (Peregriana) intermedia* (Lamarck, 1822)**

(Fig. 3, N)

**Distribution:** One of the widespread pond snails in the region – we found its populations in seven localities (Table 1). In Ukraine the species is registered in Forest-Steppe and Polissya zones (Stadnichenko 1982, 2004), recently recorded also in Transcarpathian (Stadnichenko & Gyrin 2011). General distribution – Palearctic.

**Remarks:** In the Transcarpathian this species inhabits shallow zone of rivers and canals up to 400 m a.s.l. associating mostly with macrophytes.

**Taxonomic remarks:** Like *R. ampullacea* (see above), this species is closely allied to *R. balthica* and can be distinguished from the latter by its higher spire and more oblong shell. The validity of *R. intermedia* is accepted in the Russian literature (Stadnichenko 2004; Kruglov 2005), whereas the Western European malacologists usually consider it as a synonym of *R. balthica*.

Interestingly, that among the mollusks listed as co-occurring with the pond snails (Table 1) two records are apparently new for the Transcarpathian region of Ukraine. In a stagnant pool located in Mukacheve district likely *Bithynia troschelii* (Paasch, 1842), a regionally new species of the family Bithyniidae was found (locality 7). The shells of this species having convex whorls separated by a deep suture have usually been identified as “*Bithynia leachii*” or “*Bithynia troschelii*” (e.g. Falniowski *et al.* 2004); more material are necessary to ensure of specimens found identity. Only *B. tentaculata* (Linnaeus, 1758) was included into the regional malacofauna lists so far (Zdun 1960).

Finding of *Terrestribythinella baidashnikovii* in the locality 13 adds the new record for this rare species distribution, only known from a few other Transcarpathian locations so far (Anistratenko & Stadnichenko 1995; Anistratenko *et al.* 2017).

## Conclusion

The data presented above improve our knowledge on the regional fauna of the lymnaeid snails. Fourteen species of the family Lymnaeidae were revealed in the samples selectively collected both in lowland and mountainous parts of the Ukrainian Transcarpathian. The most widespread pond snails appear *Lymnaea stagnalis* and *Radix intermedia*, occurred in 8 of 21 localities, the rarest – *Ladislavella terebra* and *Radix parapsilia* that have been found at only 1 locality each.

Relatively high species diversity of lymnaeid and other mollusk taxa coincides with the presence of some species which are rare for the entire Ukraine. This validates consideration of the Transcarpathian as a specific region apparently representing a separate biogeographic unit. The assessment of both the rank and faunal uniqueness of this unit requires further investigations with intensive field sampling of mollusks. This is needed also to properly estimate the potential conservation status of some regionally rare species inhabiting there.

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