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TERRESTRIAL MOLLUSCS OF THE TSYR-PRIPYAT AREA IN VOLYN (NORTHERN UKRAINE): THE FIRST FINDINGS OF THE THREATENED SNAIL *VERTIGO MOULINSIANA* IN MAINLAND UKRAINE

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Terrestrial Molluscs of the Tsyr-Pripyat Area in Volyn (Northern Ukraine): the First Findings of the Threatened Snail *Vertigo moulinsiana* in Mainland Ukraine. Balashov, I., Yarotskaya, M., Filatova, J., Starichenko, I., Kovalov, V. — 26 species of terrestrial molluscs were found in the studied area, including the rare and globally threatened *Vertigo moulinsiana* that is listed in "Habitats Directive" of the EU and in numerous red lists. Until now it was known in Ukraine only by one population in the Crimea that became extinct in 2014. Its conservation status, taking threats into account, is considered to be "Critically Endangered" on the national level in Ukraine. The characteristics of the phytocenoses to which it is restricted and the associated molluscan faunas are discussed.
Key words: Mollusca, Gastropoda, Stylommatophora, fens, conservation.

Introduction

Several species of terrestrial molluscs that inhabit European fens are considered to be of high conservation priority. First of all, it refers to the 4 species of the genus *Vertigo* listed in Annex II of European Union's "Habitats Directive" and numerous red lists: *V.moulinsiana* (Dupuy, 1849), *V. genesii* (Gredler, 1856), *V. geyeri* Lindholm, 1925 and *V. angustior* Jeffreys, 1830 (Cameron et al., 2003).

Three of these species were reported to occur in Ukraine. *V. angustior* is sporadically distributed across almost all the country and considered to be "Near Threatened" on the national level (Balashov, 2016 a, b). *V moulinsiana* was known in Ukraine from one locality only in the northern foothills of the Crimean Mountais where it was considered to be "Critically Endangered" (Balashov, Palatov, 2011; Balashov, 2013). However this population became extinct in 2014 or 2015 (Balashov, 2016 c). Therefore, there were no surviving populations of this species known in Ukraine before now. *V. geyeri* is known in Ukraine only by the 2 records in northwestern Ukraine in the begining of the 20th century, corresponding shells are preserved in the collection of State Museum of Natural History in Lviv (Balashov, 2016 a, b). One of these two reported locations of *V. geyeri* (under the name *V. genesii*) was near Velyka Glusha Village, between Tsyr and Pripyat rivers (Polansky, 1932). *V. genesii* (sensu stricto) is not known in Ukraine.

This area is located in the western part of Polesian Lowland, in the upper basin of the Pripyat River and of its confluent, the Tsyr River. It is a swampy plain (altitude 145–150 m) with few minor villages, covered mainly by alder swamps, fens, pastures and hayfields. The northern part of this area that is adjacent to the Pripyat River is relatively well-preserved and included into the "Pripyat–Stohid" National Nature Park. The southern part is much transformed: many swamps are drained, the Tsyr River is regulated and its bed is turned into a channel.

The aim of this study was to re-find populations of *V.geyeri* and other threatened terrestrial molluscs around Velyka Glushavillage, to describe their habitats and possible threats to them.

Material and methods

Material was collected during 9–13.07.2015 in Liubeshiv District of Volyn Region of Ukraine. Common methods of terrestrial molluscs' collecting, fixation and identification were used (Balashov, 2016 b).

Studied plots (fig. 1): 1 — fen (mainly covered by *Menyanthes trifoliata* L.,) near Velyka Glusha, 51°50′20.43″ N 25°4′7.96″ E; 2 — fen (mainly covered by *Carex omskiana* Meinsh.) near Velyka Glusha, 51°50′45.48″ N 25°4′27.35″ E; 3 — fen (see description below) near Velyka Glusha, 51°50′26.64″ N 25°7′4.57″ E; 4 — fen (mainly covered by *Carex elongata* L.) near Pogulianka village, 51°50′40.81″ N 25°6′31.55″ E; 5 — fen (mainly covered by *Carex acuta* L.) near Pogulianka, 51°49′16.55″ N 25°9′23.99″ E; 6 — fen (mainly covered by *C. acuta* and *Comarum palustre* L.) near Pogulianka, 51°49′17.89″ N 25°10′1.03″ E; 7 — fen (mainly covered by *Carex acutiformis* Ehrh.) near Birky village, 51°49′12.10″ N 25°10′38.97″ E; 8 — fen (mainly covered by *C. acuta*) near Birky, 51°47′23.90″ N 25°12′21.09″ E; 9 — fen (mainly covered by *C. acuta*) near Velyka Glusha, 51°51′2.57″ N 24°59′39.69″ E; 10 — fen (see description below) near Velyka Glusha, 51°50′19.34″ N 24°59′52.08″ E; 11 — alder forest near Velyka Glusha, 51°50′8.71″ N 25°3′51.97″ E; 12 — alder forest near Pogulianka, 51°50′7.29″ N 25°6′36.40″ E; 13 — alder forest near Birky, 51°47′6.08″ N 25°14′57.62″ E;14 — alder forest near Velyka Glusha, 51°50′5.05″ N 25°0′18.21″ E; 15 — willow forest near Nevir village, 51°51′49.94″ N 24°59′27.92″ E; 16 — hornbeam-birch forest near Pogulianka, 51°49′39.89″ N 25°10′6.03″ E; 17 — oak-pine forest near Pogulianka, 51°50′20.14″ N 25°9′43.80″ E; 18 — pine forest near Pogulianka, 51°49′57.02″ N 25° 6′29.90″ E.

The studied materials are stored in the Collection of terrestrial molluscs of I. I. Schmalhausen Institute of Zoology of National Academy of Sciences of Ukraine (Kyiv) under the numbers from IZAN GT 6082 to IZAN GT 6194. A few specimens of *V. moulinsiana* were also sent to Dr. M. Horsák (Masaryk University, Brno, Czech Republic).

The botanical part of this study was carried by M. Yarotskaya.

Tables 1 and 2 show the numbers of molluscs (including empty shells) collected in the above plots. These values are given only to provide an idea of how representative the data are and which species occur sporadically or are relatively abundant in the communities studied; there should be no quantitative interpretation of this data, because plots were studied unevenly.

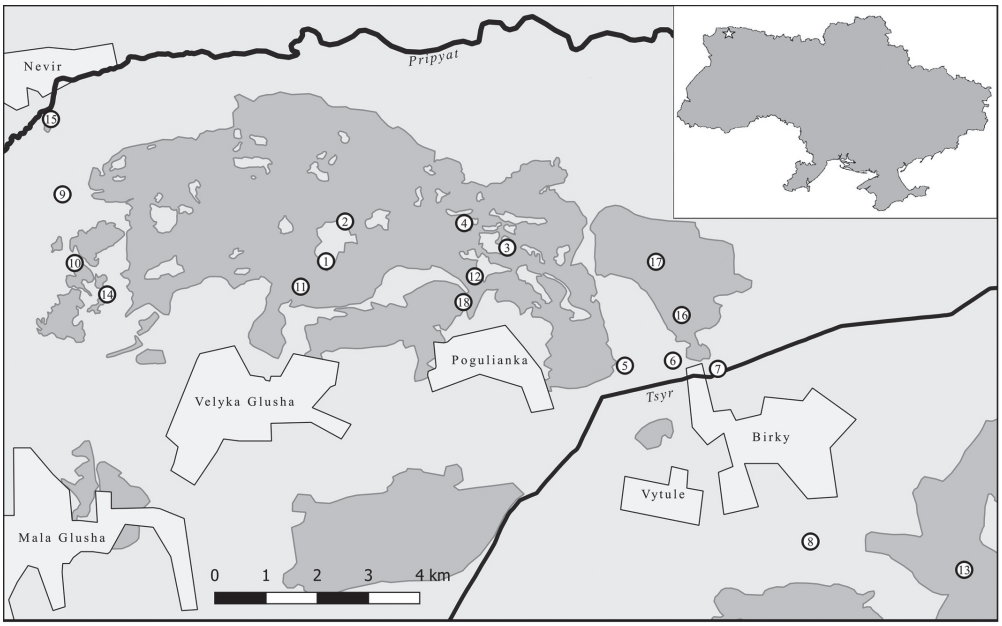

Fig. 1. Map with studies plots, 1–18 — see "Material and methods".

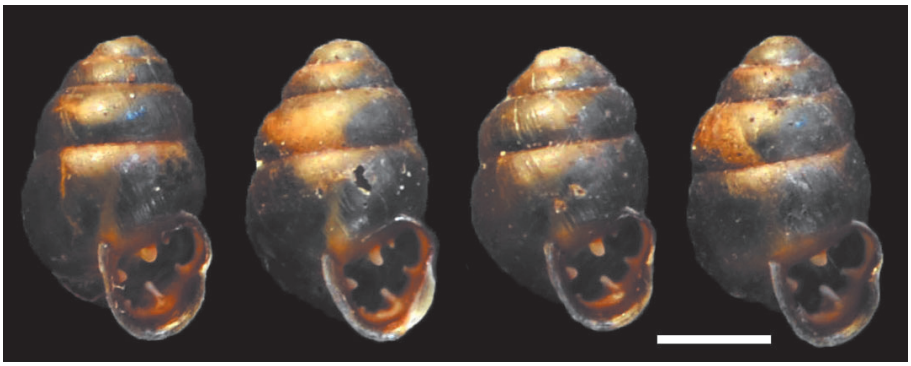

Fig. 2. Shells of *Vertigo moulinsiana* from the vicinities of Velyka Glusha (plot 10), scale bar 1 mm.

Results and discussion

Twenty-six species of terrestrial molluscs were found in the study area. In general, this species composition is similar to that reported from the vicinities of Velyka Glusha by Polansky (1932) who found here 20 species of this group. From the species reported by Polansky (1932) we have found all except two: *V. geyeri* and *Pupilla muscorum* (Linnaeus, 1758). In the latter case from the Polansky's (1932) comments it is more likely that he dealt with another species — *Pupilla alpicola* (Charpentier, 1837) [syn. *P. pratensis* (Clessin, 1871)]. Both these species are very rare on the East European Plain and restricted mainly to undisturbed fens (Balashov, 2016 a). Therefore, it is possible that these species are in decline in the area due to drainage of the fens, regulation of the Tsyr River and transformation of their habitats (but the area searched here is not studied enough to assume disappearance). At the same time, on the studied fens we have found several species that were not revealed by Polansky, most importantly *V. moulinsiana* and *V. angustior*.

The 33 specimens of *V. moulinsiana* (fig. 2) were collected in the two distant plots (at 5.5 km from each other) in fens, mainly alive from the vegetation, most frequently from the leaves of *Carex* spp. (fig. 3). Width of shell in collected specimens is 1.4–1.6 mm, height — 2.4–2.7 mm. Shell is ovate, dark brown or reddish, of 4.5–5 whorls. Aperture with broadly reflected margins, palatal incision, clear callus and 5–7 teeth: 1 parietal, 1 columellar, 1 basal, 2 palatal and often also additional small parietal and/or palatal. This is clearly corresponding to the descriptions of *V. moulinsiana* and within the known variability of this species (Pokryszko, 1990; Balashov, 2016 b).

Fig. 3. Alive *Vertigo moulinsiana* on the grass in the vicinities of Velyka Glusha (plot 10).

The two studied populations of *V. moulinsiana* are isolated from each other and much limited in their area of occupancy to the small fens on the margins of hayfields (plots 3 and 10). Since this snail lives in the sedges, it is worthwhile to describe the composition of the plants in its habitats. Plot 3 is the richest one among studied by us in this area not only regarding molluscs, but also by its plants' species composition. It is a wet fen with tussocks and mosses, mainly covered by *Carex elongata* L. and *Carex pallescens* L. The following plants are also relatively numerous here: *Comarum palustre* L., *Galium palustre* L., *Thelypteris palustris* Schott, *Phragmites australis* (Cav.) Trin. ex Steud., *Equisetum fluviatile* L., *Equisetum* sp., *Menyanthes trifoliate* L. The following plants occur here rather singularly or sporadically: *Lysimachia vulgaris* L., *Iris pseudacorus* L., *Caltha palustris* L., *Juncus effusus* L.,*Poa pratensis* L., *Alnus glutinosa* (L.) Gaertn., *Carex spicata* Huds., *Epilobium* sp., *Mentha aquatica* L., *Stachys palustris* L., *Ranunculus repens* L., *Stellaria fragilis* Klok., *Stellaria palustris* Retz., *Thyselium palustre* (L.) Raf., *Equisetum ramosissimum* Desf., *Salix cinerea* L., *Salix rosmarinifolia* L., *Ranunculus lingu* L., *Betula pubescens* Ehrh., *Bidens* sp., *Cirsium arvense* (L.) Scop., *Dactylorhiza incarnata* (L.) Soo, *Filipendula ulmaria* (L.) Maxim., *Geum rivale* L., *Lathyrus palustris* L., *Ranunculus acris* L., *Valeriana officinalis* L., *Coronaria flos-cuculi* (L.) A. Braun, *Frangula alnus* Mill. The orchid *D. incarnata* is officially protected in Ukraine by its Red Book and was not found by us on the other studied plots.

Plot 10 is also a wet fen with tussocks and mosses, mainly covered by *Carex acuta* L. and in less proportion by *Carex vesicaria* L., *Lysimachia vulgaris*, *Iris pseudacorus*, *Comarum palustre*, *Galium elongatum* C. Presl and *Phragmites australis*. The following plants are also present here: *Caltha palustris*, *Epilobium hirsutum* L., *Thelypteris palustris*, *Stellaria fragilis*, *Salix triandra* L., *Symphytum tauricum* Willd.

Therefore, both plots are similar in general appearance, covered mainly by the different *Carex* species. On both plots such plants as *Lysimachia vulgaris*, *Iris pseudacorus*, *Comarum palustre*, *Caltha palustris*, *Galium* spp., *Thelypteris palustris*, *Stellaria fragilis*, *Epilobium* spp. and *Phragmites australis* are present. All these plants were revealed also on some other plots around. Thus, we are unable to say that particular plant communities will necessarily hold *V. moulinsiana*, but the species appears to be restricted to a particu-

Table 1. Terrestrial molluscs of the studied fens in the Tsyr-Pripyat area (numbers of collected specimens are indicated)

Species / Locations	1	2	3	4	5	6	7	8	9	10
Carychium minimum Müller, 1774	–	2	40	19	–	–	–	12	–	–
Succinea putris (Linnaeus, 1758)	8	-	19	-	14	3	16	1	6	7
Oxyloma elegans (Risso, 1826)	–	–	–	–	–	–	–	–	14	3
Cochlicopa lubrica (Müller, 1774)	–	–	–	–	–	–	–	1	–	–
Cochlicopa nitens (Gallenstein, 1848)	–	–	15	–	–	–	–	–	–	–
Vertigo antivertigo (Draparnaud, 1801)	–	–	7	–	–	–	6	4	–	1
Vertigo pygmaea (Draparnaud, 1801)	–	–	2	–	–	–	–	1	–	–
Vertigo moulinsiana (Dupuy, 1849)	–	–	17	–	–	–	–	–	–	16
Vertigo angustior Jeffreys, 1830	–	–	–	–	–	–	–	1	–	–
Vallonia pulchella (Müller 1774)	–	–	7	–	–	–	–	2	–	–
Perpolita hammonis (Strøm, 1765)	–	–	–	–	–	–	–	3	–	–
Zonitoides nitidus (Müller, 1774)	–	1	3	3	4	1	9	10	1	4
Euconulus fulvus (Müller, 1774)	–	–	11	2	–	–	–	2	–	3
Deroceras laeve (Müller, 1774)	–	–	1	–	-	–	2	3	2	–
Pseudotrichia rubiginosa (Rossmässler, 1838)	–	–	6	–	–	–	–	–	–	–
Number of species	1	2	11	3	2	2	4	11	4	6

Table 2. Terrestrial molluscs collected in the studied forests of the Tsyr-Pripyat area

Species / Locations	Alder-1 (11)	Alder-2 (12)	Alder-3 (13)	Alder-4 (14)	Willow (15)	Hornbeam-birch (16)	Oak-pine (17)	Pine (18)
Carychium minimum Müller, 1774	3	16	9	1	–	–	–	–
Succinella oblonga (Draparnaud, 1801)	2	–	6	3	–	2	1	–
Oxyloma elegans (Risso, 1826)	–	3	–	–	4	–	–	–
Cochlicopa lubricella (Porro, 1838)	–	–	–	-	–	3	–	–
Cochlicopa lubrica (Müller, 1774)	13	1	4	8	–	–	–	–
Cochlicopa nitens (Gallenstein, 1848)	2	–	–	6	–	–	–	–
Vertigo pusilla Müller, 1774	–	–	–	–	–	1	–	–
Vertigo antivertigo (Draparnaud, 1801)	–	2	–	–	–	–	–	–
Vertigo substriata (Jeffreys, 1833)	–	–	3	–	–	–	–	–
Vallonia costata (Müller, 1774)	–	–	–	–	–	6	2	-
Vallonia pulchella (Müller, 1774)	1	-	2	-	-	–	–-	-
Punctum pygmaeum (Draparnaud, 1801)	1	-	1	-	-	3	1	-
Discus ruderatus (Férussac, 1821)	–	–	–	-	–	5	–	–
Perpolita hammonis (Strøm, 1765)	6	11	20	3	–	9	11	–
Zonitoides nitidus (Müller, 1774)	21	5	6	3	2	–	–	–
Euconulus fulvus (Müller, 1774)	2	3	1	1	1	1	2	-
Vitrina pellucida (Müller 1774)	–	–	–	1	–	5	13	–
Deroceras laeve(Müller, 1774)	–	–	–	2	–	–	–	–
Deroceras agreste (Linnaeus, 1758)	–	–	–	1	–	–	-	–
Arion fuscus (Müller, 1774)	–	–	–	–	-	–	–	1
Fruticicola fruticum (Müller, 1774)	–	–	–	–	–	4	2	–
Pseudotrichia rubiginosa (Rossmässler, 1838)	11	–	–	–	–	–	–	–
Number of species	10	7	9	10	3	10	7	1

lar type of fen. It is likely that the presence of this snail depends on the history of plot's usage, other anthropogenic influences, water regime and soils.

The locality where *V. moulinsiana* was known in the Crimea is somewhat similar botanically, as shown by the presence of such plants as *Carex* spp., *Epilobium* spp., *Equisetum* spp. and *Stachys palustris* (Balashov, Palatov, 2011; Balashov, 2013).

For Europe generally *V. moulinsiana* was reported to live most often on the *Glyceria maxima* (Hartm.) Holmb., *Carex* spp. (the species different from those listed above), *Phragmites australis*, *Typha* spp., *Iris pseudacorus*, *Epilobium* spp. and some other plants (Killeen, 2003). It corresponds with our botanical observations only on the generic level or with some very common species of plants.

The area of occupancy of these two populations of *V. moulinsiana* cannot be exactly estimated from our data, however in both cases it is probably less than 0.01 km^2. It is likely that there are other similar restricted populations to be found in the vicinity. It is worth noting that most sites in this area hold very few molluscs. In the most of the checked open habitats (fens, meadows, etc.) we found no molluscs at all; even plots with 1–2 common species (table 1) are rather exceptional. Fens with several terrestrial mollusc species are very rare here and hard to predict visually without searching for mollusks for some time. In our study, fens in which *Vertigo* species (table 1) were found were searched for several hours by 4 collectors; nevertheless, rather few molluscs were collected, and for many species only 1–2 specimens were revealed.

Both plots with *V. moulinsiana* are placed within "Pripyat-Stohid" National Nature Park, however one of them (plot 3) is on its southern border. We have no information on zonation of the territories within this park, but from what we know on the other protected areas with such status in Ukraine, most likely anthropogenic activities are only slightly limited on these plots in park's periphery. Therefore, conservation management of these lands should be changed in accordance with the requirements of *V. moulinsiana*.

There are several major threats for the habitats of *V. moulinsiana* in this area. These habitats can be transformed by excessive grass cutting and regular premeditated fires, which take place on the other plots in this area and can be crucial for surviving of *V. moulinsiana* (Cameron et al., 2003; Killeen, 2003). Any marsh drainage on adjacent territories or regulation of the adjacent rivers will be dangerous for populations of *V. moulinsiana*, because this species is very sensitive to any changes in hydrological regime (Cameron et al., 2003). Such changes are not so much expected in this area as other threats, since there is a "Pripyat-Stohid" National Nature Park. However, it is still possible and already takes place near some other protected areas in Northern Ukraine, which caused major hydrological changes within such protected territories and decline of terrestrial molluscs (Balashov, Kobzar, 2013; Balashov, 2016 a). However, the most immediate threat for the revealed habitats of *V. moulinsiana* is illegal amber mining that can take place here in the near future. Such activities have obtained huge proportions in north-western Ukraine during last 3 years. They often involve hundreds of illegal miners at the same time and result in complete destruction of any habitats. It has already taken place in some protected territories (Balashov, 2016 a). From the words of the local people in Velyka Glusha village they are expecting such activities in the near future around their village. The level of threat within the national nature park is unpredictable.

Therefore, according to IUCN criterions (IUCN, 2012 a, b) conservation status for *V. moulinsiana* in this area should be considered as CR B1ab(iii)+2ab(iii), which is true also for Ukraine on the national level, since there are no other known population remaining. This species should be listed into the Red Book of Ukraine.

Most of the other mollusk species revealed in the studied plots are common and widespread not only in Volyn, but across almost whole Ukraine (Balashov, 2016 b). Among the species that were found in Tsyr-Pripyat area the uncommon and rare ones all belong to the genus *Vertigo*. In addition to *V. moulinsiana* these are *V. angustior*, *V. antivertigo* and *V. substriata*. The first two of these species were reported from the "meadows" of Volyn as very rare ones (Baidashnikov, 1992), they are sporadically distributed across most part of East European Plain, first of all its forest-steppe zone (Balashov, Gural-Sverlova, 2012; Balashov et al., 2013; Balashov, Kryvokhyzha, 2015; Balashov, Brusentsova, 2015; Balashov, 2016 a, b). The third species, *V. substriata*, is not rare for the swampy landscapes of Polesian Lowland, but almost absent to the south from it: the only known population is on the small fen in "Slobozhansky" National Nature Park (Balashov, Brusentsova, 2015).

General species composition of terrestrial molluscs in the studied area is similar to that known for the swampy landscapes without broad-leaved forests in western part of Polesian Lowland (Baidashnikov, 1992; Balashov, 2012, 2016 a, b; Balashov, Gural-Sverlova, 2012; Balashov, Kobzar, 2013). In Polesie, the greatest part of terrestrial molluscan diversity is restricted to the oak and hornbeam forests (Baidashnikov, 1992; Balashov, 2012, 2016 b; Balashov, Kobzar, 2013). In the Tsyr-Pripyat area there are very few plots with such habitats, they are much fragmented and not well preserved. In the studied forests, there are only two species that generally (but not exclusively) associated with broad-leaved forests of Polesian Lowland: *Vertigo pusilla* Müller, 1774 and *Discus ruderatus* (Férussac, 1821). These species are common and widespread in the oak and hornbeam forests not only in Polesian Lowland, but also on almost the whole East European Plain (Balashov et al., 2013; Balashov,

Kryvokhyzha, 2015; Balashov, Brusentsova, 2015; Balashov, 2016 b). Consequently, species composition of terrestrial molluscs associated with broad-leaved forests is very poor in the studied area.

The revealed species composition of terrestrial molluscs in the alder forests of the studied area is not so poor and is comparable to that generally known for the alder forests of Volyn Region, of other parts of Polesian Lowland (Baidashnikov, 1992; Balashov, 2012; Balashov, Kobzar, 2013) and even other parts of East European Plain (Balashov et al., 2013; Balashov, Kryvokhyzha, 2015; Balashov, Brusentsova, 2015). From the species commonly known for the alder forests of Volyn (Baidashnikov, 1992) only two were not revealed here: *Perpolita petronella* (Pfeiffer, 1853) and *Perforatella bidentata*(Gmelin, 1791).

Thus while the recorded molluscan faunas of this area are generally poor, and consist mainly of common and widespread species, there are small, isolated areas of fen in which rare species of *Vertigo* survive. Most importantly, these include *V. moulinsiana*. There are no other existing populations of this species known in Ukraine and its conservation status is estimated to be "Critically Endangered" on the national level.

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