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TERRESTRIAL MOLLUSCS IN THE DRY GRASSLANDS OF THE DNIPRO UPLAND (CENTRAL UKRAINE): NEW RECORDS, RARE SPECIES AND CONSERVATION POTENTIAL

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Terrestrial Molluscs in the Dry Grasslands of the Dnipro Upland (Central Ukraine): New Records, Rare Species and Conservation Potential. Balashov, I., Vasyliuk, O., Shyriaieva, D., Shvydka, Z., Oskyrko, O., Marushchak, O., Stetsun, H., Bezsmeretna, O., Babytskij, A., Kostiushyn, V. — Thirty-six species of terrestrial molluscs were found in the dry grasslands and rock outcrops of the study area, including three that were not previously known for Central Ukraine: *Granaria frumentum*, *Pupilla bigranata* and *Mediterranea inopinata*. These species are relics related to dry open habitats and require conservation in Ukraine on the national level, *G. frumentum* is already listed in the Red Book of Ukraine, and the other two should be listed in its next edition. It is proposed to create the new protected areas in the most important newly revealed locations of these species. These rocky areas also retain the high diversity of land molluscs in the region. The invasive snail *Xeropicta derbentina* was found for the first time on the Dnipro Upland, on the edge of natural dry grassland. The rare native snail *Morlina glabra* was recorded for the first time in Kyiv Region, it is proposed to be included into the regional red list.

Key words: Mollusca, Gastropoda, Stylommatophora, ecology, conservation.

Introduction

The Dnipro Upland is situated between the Dnipro and Southern Bug rivers in the forest-steppe zone of the East European Plain. Its altitude is mostly around 200–240 m and the highest point is 323 m. Originally it was covered mainly by oak-hornbeam forests, steppes (dry grasslands) and alder forests in the floodplains along rivers, but most of this upland is now covered with anthropogenic habitats.

The terrestrial molluscs of the Dnipro Upland are relatively well-known (Balashov, Baidashnikov, 2010; Balashov, Gural-Sverlova, 2012; Balashov, 2016 a, b). 56 species are known from its natural habitats, but only 13 of these have been recorded from the steppes (Balashov, Baidashnikov, 2010). These 13 species are widespread and common. Most of them are not specific to dry habitats, except for *Pupilla muscorum* (Linnaeus, 1758) and *Chondrula tridens* (Müller, 1774). However, several rare steppe relic land snails are known to occur in some regions both west and east of the Dnipro Upland, that are also situated in the forest-steppe zone of the East European Plain: on the Podolian Upland (Balashov et al., 2013 a) and the Central Russian Upland (Balashov & Kryvokhyzha, 2015). These rare species require conservation at least on the national level in Ukraine (Balashov, 2016 a).

The goal of this study was to find threatened relic land snails in the steppes and rock outcrops of the Dnipro Upland, to describe their habitats, to reveal possible threats to them and to propose conservation of these habitats.

Material, methods and habitats

Material was collected between 13.07 and 11.09.2016 in Cherkasy, Kyiv and Kirovograd Regions of Ukraine. Plots were not standard in size, but within each common methods of terrestrial mollusc collecting, fixation and identification were used (Kerney & Cameron, 1979; Balashov, 2016 b). All studied materials are deposited 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.

The selection of study locations was carried out using existing botanical data and GIS data from Google Earth — the visually less disturbed grasslands and rock outcrops in the region were chosen to for sampling. Figure 1 shows the location of study plots, and the list below gives details of their location and altitude.

Study plots (fig. 1): 1 — rocky steppe, large island on the Ros' River in Boguslav town (Kyiv Region), 135 m, 49.54420 N 30.86845 E; 2 — same, another plot, 130 m, 49.54483 N, 30.87098 E; 3 — same, another plot, 120 m, 49.54301 N 30.87610 E; 4 — same, another plot, 115 m, 49.54156 N 30.87773 E; 5 — rocky steppe on the right bank of Ros' River near monastery in the vicinities of Boguslav, 125 m, 49.53594 N 30.88944 E; 6 — rocky steppe, island on the Ros' River near Khokhitva village (Boguslav District), 120 m, 49.52398 N 30.91413 E; 7 — large rock above the Ros' River on its right bank near Khokhitva village, 125 m, 49.52328 N 30.91409 E; 8 — rocky steppe below large rocks, neglected quarry on the right bank of Ros' River near Khokhitva village, 115 m, 49.52231 N 30.92343 E; 9 — rocky steppe on the right bank of Ros' River near Deshky village (Boguslav District), 115 m, 49.535444 N 30.953086 E; 10 — rocky steppe on the left bank of Ros' River near Deshky village, 120 m, 49.53396 N 30.95664 E; 11 — rocky steppe on the left bank of Ros' River near Kalynivka village (Boguslav

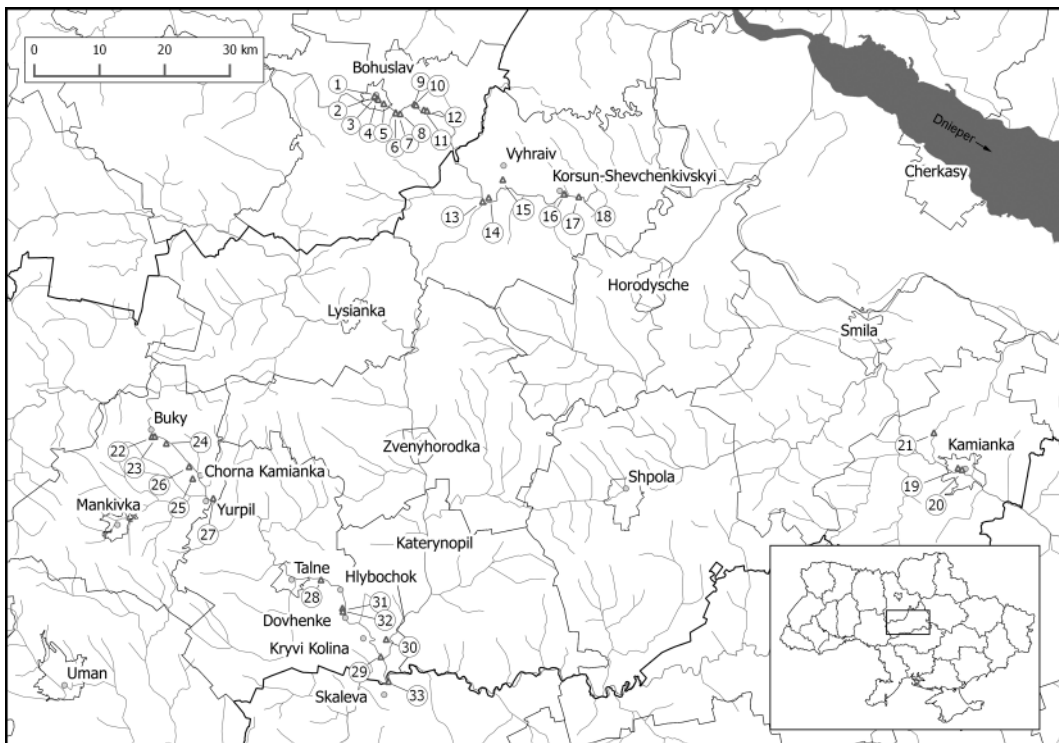


Fig. 1. Map showing the location of study plots.

District), 120 m, 49.52753 N 30.97261 E; 12 — large rock above the Ros' River on its left bank near Kalynivka village, 120 m, 49.52644 N 30.97919 E; 13 — large rock (Rock of Nechuy-Levytsky) above the Ros' River on its right bank, near church of Stebliv settlement (Cherkasy Region, Korsun-Shevchenkivskiy District), 115 m, 49.403598 N 31.095043 E; 14 — rocky steppe above the left bank of the Ros' River, near hydroelectric station of Stebliv settlement, 120 m, 49.408729 N 31.107705 E; 15 — feather grass steppe (more details in text below) near Stebliv settlement, 130 m, 49.433231 N 31.137030 E; 16 — steep slope with large rocks, large island on the Ros' River, park of Korsun-Shevchenkivskiy town (more details in text below), 100 m, 49.413893 N 31.265968 E; 17 — island adjacent to previous, large rocks with shrubs, 100 m, 49.413669 N, 31.264368 E; 18 — rocky steppe on the right bank of the Ros' River near Karashyna village, 95 m, 49.4100 N 31.2953 E; 19 — rocky steppes along the right side of the Canyon of Tiasmin River in Kamyanka town (Cherkasy Region), 115–125 m, around 49.04112 N 32.08538 E; 20 — small plot of the rocky steppe on the left bank of Tiasmin River near its canyon, Kamyanka town, 120 m, 49.03902 N 32.09383 E; 21 — rocky steppe on the hill above small river, site of ancient settlement, near Plyakivka village (Kamyanka District), 130 m, 49.08931 N 32.03525 E; 22 — rocky steppe on the right bank of Girskiy Tikych River near Buky settlement (Man'kivka District, Cherkasy Region), 165 m, 49.08414 N 30.40568 E; 23 — rocky dry grassland on the left bank of Girskiy Tikych River near bridge Buky settlement, 160 m, 49.08442 N 30.41179 E; 24 — rocky steppe in small reserve on the right bank of the Girskiy Tikych River near Buky settlement, 150 m, 49.07488 N 30.43574 E; 25 — dry grassland on the hill above the right of the Girskiy Tikych River near Chorna Kam'yanka village (Man'kivka District), 175 m, 49.02676 N 30.49067 E; 26 — rocky steppe on the left bank of the Girskiy Tikych River near Chorna Kam'yank village, 170 m, 49.04319 N 30.48321 E; 27 — rocky steppe on the left bank of the Girskiy Tikych River near Yurpil village (Man'kivka District), 160 m, 48.99987 N 30.53354 E; 28 — rocky steppe on the left bank of the Girskiy Tikych River near Tal'ne settlement (Cherkasy Region, Tal'ne District), 48.88852 N 30.75862 E; 29 — feather grass steppe without rocks on the left bank of the Girskiy Tikych River near Dobrianka village (Tal'ne District), 48.78309 N 30.88288 E; 30 — steppe without rocks near Lotasheve village (Tal'ne Ddistrict), 120 m, 48.80693 N 30.89432 E; 31 — well represented rocky steppe on the left bank of the Girskiy Tikych River near Glybochok village (Tal'ne District), 120 m, 48.849710 N 30.803300 E; 32 — same, another plot, 48.84497 N 30.804212 E; 33 — rocky steppe near Skaleva village (Novoarhangelsk District, Kirovograd Region), 48.74907 N 30.899227 E.

The main vegetation class in most plots was *Festuco-Brometea*. Often, there were granite outcrops, covered by various epilithic plants (vegetation classes *Asplenieta trichomanes* and *Sedo-Scleranthetea*), and occasionally with shrubs — *Spiraea hypericifolia* L., *Cerasus fruticosa* (Pall.) Woronow, *Chamaecytisus austriacus* (L.) Link, *Amygdalus nana* L., *Cotoneaster melanocarpus* Fisch. ex A. Blytt.

The vegetation and relief of plots in most cases had a mosaic structure (plots 1–7, 9–14, 18–24, 26–28, 31–33), which depends on granite outcrops and combines cl. *Festuco-Brometea* with cl. *Sedo-Scleranthetea* and sometimes cl. *Asplenieta trichomanes*. These plots were covered mainly by *Festuca valesiaca* aggr., *Poa bulbosa* L., *Poa angustifolia* L., *Koeleria cristata* (L.) Pers., *Teucrium chamaedrys* L., *Medicago falcata* L., *Sedum maximum* subsp. *ruprechtii* (Jalas) Soó, *Sedum acre* L., *Sempervivum ruthenicum* (W. D. J. Koch) Schnittsp. & C. B. Lehm., *Eryngium campestre* L., *Elytrigia repens* (L.) Nevski, *Galium verum* L., *Bromopsis inermis* (Leyss.) Holub, *Trifolium arvense* L., *Salvia nemorosa* L., *Potentilla incana* P. Gaertn., B. Mey. & Scherb., *Seseli tortuosum* L., *Salvia nutans* L., *Phlomis tuberosa* L., *Artemisia austriaca* Jacq., *Artemisia marschalliana* Spreng. Shrubs were sometimes present.

Plots 14, 19, 28, 31 had sites covered by feather grass steppe on granite outcrops, with *Stipa capillata* L., *Euphorbia cyparissias* L., *Poa bulbosa* L., *Festuca valesiaca* aggr., *Teucrium chamaedrys* L., *Sempervivum ruthenicum* (W. D. J. Koch) Schnittsp. & C. B. Lehm., *Salvia nemorosa* L., *Allium* sp.

Plots 5, 7, 13, 16, 17 were notable for large rocks with rich moss and lichen cover.

Plots 15, 29, 30 lacked granite rocks, and were covered by feather grass steppe vegetation with *Stipa capillata* L., *Festuca valesiaca* aggr., *Salvia nemorosa* L., *Galium verum* L., *Seseli tortuosum* L., *Thymus marschallianus* Willd., *Allium* sp., etc., with moss and occasional shrubs.

Plots 8 and 25 differed from other plots in the degree of anthropogenic transformation of relief and vegetation. The areas of these plots were used as quarries in the past, and they were covered mainly by *Elytrigia repens* (L.) Nevski, with such plants as *Anisantha tectorum* (L.) Nevski, *Berteroa incana* L., *Sonchus arvensis* L., *Convolvulus arvensis* L.

Dry grass had been burnt in the previous year in plots 1–5, 9, 11, 13, 14, 19, 20, 22–25, 28–32. Cattle grazing was seen in plots 5, 9, 14, 19, 20, 23, 24, 30.

Tables 1, 2 and 3 show the numbers of molluscs (including empty shells) collected in the study plots. Numbers of specimens recovered are shown to indicate relative abundance. Because sampling was not standardized (but never superficial), no quantitative analyses have been carried out.

Results and discussion

36 species of terrestrial molluscs were found in the steppes and rock outcrops of the Dnipro Upland during this study (tables 1–3). The faunas revealed are unexpectedly rich for the open habitats of the East European Plain. They contain numerous rare species and

Table 1. Terrestrial molluscs of the dry grasslands and rock outcrops in Ros' River Valley in Kyiv Region

Species / Locations	1	2	3	4	5	6	7	8	9	10	11	12
<i>Succinella oblonga</i> (Draparnaud, 1801)	2	2	8	16	1	23	–	–	–	1	–	–
<i>Succinea putris</i> (Linnaeus, 1758)	–	–	–	–	–	–	25	–	–	–	–	–
<i>Cochlicopa lubricella</i> (Porro, 1838)	12	1	25	7	6	16	–	30	5	19	–	1
<i>Cochlicopa lubrica</i> (Müller, 1774)	2	2	6	11	–	35	4	33	–	–	–	–
<i>Cochlicopa nitens</i> (Gallenstein, 1848)	–	–	–	–	–	6	2	–	–	–	–	–
<i>Pupilla muscorum</i> (Linnaeus, 1758)	1	–	1	51	4	24	–	65	5	8	–	–
<i>Pupilla bigranata</i> (Rossmässler, 1839)	16	–	–	1	3	3	–	–	–	–	–	–
<i>Vertigo pygmaea</i> (Draparnaud, 1801)	–	–	1	5	3	–	–	–	–	–	–	–
<i>Truncatellina cylindrica</i> (Férussac, 1807)	2	–	–	–	2	1	1	–	–	1	–	–
<i>Vallonia costata</i> (Müller, 1774)	3	–	32	15	5	13	–	48	2	17	4	–
<i>Vallonia pulchella</i> (Müller, 1774)	16	1	12	39	32	28	–	22	8	24	–	4
<i>Granaria frumentum</i> (Draparnaud, 1801)	–	–	–	–	–	38	–	320	–	49	–	–
<i>Chondrula tridens</i> (Müller, 1774)	–	2	–	1	–	11	–	–	3	51	54	–
<i>Laciniaria plicata</i> (Draparnaud, 1801)	–	–	–	–	–	84	–	1	–	–	–	–
<i>Punctum pygmaeum</i> (Draparnaud, 1801)	–	–	1	–	–	–	–	–	–	–	–	–
<i>Discus ruderatus</i> (Férussac, 1821)	–	–	–	1	–	1	–	–	–	–	–	–
<i>Perpolita hammonis</i> (Strøm, 1765)	8	–	3	7	3	5	2	12	–	–	–	–
<i>Morlina glabra</i> (Rossmässler, 1836)	–	–	–	–	–	–	19	–	–	–	–	–
<i>Mediterranea inopinata</i> (Uličný, 1887)	–	–	–	–	2	–	–	–	–	1	–	–
<i>Zonitoides nitidus</i> (Müller, 1774)	–	1	1	–	–	2	19	–	–	–	–	–
<i>Euconulus fulvus</i> (Müller, 1774)	–	–	–	–	–	–	1	–	–	–	–	–
<i>Vitrina pellucida</i> (Müller 1774)	11	6	–	9	15	6	–	–	1	3	–	–
<i>Lehmannia marginata</i> (Müller, 1774)	–	–	–	–	–	–	–	–	–	1	–	–
<i>Deroceras</i> sp. (juvenile)	–	–	–	–	–	–	1	–	–	–	–	–
<i>Arion</i> sp. (juvenile)	–	–	–	–	–	–	1	–	–	–	–	–
<i>Fruticicola fruticum</i> (Müller, 1774)	–	–	–	–	11	–	4	–	–	–	–	–
<i>Austrotachea vindobonensis</i> (Férussac, 1821)	4	–	2	4	6	60	1	2	6	40	26	1
<i>Euomphalialis trigella</i> (Draparnaud, 1801)	–	–	–	–	2	–	–	1	–	–	–	–
<i>Pseudotrichia rubiginosa</i> (Rossmässler, 1838)	–	5	–	5	–	9	45	–	–	–	–	–
Number of species	11	8	11	14	14	18	13	10	7	12	3	3

Note. 1–12 — numbers of plots, see “material and methods”.

species that are not typical for these open habitats. Three species found were not previously known from Central Ukraine: *Pupilla bigranata* (Rossmässler, 1839), *Granaria frumentum* (Draparnaud, 1801) and *Mediterranea inopinata* (Uličný, 1887). These species are relic inhabitants of the open dry habitats, mainly rocky ones.

G. frumentum is distributed mostly in Southern and Central Europe, from south-eastern France and southern Germany to Balkans and Ukraine (Welter-Schultes, 2012). The most eastern locality of this species previously known is situated in Moldova (Balashov et al., 2013 b), 250 km south-west from our findings. In Ukraine only 3 locations of this species were known (or 2 in the terms of IUCN), in its most western part (Lviv and Transcarpathian Regions), so more than 500 km from our sites. This species is listed in the Red Book of Ukraine since 1994 and considered to be EN B2ab (iii) according to IUCN criteria (IUCN, 2012 a, b) on the national level (Balashov, 2016 a).

It should be noted that “*Abida frumentalis* Drap.” was reported from Stebliv in the Cherkasy region of Ukraine by Put’ (1954). Because there were many errors in that work, this record was discounted other than in an historical context (Balashov, 2016 a). Since we have found *G. frumentum* (fig. 2) in 5 locations (in the terms of IUCN it could be considered as 3) along Ros’ River in both Kyiv and Cherkasy Regions, it would appear that this record is correct.

Near the town of Boguslav, three plots with *G. frumentum* are situated in the rocky steppes on both banks of Ros' River and on the one island. Apparently, one of these localities is a small quarry that was abandoned at least a few tens of years ago. Nowadays it is covered by natural vegetation and large rocks remain exposed, so it seems that *G. frumentum* has been able to colonise the site, which appears to be particularly favourable, as since these snails are very numerous here. The size of 3 plots with *G. frumentum* near Boguslav is: about 100 × 200 m (island), 20 × 50 m (former quarry on right bank) and 10 × 40 m (plot on left bank), but it should be considered that snail is distributed patchily on these plots and does not cover them completely.

Another locality of *G. frumentum* (fig. 2) is near Korsun-Shevchenkivskiy town on the island in canyon of Ros' River in the park of a historical 18–19th century estate that was founded by Stanisław Poniatowski the last king of Poland (the locality of *G. frumentum* is 100 m below the palace). This population inhabits a very steep slope (practically a wall of the canyon) that is mainly formed by large rocks. The area of this slope where we have found *G. frumentum* is much limited: we have found it on a plot about 40 m long and 10 m wide. The rich species composition of molluscs revealed in this locality is also discussed below.

This plot (16) was covered mainly by *Aurinia saxatilis* (L.) Desv., *Sempervivum rutenicum* (W. D. J. Koch) Schnittsp. & C. B. Lehm., *Syringa* sp., *Spiraea hypericifolia* L., *Sedum maximum* subsp. *ruprechtii* (Jalas) Soó, *Allium* sp., on an almost vertical granite slope.

The most unusual site containing *G. frumentum* is situated near Stebliv settlement: it is a plot about 100 m long and 20 m wide along a dirt road with natural feather grass steppe on the slope, 500 m north to the Ros' River in the upper part of its valley. There are no rock outcrops in this habitat or elsewhere around, which is very unusual for *G. frumentum* that is generally considered to be a rock-dweller. This species is numerous in this locality and living specimens were found.

The vegetation of the plot was feather grass steppe vegetation without granite rocks, with *Stipa capillata* L., *Festuca valesiaca* aggr., *Salvia nemorosa* L., *Poa angustifolia* L., *Medicago falcata* L., *Galium verum* L., *Artemisia marschalliana* Spreng., *Seseli tortuosum* L., *Thymus marschallianus* Willd., *Bromopsis inermis* (Leys.) Holub, *Allium* sp., etc., with rich moss cover.



Fig. 2. Shells of *Granaria frumentum* from the vicinities of Korsun-Shevchenkivskiy town.

Table 2. Terrestrial molluscs of the dry grasslands and rock outcrops of Ros' and Tiasmin rivers basins in Cherkasy Region

Species / Locations	13	14	15	16	17	18	19	20	21
<i>Succinella oblonga</i> (Draparnaud, 1801)	3	1	5	122	1	2	–	3	–
<i>Cochlicopa lubricella</i> (Porro, 1838)	–	1	35	13	1	1	19	10	2
<i>Cochlicopa lubrica</i> (Müller, 1774)	10	–	–	–	–	–	27	2	2
<i>Pupilla muscorum</i> (Linnaeus, 1758)	10	1	–	–	–	3	32	11	–
<i>Pupilla bigranata</i> (Rossmässler, 1839)	11	2	–	114	2	3	–	–	–
<i>Vertigo pusilla</i> Müller, 1774	–	–	–	22	–	–	–	–	–
<i>Vertigo pygmaea</i> (Draparnaud, 1801)	–	–	17	42	–	3	–	–	–
<i>Vertigo angustior</i> Jeffreys, 1830	–	–	–	1	2	–	–	–	–
<i>Truncatellina cylindrica</i> (Férussac, 1807)	1	–	17	186	–	29	1	–	–
<i>Truncatellina costulata</i> (Nilsson, 1823)	–	–	–	54	–	–	–	–	–
<i>Vallonia costata</i> (Müller, 1774)	16	–	4	29	–	26	8	10	8
<i>Vallonia pulchella</i> (Müller, 1774)	6	3	74	71	–	4	13	49	4
<i>Granaria frumentum</i> (Draparnaud, 1801)	–	–	197	190	–	–	–	–	–
<i>Chondrula tridens</i> (Müller, 1774)	–	15	30	–	–	–	252	7	182
<i>Cochlodina laminata</i> (Montagu, 1803)	–	–	–	5	–	–	–	–	–
<i>Laciniaria plicata</i> (Draparnaud, 1801)	–	–	–	1	12	–	4	1	–
<i>Punctum pygmaeum</i> (Draparnaud, 1801)	–	–	–	5	–	8	–	–	–
<i>Discus ruderratus</i> (Férussac, 1821)	–	–	–	–	–	–	1	–	–
<i>Aegopinella minor</i> (Stabile, 1864)	–	–	–	7	–	–	–	–	–
<i>Perpolita hammonis</i> (Strøm, 1765)	13	–	–	9	–	2	1	–	1
<i>Mediterranea inopinata</i> (Uličný, 1887)	–	1	3	3	–	–	1	–	2
<i>Zonitoides nitidus</i> (Müller, 1774)	–	–	–	–	–	–	1	–	–
<i>Euconulus fulvus</i> (Müller, 1774)	–	–	13	7	–	–	–	–	–
<i>Vitrina pellucida</i> (Müller 1774)	1	1	6	52	5	6	1	2	6
<i>Fruticicola fruticum</i> (Müller, 1774)	–	–	–	–	–	–	2	–	–
<i>Austrotachea vindobonensis</i> (Férussac, 1821)	–	12	2	1	1	4	–	7	6
<i>Helix pomatia</i> (Linnaeus, 1758)	–	–	–	3	–	–	–	–	–
<i>Xeropicta derbentina</i> (Krynicky, 1836)	–	–	–	–	–	–	57	–	–
<i>Euomphalia strigella</i> (Draparnaud, 1801)	–	11	–	8	3	5	–	–	1
<i>Pseudotrichia rubiginosa</i> (Rossmässler, 1838)	–	–	–	1	2	–	1	–	–
Number of species	9	10	12	24	9	13	16	10	10

Note. 13–21 — numbers of plots, see “Material and methods”.

Therefore, four of the recorded locations for *G. frumentum* are situated directly on the banks of Ros' River and the fifth one is situated in its valley. This species was not found in the similar rocky habitats along other rivers in the region. It allows us to hypothesize that perhaps most of the revealed (sub)populations, or even all of them, exist here because of metapopulation dynamics (Hanski, 1998) with the flow of Ros' River: snails are dispersed by water and have re-colonized plots where they were once destroyed due to anthropogenic activities that have now ceased. At the least, this suggests that the most important locations for conservation of this species are ones situated in upper part of the river, near Khohitva village, first of all an island with rocky steppe (plot 6).

Pupilla bigranata is distributed from Central Europe to Central Asia, mainly through the steppe zone (Balashov, 2016 b). There are some differences in understanding of this species: western authors mainly understood under this name a form of *Pupilla muscorum* from France (e. g. Nekola et al., 2015), but authors from Eastern Europe view it as a species that is rather close to *Pupilla triplicata* (Studer, 1820) and associated mainly with Eurasian Steppe (see review of these problems in Balashov, 2016 b). The latter view is followed here. In Ukraine *P. bigranata* is known from several locations in the Black Sea Lowland, Podo-

Table 3. Terrestrial molluscs of the dry grasslands and rock outcrops of Girsky Tikych River Basin

Species / Locations	22	23	24	25	26	27	28	29	30	31	32	33
<i>Succinella oblonga</i> (Draparnaud, 1801)	3	–	4	2	–	4	–	–	–	5	2	15
<i>Cochlicopa lubricella</i> (Porro, 1838)	12	1	24	2	39	9	6	–	5	–	3	11
<i>Cochlicopa lubrica</i> (Müller, 1774)	1	–	22	–	–	2	–	–	–	–	–	18
<i>Pupilla muscorum</i> (Linnaeus, 1758)	8	–	3	–	–	5	1	–	–	–	–	1
<i>Pupilla bigranata</i> (Rossmässler, 1839)	1	–	–	–	–	7	4	–	–	–	–	6
<i>Vertigo pygmaea</i> (Draparnaud, 1801)	7	–	–	–	–	4	–	–	2	5	1	1
<i>Truncatellina cylindrica</i> (Férussac, 1807)	–	–	3	–	–	–	–	–	1	1	2	1
<i>Vallonia costata</i> (Müller, 1774)	9	1	3	3	–	8	6	–	11	8	29	18
<i>Vallonia pulchella</i> (Müller, 1774)	15	3	16	–	16	10	5	2	–	57	12	39
<i>Chondrula tridens</i> (Müller, 1774)	–	–	8	11	14	1	14	–	2	6	13	2
<i>Punctum pygmaeum</i> (Draparnaud, 1801)	–	–	–	–	–	1	–	–	–	–	–	–
<i>Perpolita hammonis</i> (Strom, 1765)	9	–	1	–	–	–	–	–	–	–	–	1
<i>Mediterranea inopinata</i> (Uličný, 1887)	3	–	1	–	2	2	–	–	–	2	–	–
<i>Euconulus fulvus</i> (Müller, 1774)	–	–	–	–	–	4	–	–	–	5	1	–
<i>Vitrina pellucida</i> (Müller 1774)	13	5	5	–	7	2	1	–	–	31	2	10
<i>Fruticicola fruticum</i> (Müller, 1774)	–	–	–	–	1	–	–	–	–	–	–	–
<i>Austrotachea vindobonensis</i> (Férussac, 1821)	–	3	–	–	17	94	13	–	3	4	3	2
<i>Helix pomatia</i> (Linnaeus, 1758)	–	2	–	–	–	–	–	–	–	–	–	–
<i>Euomphalia strigella</i> (Draparnaud, 1801)	–	–	–	–	–	–	–	–	–	6	–	–
<i>Pseudotrichia rubiginosa</i> (Rossmässler, 1838)	–	–	5	–	–	1	–	–	–	–	–	–
Number of species	11	6	12	4	7	15	8	1	6	11	10	13

Note. 22–33 — numbers of plots, see “Material and methods”.

lian Upland and by unconfirmed data in the Donetsk Upland (Balashov & Gural-Sverlova, 2012; Balashov et al., 2013 a, 2017; Balashov, 2016 a, b). It is considered to be VU B2ab(iii) for Ukraine and proposed for listing in the Red Book of Ukraine (Balashov, 2016 a). During our study this species was found in the 9 plots along Ros’ River and 4 plots along Girsky Tikych River, which is more than was previously known for Ukraine in general. It inhabits rocky steppes.

Mediterranea inopinata is distributed mainly in the Balkans, also in Central Europe to southern Poland in the north, to Austria and Czech Republic in the west and to Ukraine and Moldova in the east (Welter-Schultes, 2012). This species was until recently placed in the genus *Oxychilus*, but it has been shown that *Mediterranea* should be considered as a separate genus (Balashov, 2014). In Ukraine this species is known from several steppe locations in the Black Sea Lowland, the Podolian Upland and the foothills of the Carpathian Mountains (Balashov & Gural-Sverlova, 2012). Moreover, one shell that probably belongs to this species was collected in the steppe at the northern foothills of the Crimean Mountains, but its identity requires confirmation, because two similar species occur in this region (Balashov, 2016 b). Our findings much expand the known range of *M. inopinata* to the east and reveal more specimens than the total previously collected in Ukraine. However, there is also one unconfirmed Pleistocene fossil record of this species from the even more eastern region — Dnipro Lowland in Poltava Region (on the left bank of the Dnipro River) (Melnichuk, 1968). So perhaps recent *M. inopinata* could also be expected to be found on the Dnipro Lowland.

The invasive snail *Xeropicta derbentina* (Krynicky, 1836) was found on the edge of a large steppe plot along the canyon of Tiasmin River, not far from a railway in the outskirts of Kamianka town. The native range of this species is situated around the Black Sea, including steppes of the Black Sea Lowland, but recently it has started to expand northwards; colonies have been found in the forest-steppe zone in the Poltava and Vinnytsia Regions, also in Lviv Region (Balashov, 2016 b) and Transcarpathia (Gural-Sverlova & Gural, 2017). Our find-

ing confirms this tendency. The occurrence of *X. derbentina* near railways is probably not coincidental; in the adjacent Vinnytsia Region a colony of this species was found on the railway station (Balashov & Baidashnikov, 2012). From our observations, in Southern Ukraine many snails of this species can often be found inactive on objects above ground level, including human-made objects, like traffic signs and metal fences. Probably snails of *X. derbentina* can climb directly on the train carriage, stay here inactive and disperse with it.

Morlina glabra (Rossmässler, 1836) is distributed mainly in Central and Southern Europe (Welter-Schultes, 2012), in Ukraine — in the Carpathians and Podolian Upland with isolated locations in Volhynia, Slovechansko-Ovrutsky Ridge and Kaniv Upland (Balashov, Baidashnikov, 2010, 2012; Balashov, 2012, 2016 a, b; Balashov et al., 2013 a). Therefore, our new locality extends the known range of this species in a northeast direction and represents the first finding in Kyiv Region. It is also unusual that *M. glabra* was found in the forestless rocky habitat. This species mainly lives in the dead wood and litter of broadleaved forests, which is the case for other known locations on the eastern border of its range (Balashov, Baidashnikov, 2010; Balashov, 2012). However, a similar situation, with *M. glabra* inhabiting large rocks in the open dry habitat, is known for the central part of the Podolian Upland (Balashov et al., 2013 a). This species should be included into the red list of protected species of Kyiv Region.

It is also worth mention that terrestrial molluscs of the Kirovograd region are poorly studied and in addition to rare *Pupilla bigranata* four common species found by us were not listed in its fauna before (Balashov, Baidashnikov, 2010; Balashov, 2016 a): *Vertigo pygmaea*, *Truncatellina cylindrica*, *Vallonia pulchella* and *Austrotachea vindobonensis*. So now 40 species of terrestrial molluscs are known to occur in the Kirovograd region which is probably still far from complete (Balashov, 2016 a).

The species composition of terrestrial mollusc faunas varies radically in the studied grasslands and rock outcrops. All plots with most diverse mollusc faunas are situated in the river valleys, mainly with large rock outcrops. Usually the dry open natural habitats on the Dnipro Upland contains only a few common species of mollusc: *Vallonia* and *Cochlicopa* species, *Chondrula tridens*, *Austrotachea vindobonensis*, sometimes also *Truncatellina cylindrica*, *Pupilla muscorum*, *Vertigo pygmaea* and sporadically some other most common eurybiotic species. This is the situation for plots 9, 11, 12, 23, 25, 29, 30 (see tables) and some sites that we have studied before in this region (Balashov, Baidashnikov, 2010). Species mainly associated with wetlands also occur in the dry grasslands or rock outcrops in valleys, where these are adjacent to the floodplains. This often occurs with *Pseudotrachia rubiginosa*, sometimes also *Zonitoides nitidus*, *Fruticicola fruticum* and *Succinea putris*. The most diverse mollusc faunas are found on the studied sites with rock outcrops, especially those with large rocks. In these open habitats, species normally associated with forests sometimes occur: *Morlina glabra* (see above), *Laciniaria plicata*, *Cochlodina laminata*, *Discus ruderratus*, *Punctum pygmaeum* and even the slug *Lehmannia marginata*. A similar situation, especially regarding *M. glabra*, *L. plicata* and *C. laminata*, is known for the forestless rocky hills (tovtrs) of the central Podolian Upland (Balashov et al., 2013 a).

The most interesting and unusual assemblage of terrestrial mollusc, with 24 species, was revealed on plot 16 (table 2) on the island in the canyon of Ros' River near Korsun-Shevchenkivskyi town. This is the richest mollusc fauna among all known for one site of dry grassland or rock outcrops in Central Ukraine. It includes 5 species that require protection in Ukraine on the national level (Balashov, 2016 a): *V. angustior*, *T. costulata*, *G. frumentum*, *P. bigranata* and *M. inopinata*. *V. angustior* is a groundwater-dependent species that lives in the various undisturbed moist habitats. Another European species, *T. costulata*, is mainly related to the relatively dry and sparse forests and to the edges between forests and steppes. The other three species, as it was already mentioned, relate to open dry rocky habitats. Therefore, these rare species, co-occurring on this plot, have quite different habitat requirements, so conditions of the habitat should be very unusual to fulfill them all at once. It is possible due to the diver-

sity of microhabitats on this very steep slope above the river with large rocks and mosaically situated shrubs. Another factor that allows this diversity to exist is its preservation, which is probably due to its historical protection as a part of the estate of Stanisław Poniatowski (see above) and later as a part of a recreation area. Despite the recreational use of the area, this small, island-like well-preserved habitat appears sufficient for the survival of these rare species. Large rocks render it unsuitable for activities that could destroy its communities.

In general, for the studied plots the higher numbers of mollusc species are related to the areas with most diverse mosaic natural habitats and microhabitats, including various dry grasslands with rocks, but also adjacent wetlands, shrubs and forests. A similar situation was noticed for the large massif of the chalk steppes in the valley of the Oskol River in Eastern Ukraine where snails have a very mosaic distribution on specific chalk outcrops, sites with small shrubs among steppe and edges with oak forests and wetlands (Balashov & Kryvokhyzha, 2015). Very mosaic distribution of terrestrial molluscs is also the case for other dry habitats on large rock outcrops — sparse Greek juniper forests of the Crimean Mountains (Balashov, Baidashnikov, 2013).

Our success in finding numerous locations of the rare inhabitants of the dry habitats, *G. frumentum*, *P. bigranata* and *M. inopinata*, probably reflects our selection of mainly rocky locations that were expected to be less disturbed (see material and methods). Hence, our findings suggest that we have revealed a considerable part of their existing habitats in the region rather than that these species are common here. Almost all locations where we have found the three species mentioned above are natural well preserved rocky steppes or relatively undisturbed communities of rock outcrops, situated on the slopes of valleys of three moderate rivers. These habitats are not common on the Dnipro Upland, and a great proportion of them is situated along these three rivers. In addition to the three species mentioned above, these locations also hold populations of other mollusc that are rare or uncommon in this region and considered to be locally threatened or near threatened (Balashov, 2016 a). Therefore, on the basis of the data given in this paper, we are proposing to create new protected areas in the following studied locations (see materials and methods and text): 6, 7, 8, 10, 14, 15, 16, 17, 21, 22, 27, 33. More detailed information on the allocation, area and general biodiversity of these plots will be given in the documentation with substantiations to create these protected areas and in local publications.

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References

- Balashov, I. 2012. Terrestrial mollusks (Gastropoda) of the Slovechansko-Ovrutsky Ridge (Zhytomyr region, Northern Ukraine). *Vestnik Zoologii*, **46** (6), 491–497.
- Balashov, I. 2014. *Taurinellushka babugana* gen. nov., sp. nov. (Stylommatophora: Pristilomatinae) from the Crimean Mountains (Ukraine) and revision of Crimean *Mediterranea* (Oxychilinae). *Journal of Conchology*, **41** (5), 575–584.
- Balashov, I. 2016 a. *Conservation of terrestrial molluscs in Ukraine*. Institute of Zoology NAS Ukraine, Kyiv, 1–272 [In Russian].
- Balashov I. A. 2016 b. *Fauna of Ukraine. Vol. 29: Molluscs. Is. 5: Stylommatophorans (Stylommatophora)*. Naukova Dumka, Kyiv, 1–592 [In Russian].
- Balashov, I. A., Baidashnikov, A. A. 2010. Terrestrial molluscs (Gastropoda) of the forest-steppe in the Dnieper Area and their confinement to different phytocenoses. *Vestnik Zoologii*, **44** (4): 309–316 [In Russian].
- Balashov, I. A., Baidashnikov, A. A. 2012. Terrestrial molluscs (Gastropoda) of the Vinnytsia region and their biotopical preferences. *Vestnik Zoologii*, **46** (1), 19–28 [In Russian].
- Balashov, I. A., Baidashnikov, A. A. 2013. Terrestrial molluscs in sparse Greek juniper forests of the Crimean Mountains. *Zoologicheskii Zhurnal*, **92** (3), 257–263 [In Russian].
- Balashov, I., Gural-Sverlova, N. 2012. An annotated checklist of the terrestrial molluscs of Ukraine. *Journal of Conchology*, **41** (1), 91–109.

- Balashov, I. A., Kryvokhyzha, M. V. 2015. Distribution patterns of terrestrial mollusks in the chalk steppe and neighboring phytocenoses of the Oskol River Valley in the Dvorichanskyi National Nature Park, Ukraine. *Russian Journal of Ecology*, **46** (4), 370–376.
- Balashov, I. A., Baidashnikov, A. A., Romanov, G. A., Gural-Sverlova, N. V. 2013 a. Terrestrial molluscs of Khmelnytsky region (the Podolian Upland, Ukraine). *Zoologicheskii Zhurnal*, **92** (2), 154–166 [In Russian].
- Balashov, I. A., Son, M. O., Coad, V., Welter-Schultes, F. 2013 b. An updated annotated checklist of the molluscs of the Republic of Moldova. *Folia Malacologica*, **21** (3), 175–181.
- Hanski, I. 1998. Metapopulation dynamics. *Nature*, **396**, 41–49.
- Gural-Sverlova, N. V., Gural, R. I. 2017. Expansion of the ranges of land mollusks of the genus *Xeropicta* (Gastropoda, Hygromiidae) in Ukraine. *Russian Journal of Biological Invasions*, **8** (3): 212–217.
- IUCN. 2012 a. *IUCN Red List Categories and Criteria: Version 3.1. Second Edition*. IUCN, Gland, Switzerland and Cambridge, UK, 1–32.
- IUCN. 2012 b. *Guidelines for Application of IUCN Red List Criteria at Regional and National Levels: Version 4.0*. IUCN, Gland, Switzerland and Cambridge, UK, 1–41.
- Kerney, M. P., Cameron, R. A. D. 1979. *A field guide to the land snails of Britain and North-west Europe*. Collins, London, 1–288.
- Melnichuk, I. V. 1968. Fauna of molluscs from the Quaternary deposits of Poltava Plain. *Geologicheskii Zhurnal*, **28** (6), 71–75 [In Russian].
- Nekola, J. C., Coles, B. F., Horsák, M. 2015. Species assignment in *Pupilla* (Gastropoda: Pulmonata: Pupillidae): integration of DNA-sequence data and conchology. *Journal of Molluscan Studies*, **81**, 196–216.
- Put', A. L. 1954. Comparative collection of recent molluscs in the Department of paleozoology of Institute of Zoology AS UkrSSR. *Zbirnyk prac Zoologichnogo muzeyu AS UkrSSR*, **26**, 97–118 [in Ukrainian].
- Welter-Schultes, F. W. 2012. *European non-marine molluscs, a guide for species identification*. Planet Poster Editions, Göttingen, 1–679.

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