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## **FURTHER AND FURTHER EAST: STEPPE LAND SNAIL, XEROLENTA OBVIA (GASTROPODA, GEOMITRIDAE), EXPANDS ITS RANGE IN UKRAINE**

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**Further and Further East: Steppe Land Snail, *Xerolenta obvia* (Gastropoda, Geomitridae), Expands its Range in Ukraine.** Gural-Sverlova, N. V., Pisaryev, S. M., Gural, R. I. — Based on our long-term observations, collection material and literature data, the process of expanding the range of the steppe snail of Pontic-Balkan origin *Xerolenta obvia* (Menke, 1828) in Ukraine from the end of the 19th century to the present day is analyzed. Known findings of this species in the Pleistocene deposits of Ukraine indicate that *X. obvia* could migrate to Western Ukraine through the Western Black Sea region and the Podolian Upland, bypassing the Carpathian Mountains. Some records of *X. obvia* in the mountainous part of the Ukrainian Carpathians and in the Transcarpathian lowland (mid-20th–early 21st century) are most likely the result of anthropochory. However, even in those areas of Western Ukraine that can be considered as part of the natural range of *X. obvia*, this species was apparently found much less frequently at the end of the 19th and beginning of the 20th century than now. To date, *X. obvia* has not only spread more in Western Ukraine, but has also been recorded in Zhytomyr and Kyiv, in the Donetsk and Zaporizhzhia regions. A similar process of gradual expansion of its range is also observed in other parts of Europe. The ecological features of the species contributing to this are discussed.

**Key words:** terrestrial mollusks, anthropochory, introduced species, Ukraine.

### Introduction

In the summer of 2021, the cohabitation of two xerophilous species of land snails with rather similar shells (fig. 1) but simply differing anatomically (Schileyko, 1978, 2005) was recorded in two localities in the north of the Donetsk Region located near each other. Both species show a distinct tendency to synanthropization and to the expansion of their ranges associated with human activity. One of them, *Xeropicta derbentina* (Krynicky, 1836), is currently widespread on the Crimean Peninsula (Popov & Kovalenko, 2000), and outside the Crimea also in the steppe zone of Ukraine from the Odesa Region in the west to Donetsk Region in the east (Gural-Sverlova, 2018; Gural-Sverlova & Gural, 2017, 2020). A few records of *X. derbentina* are also known in the

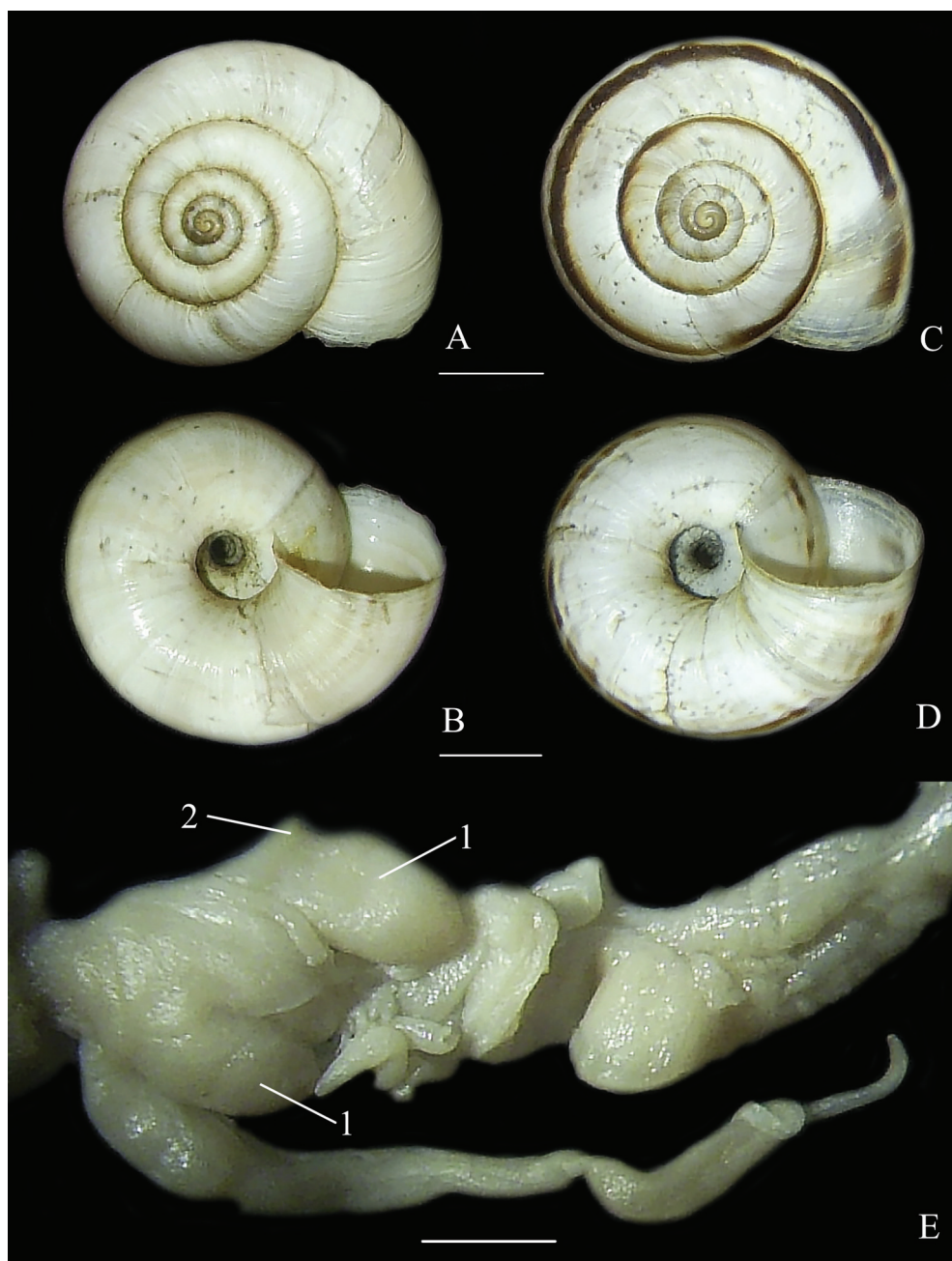


Fig. 1. *Xeropicta derbentina* (A, B) and *Xerolenta obvia* (C–E) from the Slovianskyi Kurort Regional Landscape Park, Donetsk Region: 1 — stylophores, 2 — swollen basal part of stylophore. Scale bars 5 mm for A–D, 1 mm for E.

forest-steppe zone in the central part of the country (Balashov, 2010; Balashov & Baidashnikov, 2012; Balashov et al., 2018 c) and in the Transcarpathian Lowland (Gural-Sverlova & Gural, 2017). The natural distribution of another species, *Xerolenta obvia* (Menke, 1828) in Ukraine is limited exclusively to the western part of the country, although its findings are already known in Zhytomyr (Gural-Sverlova & Gural, 2020), Kyiv (Tappert et al., 2001) and in the Zaporizhzhia Region (Gural-Sverlova et al., 2018). In the Donetsk Region, *X. obvia* was recorded for the first time.

While the process of gradual expansion of the range of *X. derbentina* in Ukraine was analyzed in a special publication (Gural-Sverlova & Gural, 2017), similar data for *X. obvia* still need such an analysis. Therefore, the main purpose of this article was not just to clarify the present distribution of *X. obvia* in Ukraine, but to compare data relating to different time periods. Such an analysis, in particular, will help to find out which areas in Western Ukraine may be part of the natural range of this species, and which, most likely, were settled relatively recently as a result of anthropochory.

## Material and methods

The records of *X. obvia* in Ukraine made in two different periods of time were analyzed and graphically presented on maps (fig. 2): 1) from the second half of the 19th century, when a purposeful study of land mollusks began in the areas of present Lviv, Ternopil and Ivano-Frankivsk Regions in the west of Ukraine (Bąkowski, 1884), until the middle of the 20th century; 2) from the end of the 20th century to the present. The choice of the second time period was due to the fact that in this time the cases of registration of introduced species of land mollusks in different parts of Ukraine became noticeably more frequent (Gural-Sverlova et al., 2018; Gural-Sverlova-Gural & Gural, 2021: table 2; Sverlova et al., 2006), some species were first recorded in Ukraine and/or rapidly expanded their ranges on its territory (Balashov et al., 2018 a; Gural-Sverlova & Gural, 2022; Gural-Sverlova et al., 2021). We considered it inappropriate to divide the first period into shorter time intervals due to, in general, a small amount of data. We also analyzed paleontological data on the presence of *X. obvia* in the territory of present Ukraine in the Pleistocene (Kunitsa, 1974).

An important role in the analysis was played by the collection of land mollusks of the State Museum of Natural History in Lviv (Gural-Sverlova & Gural, 2020), which contains numerous samples from Western Ukraine collected from the second half of the 19th century to the present day, as well as from other parts of Ukraine collected in the last few decades. In addition to collection materials and our own long-term observations, some literary sources were also used, if they indicated more or less exact locations of *X. obvia* findings (Bąkowski, 1884; Put, 1954; Rybka, 2017; Urbanski, 1933; Zdun, 1960).

In the Donetsk Region, two samples containing *X. obvia* and the conchologically similar species *X. derbentina* mentioned in the Introduction were collected by S. M. Pisaryev in the localities described below.

1) Kramatorsk District, Sloviansk town, the Slovianskyi Kurort Regional Landscape Park located on the northeastern outskirts of the city, 48°51'56" N, 37°37'48" E, July 28, 2021, 54 *X. obvia* and 1 *X. derbentina*.

2) Kramatorsk District, between Cherkaske urban-type settlement and Oleksandrivka village (about 10 km west of Sloviansk), near the railway station Shydlovska, bank of the Sukhyi Torets river, 48°49'41" N, 37°24'29" E, August 26, 2021, 3 *X. obvia* and 13 *X. derbentina*.

Some of the collected specimens were transferred to the museum collection mentioned above. The shell width, also called the greater shell diameter (Schileyko, 1978), was measured for all specimens of *X. obvia* from the Donetsk Region. The number of whorls was determined according to this scheme (Gural-Sverlova & Gural, 2012: fig. 6).

## Results and discussion

In both compared time periods, the main part of *X. obvia* records (fig. 2) is clearly associated with the western part of the Podolian Upland and with such physiographic regions adjacent to it from the west as Roztocze and Opillia, Male Polissia, and the Volhynian Upland. This is in good agreement with paleontological data (Kunitsa, 1974), according to which, in the Pleistocene, *X. obvia* was distributed throughout the Podolian Upland, as well as in the western part of the Black Sea Lowland adjacent to it from the south (the territory of the present Odesa Region). Obviously, this steppe species of Pontic-Balkan origin (Alexandrowicz & Alexandrowicz, 2010) migrated to the Podolian Upland through the western Black Sea region and bypassing the Carpathian Mountains, like some other species of land mollusks: *Laciniaria plicata* (Draparnaud, 1801), *Sphyradium doliolum* (Bruguère, 1792), *Deroceras turcicum* (Simroth, 1894), possibly also *Euomphalia strgella* (Draparnaud, 1801) and *Merdigera obscura* (O. F. Müller, 1774) (Baidashnikov, 1996). Later, *X. obvia* probably became completely extinct on the south of Ukraine, remaining in Moldavia and Western Ukraine (Schileyko, 1978).



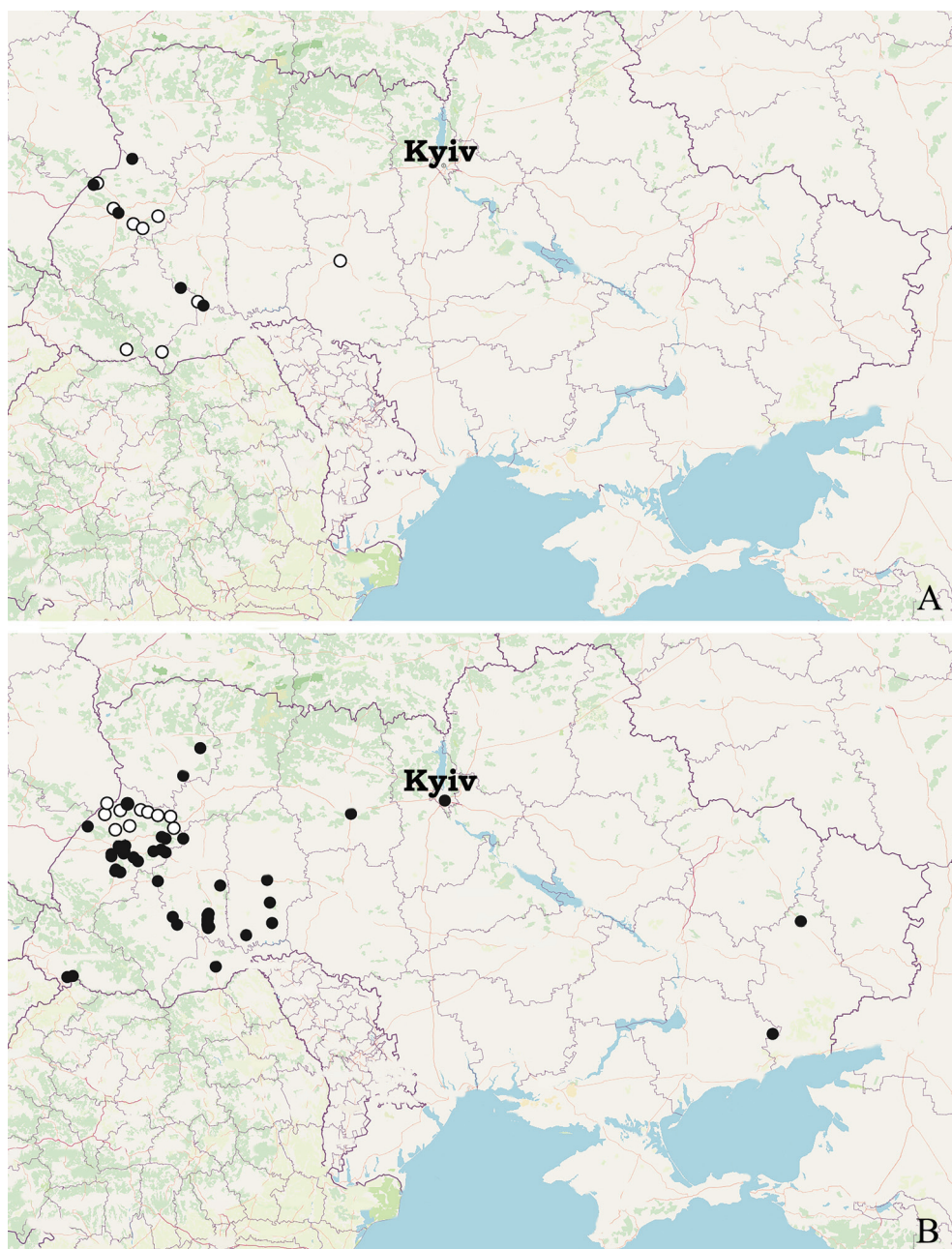


Fig. 2. Records of *X. obvia* in Ukraine in different time periods: A — from the second half of the 19th century to the middle of the 20th century, B — from the end of the 20th century to the present. Black circles indicate the collection materials of the State Museum of Natural History (Lviv) and own data, white ones indicate literature data.

A few records of *X. obvia* made from the middle of the 20th century (fig. 2, A) to the beginning of the 21st century (fig. 2, B) in the mountainous part of the Ukrainian Carpathians (Put, 1954; Zdun, 1960) and in the Transcarpathian lowland (Gural-Sverlova & Gural, 2017) are clearly confined to populated localities, railways or roads. The recent discovery of *X. obvia* at the railway stations of two adjacent settlements of the Vynohradiv District of the Transcarpathian Region (Vynohradiv, Korolevo) is especially indicative. In both cases, as in the Donetsk Region (see Introduction), *X. derbentina*, previously unknown for Western Ukraine (Gural-Sverlova & Gural, 2017), was found together with *X. obvia*. With

a high probability, it can be assumed that both ecologically similar species were brought here by rail, with some kind of cargo. It is also very likely that *X. obvia* is not native to the mountainous part of the Ukrainian Carpathians and the Transcarpathian lowland, and its appearance here is caused by anthropochory.

The northernmost records of *X. obvia* in Western Ukraine, made in the Volyn Region (fig. 2, B) at the beginning of the 21st century (Gural & Gural-Sverlova, 2018; Gural-Sverlova & Gural, 2020), may also be the result of a relatively recent expansion of the range of this species. Further north, *X. obvia* was found in Brest in southwestern Belarus (Sverlova et al., 2006), and is now also known in the central part of this country (Zemoglyadchuk, 2020).

In Poland, bordering the Lviv and Volyn regions of Ukraine, *X. obvia* is presently distributed almost everywhere, except for the high mountains and the northeastern part of the country (Wiktor, 2004). However, here it is considered as a species alien to the whole country (Marzec et al., 2020; Wiktor, 2004) or most of its territory, except for the south (Cehanoviča & Stalažs, 2020). Polish paleontologists and malacologists Alexandrowicz & Alexandrowicz (2010: 39) write: “On broad areas of Central Europe, north to the Alps and the Carpathians, it does not occur in Holocene deposits older than the historic period. In this region the emergence of this snail began probably as late as in the 17th or 18th century but it is also possible that it was a bit earlier”.

Even in the Lviv and Ternopil regions of Ukraine, where *X. obvia* is most often recorded at present (fig. 2, B), there are not many records made until the middle of the 20th century (fig. 2, A). In addition to numerous findings of *X. obvia* near Lviv and in the city itself, Bąkowski (1884: 387) mentioned the presence of this species only in three localities of the Lviv Region: Skomorokhy in the Volhynian Upland, Romaniv and Ushkovichy in Opillia. And the malacological collection of the State Museum of Natural History in Lviv contains the corresponding samples only from Lviv and Skomorokhy (Gural-Sverlova & Gural, 2020).

Despite two expeditions to the territory of the present Ternopil Region, Bąkowski (1880, 1881) never found *X. obvia* there, in contrast to the conchologically similar xerophilous snails of the genus *Helicopsis* Fitzinger, 1833. The oldest sample of *X. obvia* from the Ternopil Region, stored in the museum collection mentioned above (Gural-Sverlova & Gural, 2020), is that from Zalishchyky, collected by A. Sitsch at the beginning of the 20th century and erroneously identified by him as *Helicopsis instabilis* (Rossmässler, 1838). For comparison: in 1998, the first author took part in an expedition along the course of the Seret River in the Ternopil Region, organized by the public organization “Tovarystvo Leva”, and noted the frequent presence of *X. obvia* along roads, on pastures, etc.

The most eastern finding of *X. obvia* in Ukraine in the first half of the 20th century (fig. 2, A) was mentioned by Novytskyi (1938). However, there are many dubious species identifications in this publication. In particular, three species of xerophilous snails with relatively similar shells are listed for Vinnytsia: *Helicella itala* (Linnæus, 1758), *X. obvia* and *Helicopsis striata* (O. F. Müller, 1774). The first of them has never been reliably found in Ukraine, and the eastern border of its present range in Europe passes through the western Poland, the Czech Republic and Austria (Welter-Schultes, 2012: 539). Later malacological studies revealed only *H. striata* in the Vinnytsia Region (Balashov & Baidashnikov, 2012), although *X. obvia* was also found in the Pleistocene deposits of the region (Kunitsa, 1974).

Currently, the most eastern known localities of *X. obvia* in Ukraine (fig. 2, B) are the railway station in Rozivka, Zaporizhzhia Region (Gural-Sverlova et al., 2018), Sloviansk and its environs (near Cherkaske) in the Donetsk Region, see Material and methods. All these findings were made not long ago, in 2012 and 2021 respectively. In all three cases, as well as in Kyiv (Balashov, 2016: 484; Gural-Sverlova & Gural, 2020: 196), the species identification was confirmed anatomically.

All specimens of *X. obvia* collected in July–August in the Donetsk Region had a well-developed reproductive system, about 5–5.5 shell whorls. The shell width varied from

11.9 to 19.3 mm (mean  $15.0 \pm 0.3$  mm) in Sloviansk and from 15.7 to 17.8 mm (mean  $16.6 \pm 0.6$  mm) near Cherkaske. This fully corresponds to the literature data on the variability of the shell size in mature specimens of this species: from 13 to 16 mm (Schileyko, 1978), 12–17, sometimes up to 20 mm (Wiktor, 2004), 13–20 mm (Balashov, 2016; Gural-Sverlova & Gural, 2012), 11–20 mm (Welter-Schultes, 2012).

In Rozivka, snails were collected from a meadow site in the railroad right-of-way (Gural-Sverlova & Gural, 2020: 195). Significantly, railways not only facilitate long-distance transport of *X. obvia* (Cehanoviča & Stalažs, 2020; Robinson & Slapcinsky, 2005) and other xerophilous land snails (Gural-Sverlova & Gural, 2017; Rabchuk & Zemoglyadchuk, 2011), but at the same time provide them with suitable habitats near the railway tracks: open, well-warmed by the sun, often with low or periodically mowed grassy vegetation. This may contribute to the successful acclimatization of some species even far north of their natural ranges: for example, the species of Crimean origin *Brephulopsis cylindrica* (Menke, 1828) in Belarus (Rabchuk & Zemoglyadchuk, 2011) or *X. obvia* in Latvia (Cehanoviča & Stalažs, 2020).

We assume that motor roads may be also important for the spreading of *X. obvia*, both within its natural range (in particular, in the western part of the Podolian Upland) and beyond. Several cases of transportation of snails attached to cars over more (Kurek & Najberek, 2009) or less (Trautner, 2000) long distances have already been described for *Monacha cartusiana* (O. F. Müller, 1774), which inhabits similar biotopes. No wonder *M. cartusiana*, appeared in Western Ukraine only at the end of the 20th century, on the one hand, spreads quite quickly here, on the other hand, it demonstrates a clear connection with roads, parking lots, etc. (Gural-Sverlova & Gural, 2022).

Since in hot weather, *X. obvia* individuals usually climb en masse onto grass, fences, and other elevations and attach there, it can be assumed that they can use also cars parked on grassy roadsides and wastelands in a similar way. An interesting observation was made several decades ago in Lviv by the first author. The day after visiting a site inhabited with *X. obvia*, one small specimen of this species was found attached to a shoe. In this way, the snail overcame at least several kilometers traveled by the author on foot. Since *X. obvia* is often found in pastures, the role of such an accidental “vehicle” can obviously also be played by cattle.

In addition to motor and railway roadsides, *X. obvia* is often found in other anthropogenic habitats. The preference that this species has for dry open biotopes with low herbaceous vegetation (Wiktor, 2004) allows it to inhabit wastelands, pastures, abandoned quarries and the vicinity of active quarries, etc. In Lviv, we also found it on lawns along the streets, grassy slopes of stadiums. Probably, it was the ecological features and the ability to spread along transport routes that contributed to the noticeable spreading of *X. obvia* even in those areas of Western Ukraine that can be considered as part of the natural range of this species, see above. Additional favorable factors could be the decrease in forest cover associated with human activities as well as the consequences of global climate change; the latter have become especially noticeable in recent decades. Not without reason, it was since the end of the 20th and beginning of the 21st century that some xerophilous species of land mollusks, previously distributed only in the south of the country, began to be increasingly recorded in Western Ukraine (Balashov et al., 2018 b; Gural-Sverlova & Gural, 2017, 2022).

If we consider the present range of *X. obvia* as a whole, it is also significantly expanded due to anthropochory. Currently, this species is widely distributed in Central Europe, reaching in the north of the countries surrounding the Baltic Sea, and in the west – south-east of France (Welter-Schultes, 2012: 588; Wiktor, 2004: 251). In 2019, *X. obvia* was also first recorded in the east of the Iberian Peninsula, Spain (Martínez-Ortí, 2020). Back in the 20th century, *X. obvia* was introduced to Canada (Forsyth et al., 2015), and in 2001 it was first discovered in the United States (Robinson & Slapcinsky, 2005), where it arrived via the Canadian Pacific Railway.



In Ukraine, *X. obvia* is not only the most distributed now in the Lviv and Ternopil Regions, see above. In the same areas, the greatest intraspecific variability in the shell coloration of this species was also noted. The shell of *X. obvia* is usually white or whitish with varying numbers of dark spiral bands (fig. 1, C, D), entire or discontinuous, especially below; rarely monochromatic white (Schileyko, 1978; Wiktor, 2004). Similar shells are shown in publications describing some introduced populations of *X. obvia*, for example in Spain (Martínez-Ortí, 2020: figs 1–10) or Canada (Forsyth et al., 2015: figs 1–3).

However, in some localities of the Lviv Region (Lviv, Romaniv) and Ternopil Region (Uhryn, Sosulivka), we collected and transferred to the malacological collection of the State Museum of Natural History in Lviv (Gural-Sverlova & Gural, 2020) specimens with an atypically dark coloration of the upper part of the shell, above upper band (fig. 3). Darkening of this part of the shell can lead to the formation of an additional fuzzy band slightly below the suture (fig. 3, A) or more or less distinct spots (fig. 3, B). At some sites, this coloration was predominant. A similar coloration can be observed in some forms of *Helicopsis*, also distributed in Western Ukraine. And small spots under the suture are quite common in *X. derbentina* mentioned in Introduction, which is also expanding its range in Ukraine (Gural-Sverlova & Gural, 2017).

Conchologically, *X. obvia* is similar to representatives of two other genera of steppe land snails distributed in Ukraine: *Xeropicta* Monterosato, 1892 and *Helicopsis* (in the latter case, with the exception of forms that have a relatively small and high shell and/or a distinct keel on the periphery). Anatomically, *X. obvia* can be easily distinguished from them by the number of stylophores: two (one pair) in *X. obvia*, four (two pairs) in *Xeropicta* and



Fig. 3. Shells of *X. obvia* with an atypically dark colored upper part from Western Ukraine: A — Sosulivka, Ternopil Region; B — Romaniv, Lviv Region; C — Lviv. Scale bars 5 mm.

**Table 1. Conchological differences between *X. obvia* and externally similar xerophilous snails distributed in Ukraine**

<i>Xerolenta obvia</i>	<i>Xeropicta</i>	<i>Helicopsis</i>
	Shape of the shell	
Usually very depressed	Similar to <i>X. obvia</i>	From very depressed to higher
	Periphery of the last whorl	
Rounded, maximum slightly angular	Similar to <i>X. obvia</i>	From similar <i>X. obvia</i> to distinct keel
	Upper part of the whorls, under the suture	
Flattened	Flattened to moderately convex	Moderately to very convex
	Number of previous whorls of the shell, visible through the umbilicus	
Usually all or almost all	Usually no more than 1.5	Similar to <i>X. obvia</i>
	Regular microscopic spiral lines, best seen at the bottom of the shell (Only for well-preserved shells!)	
Present	Present	Absent or unclear traces
	Radial sculpture on initial definitive whorls	
Thin, but regular and clearly visible under magnification	Very smoothed	Distinct

*Helicopsis* (Schileyko, 1978, 2005). In addition, the stylophores of *X. obvia* are massive, with a characteristic swelling at the base (fig. 1, E). In the absence of anatomical material (in particular, when analyzing museum collections), we can recommend using table 1, compiled on the basis of our long-term studies of land mollusks in different parts of Ukraine (Gural-Sverlova & Gural, 2012).

## Conclusions

As in other parts of Europe, the range of *X. obvia*, a steppe species of Pontic-Balkan origin, is expanding in Ukraine. Even in those areas of Western Ukraine that can be considered as part of its natural range, *X. obvia* seems to be found now much more often than at the end of the 19th or the beginning of the 20th century. The easternmost known records of *X. obvia* in Ukraine were made in 2012 in the Zaporizhzhia Region (Rozivka) and in 2021 in the Donetsk Region (in Sloviansk and near Cherkaske). Reliable findings of the species are also known from the central part of Ukraine (Zhytomyr, Kyiv). The dispersal of *X. obvia* across Ukraine can be promoted by railway and automobile connections, as well as by the ecological features of the species, which prefers open dry biotopes with low vegetation and often settles along roads and in other anthropogenic habitats.

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