


# First record of *Helix lucorum* (Gastropoda: Helicidae) in Western Ukraine, with remarks on its present distribution in other parts of the country

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In the west of Ukraine, the Turkish snail *Helix lucorum* was first discovered in 2020 at one of the household plots in Chortkiv, Ternopil region. It was found that the owner of the house specially brought snails from France for his children. Until the beginning of the 21st century, *H. lucorum* was known in Ukraine only from the mountainous Crimea, where it was presumably brought by Greek colonists. The distribution area of this species in Crimea gradually expanded, in particular, due to targeted introductions. Since 2010, single population of *H. lucorum* have been recorded in Ukraine outside of Crimea. Judging by the shell colouration, only some of them could have been founded by individuals from the Crimea, with almost unnoticeable spiral banding and distinct radial streaks. Other populations are of unclear origin, and their founders may have been brought from different parts of the present range of *H. lucorum*. In particular, shells with wide dark, often fused bands and a distinct light gap between them on the shell periphery are characteristic of most known introduced European populations of *H. lucorum*, and are also common in the Krasnodar region of Russia, from where they could have been introduced to the east of Crimea (Kerch Peninsula).

**Key words:** Turkish snail, introduction, spreading history, shell colouration, land molluscs

## Introduction

Currently, various regions of Ukraine are home to non-native species of land molluscs whose distribution has been facilitated by human activity. Moreover, their number is increasing, which has become especially noticeable in recent years. Not long ago, at least 22 such species were known in Western Ukraine, which traditionally includes Volyn, Rivne, Lviv, Ternopil, Khmelnytskyi, Chernivtsi and Transcarpathian administrative regions (GURAL-SVERLOVA & GURAL 2021: table 2), not taking into account several species of slugs with unclear boundaries of natural ranges. In the spring of 2023, their list was supplemented by a medium-sized snail of Mediterranean origin, *Hygromia cinctella* (Draparnaud, 1801), discovered in Uzhhorod, Transcarpathian region (GURAL-SVERLOVA & ANDRIK 2023). This was made possible by an observation in one of the citizen science databases (iNATURALIST 2024), illustrated with photographs. In the autumn of the same year, in a similar Ukrainian database (UKRBIN 2024), images of several specimens of the Turkish snail *Helix lucorum* Linnaeus, 1758 from Western Ukraine (Fig. 1A, B) were found, made in 2020 and initially erroneously identified as *Helix pomatia* Linnaeus, 1758. A re-survey of the same

site in September 2023 confirmed the presence of a recently founded population of *H. lucorum* there and also provided insight into its origin.

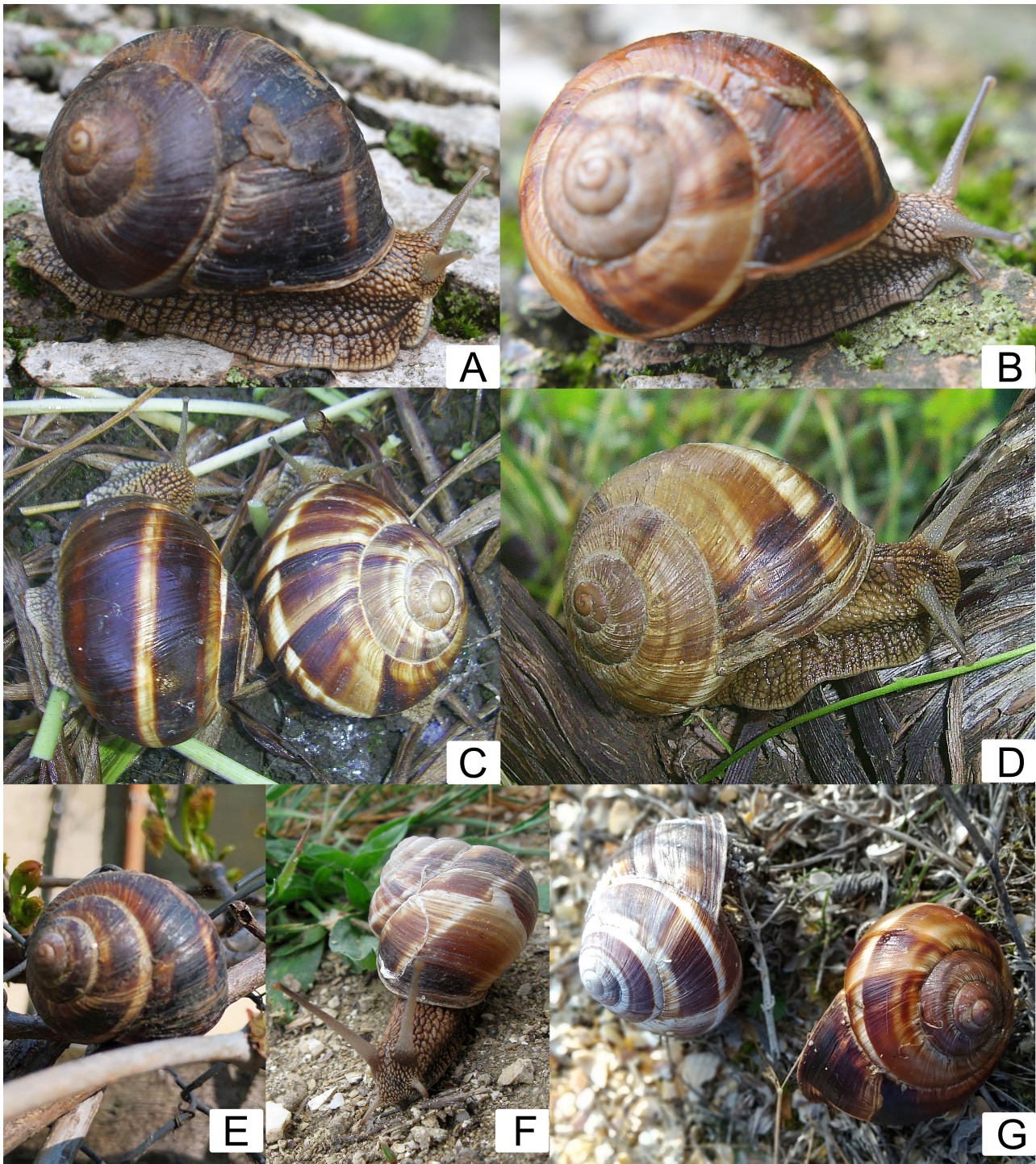
According to recent data, *H. lucorum* is an originally Anatolian and Caucasian species whose natural range may also include the south and east of the Balkans (KORÁBEK et al. 2018). Its present range has been significantly expanded due to anthropochory, this applies to Western (MIENIS & RITTNER 2010; SALGADO et al. 2010; BERTRAND & SANÈGRE 2015), Central (FISCHER et al. 2008; PELTANOVA et al. 2012; HENKEL 2013; ČEJKA & ČAČANÝ 2014; PÁLL-GERGELY et al. 2019; DOLEŽAL 2021; SZPALEK et al. 2023; ZAJĄC et al. 2023), Northern (PALMER 2010; WHITEHEAD 2014) and Eastern Europe (STOJKO & BULAVKINA 2010; EGOROV 2017), including Ukraine (KHLUS & TKACHUK 2012; BALASHOV et al. 2013; GURAL-SVERLOVA et al. 2018), as well as Central Asia (IZZATULAEV 2013; SCHIKOV 2017: table 1).

In Ukraine, until the beginning of the 21st century, *H. lucorum* was known only from the mountainous Crimea, from where it was described as *Helix taurica* Krynicki, 1833, and then for a long time was considered a subspecies of *H. lucorum* (LIKHAREV & RAMMELMEYER 1952). *H. lucorum* was even included in the Red Book

of Ukraine (AKIMOV 2009: 300) then in the regional Red Book of Crimea (IVANOV & FATERYGA 2015: 49) as an endemic Crimean subspecies. However, phylogenetic analysis of mitochondrial markers did not confirm either the special taxonomic status of the Crimean form of *H. lucorum*, or the endemic or even native nature of the Crimean populations of the species (KORÁBEK et al. 2018). On the contrary, the obtained results rather confirm the correctness of the previously existing version that *H. lucorum*

could have been introduced to the Crimean Peninsula by Greek colonists (PUZANOV 1925).

However, the specific shell colouration of *H. lucorum* from the mountainous Crimea can be used to study the species' spreading history in other parts of Ukraine (KHLUS & TKACHUK 2012; BALASHOV et al. 2013; GURAL-SVERLOVA et al. 2018) and even within the Crimean peninsula itself (LEONOV, 2006). It makes it possible to distinguish populations founded by such individuals (GURAL-SVERLOVA et al.



**Fig. 1.** Specimens of *H. lucorum* from different parts of Ukraine with well-developed dark spiral bands on the shell: A, B – Chortkiv, Ternopil region, 2020; C, D – from the same location, 2023; E – Odesa, 2023; F – Pokrov, Dnipropetrovsk region, 2011; G – Henichesk Hirka, Kherson region, 2019. Photos by O. Lyzhechka (A, B), N. Gural-Sverlova (C, D), I. Pituk (E), K. Kolesnykova (F) and K. Orlova-Hudim (G).

2018) from populations with other origins (LEONOV, 2006; KHLUS & TKACHUK 2012; BALASHOV et al. 2013), which will also be shown in this publication.

### Material and methods

In Western Ukraine, specimens of *H. lucorum* were first discovered and photographed by Orest Lyzhechka in June 2020 on the southern outskirts of Chortkiv, Ternopil region, on the fence of a household plot, 48.986599N, 25.795244E. Two years later, in October 2022, images of several individuals were posted in the citizen science database UkrBIN (Ukrainian Biodiversity Information Network), observations Nos 268920–268924. Two of them are shown in Figure 1A, B. At the same location, snails were observed periodically for several years. In September 2023, a small sample of *H. lucorum* (Figs 1C, D, 2) was collected under the fence and in the courtyard of this private house and transferred to the State Museum of Natural History of the National Academy of Sciences of Ukraine in Lviv (hereafter referred to as SMNH NANU). The shells of 7 specimens of different ages are deposited in the malacological collection of the museum, inventory No. 5230.

To analyze the current distribution of *H. lucorum* in Ukraine (Fig. 3), we used personal observations, materials from the malacological collection of SMNH NANU, literary data (RETOWSKI 1883; PUZANOV 1925; POPOV & LYSIAKOV 1999; LEONOV 2006; KRAMARENKO 2009; KHLUS & TKACHUK 2012; BALASHOV et al. 2013), and information from two citizen science databases (iNATURALIST 2024, UKRBIN 2024), if the photographs posted there allowed reliable species identification. Only thanks to these databases, we know about the presence of *H. lucorum* in the following localities outside of Crimea:

- 1) Kyiv region, Kyiv city, a number of observations in 2023 in the Pechersk district (Lypky): 21.06.2023, 50.43761N, 30.53347E (iNATURALIST, No. 168891629), 29.06.2023, 50.43943N, 30.53790E (iNATURALIST, No. 170264467), 29.06.2023, 50.43780N, 30.53344E (iNATURALIST, No. 170265227) (Fig. 4D), etc., as well as one record in the Shevchenko district of the city: 08.09.2023, 50.45956N, 30.419477E (iNATURALIST, No. 182322749);
- 2) Kherson region, outskirts of Henicheska Hirka village, 16.11.2019, 46.06983N, 34.83199E (iNATURALIST, No. 57846485) (Fig. 1G);
- 3) Zaporizhzhia region, Zaporizhzhia city (Voznesenivka district), 29.04.2016, 47.85601N, 35.07797E (iNATURALIST, No. 109089962).



Fig. 2. The shell colouration of *H. lucorum* from Chortkiv, Western Ukraine (SMNH NANU, No. 5230). Photos by N. Gural-Sverlova.

## Results

In Chortkiv, individuals of *H. lucorum* have been found only in the household plot of one mansion and along its fence. The mistress of the house reported that her husband, who works in France, several years ago brought a “small bucket” of beautiful snails from there for his children and released them in the yard. When the snails reproduced greatly, he took part of them to the nearby forest. The further fate of these individuals is unknown: *H. lucorum* has not yet been observed in the forest.

The shells of most of the collected snails had well-developed dark spiral bands. The bands located above and below the shell periphery were often fused, forming wide dark ribbons. Even a shell with relatively light and narrow bands (on the right in Fig. 2) had a clearly visible light gap at the periphery, corresponding to the gap between the 3rd and 4th bands, if counted according to the standard method from the apex. Radial dark streaks were expressed varying degrees, from frequent and clearly visible to almost completely absent. In four measured shells of adults shown in Figure 2, the width (diameter) ranged from 45 to 48 mm, and the height – from 39 to 41 mm.

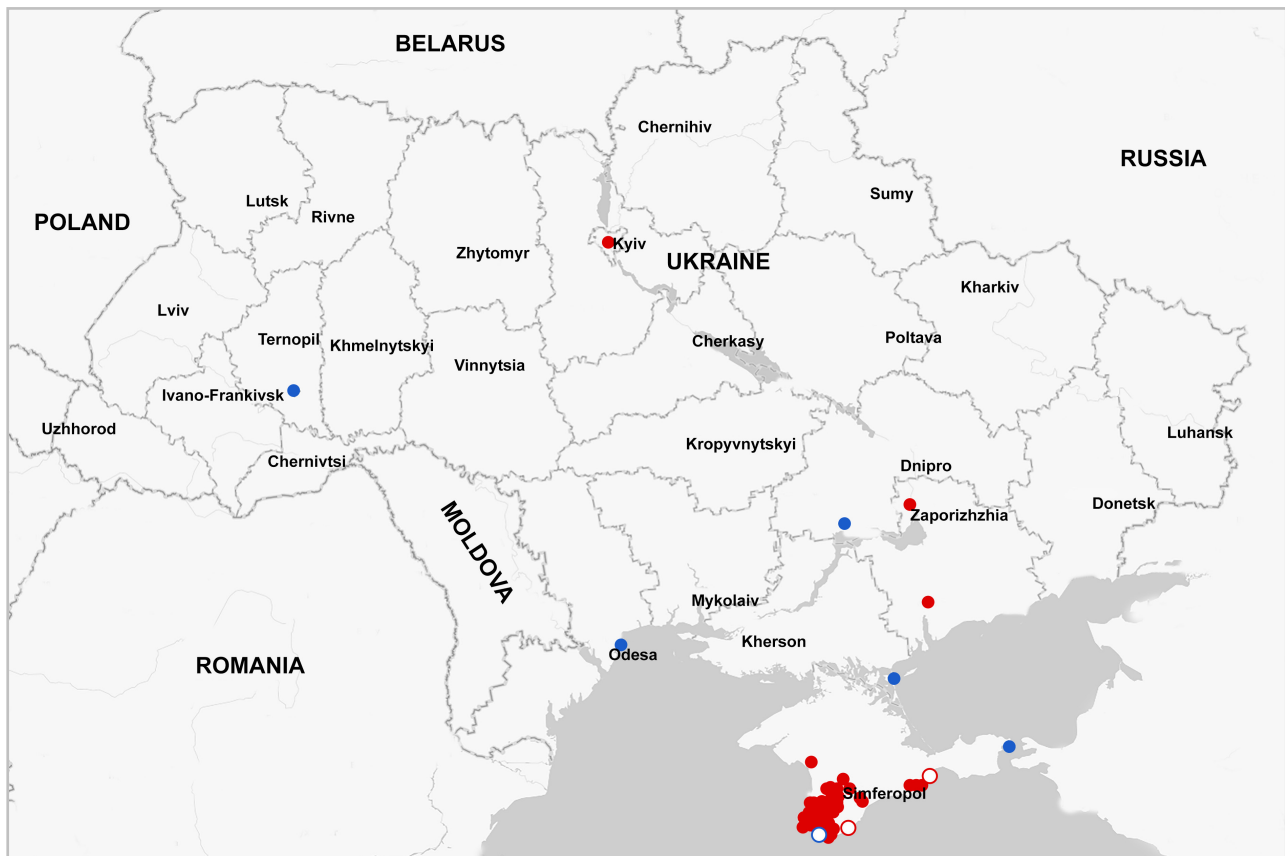
In addition to Chortkiv in Western Ukraine, *H. lucorum* with a similar shell colouration is occasionally found, judging by the analyzed literary sources and databases, also in the south of the country (Fig. 3). Such records are known from Kerch in the east of the Crimean Peninsula,

from the south of the Kherson region (Fig. 1G), from the cities of Odesa (Fig. 1E) and Pokrov (until 2016 – Orzhonikidze, Dnipropetrovsk region) (Fig. 1F). In the last two cases, there are repeated independent observations made in different years, which may indicate the successful acclimatization of *H. lucorum* in these settlements.

Specimens of *H. lucorum* with the shell colouration typical of the mountainous Crimea (Fig. 4A, B), were also recorded in the capital of Ukraine (Fig. 4D) and two cities of the Zaporizhzhia region (Zaporizhzhia, Melitopol – Fig. 4C). In addition to distinct dark radial streaks, they are characterized by very weak development of spiral bands, which in adults are often visible only on the upper whorls (Fig. 4B). Accordingly, such shells do not have a distinct light stripe on the periphery.

## Discussion

The distribution area of *H. lucorum* in Ukraine is gradually expanding, both in Crimea (POPOV & LYSIAKOV 1999; SIROTINA et al. 2002; LEONOV 2006) and beyond (KHLUS & TKACHUK 2012; BALASHOV et al. 2013; GURAL-SVERLOVA et al. 2018; iNATURALIST 2024). However, most of the known records of this species (Fig. 3), like a century ago (PUZANOV 1925), remain limited to the south-western part of Crimea, where *H. lucorum* could have been brought by Greek colonists (PUZANOV 1925; KORÁBEK et al. 2018), possibly from Anatolia, Turkey (KORÁBEK et al. 2018).



**Fig. 3.** Distribution of *H. lucorum* in Ukraine: in red – shell colouration characteristic for the mountainous Crimea; in blue – well developed dark spiral bands. Circles with a light center indicate some records made by the end of the 19th century or in the beginning of the 20th century, see Discussion.

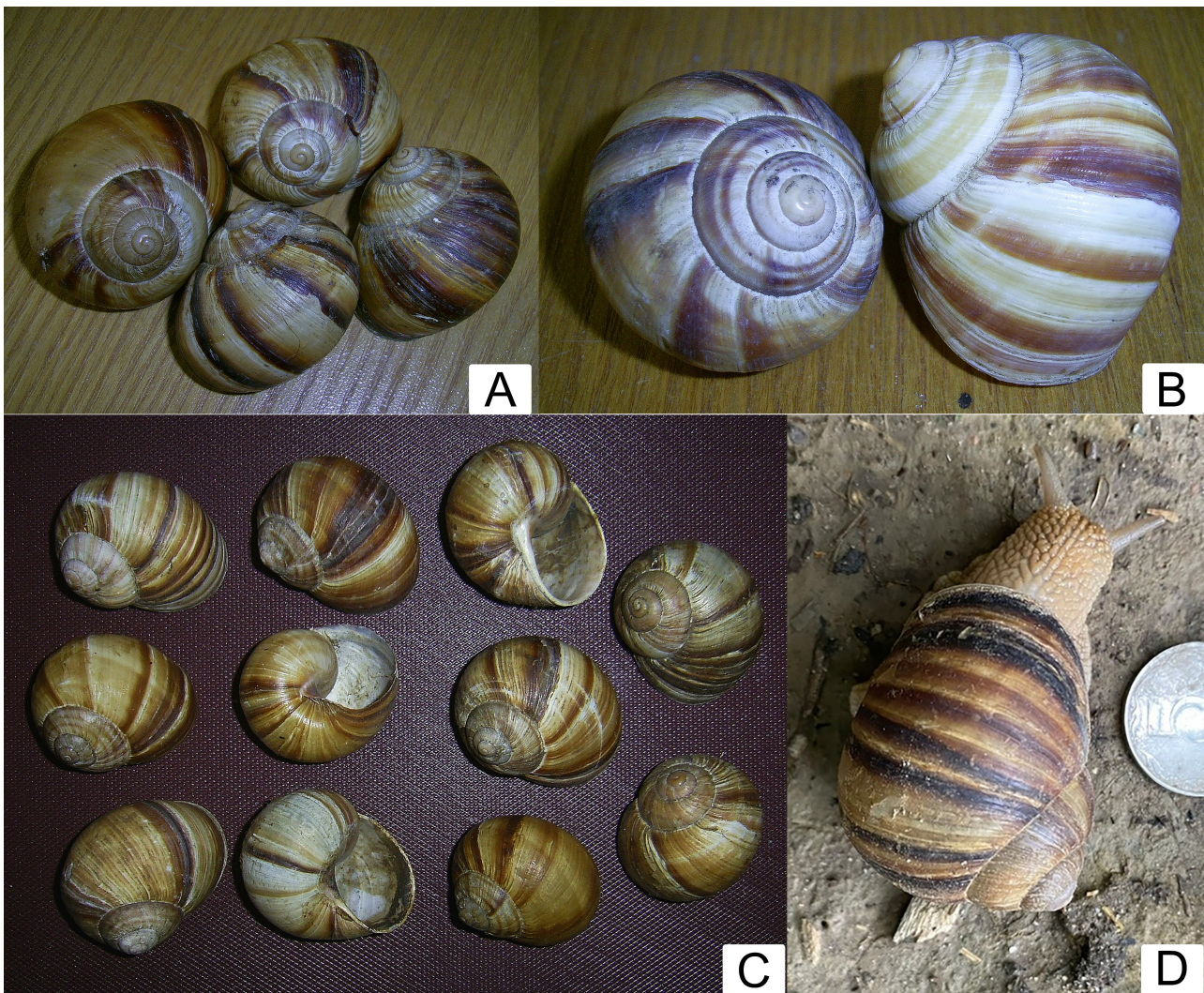
Already PUZANOV (1925) drew attention to the fact that the primary distribution of *H. lucorum* in Crimea coincides with the location of the oldest and most populous Greek settlements around Tauric Chersonesos (now the ruins of ancient Chersonesos are within the administrative boundaries of Sevastopol city).

In the Middle Ages, *H. lucorum*, used as food by the local population, could have spread along the inner ridge of the Crimean Mountains to Bakhchysarai (SIROTINA et al. 2002). By the end of the 20th century, the range of *H. lucorum* in Crimea slowly expanded northward, its local populations were recorded north of Simferopol and even in the semi-desert landscapes near Lake Sasyk-Syvash, western Crimea (SIROTINA et al. 2002). This species was also repeatedly introduced to the Southern coast of Crimea; already by the end of the 19th century, it was recorded in Feodosia (RETOWSKI 1883), at the beginning of the 20th century – in one of the gardens of Yalta (PUZANOV 1925). These two records are shown as light circles with red borders in Figure 3. In 1989, fifty adults of *H. lucorum* were released into the Karadag Nature Re-

serve, and 9 years later, their numbers increased by more than 500 times (POPOV & LYSIAKOV 1999).

By the end of the 20th and in the beginning of the 21st century, there were favourable preconditions for the introduction of *H. lucorum* from Crimea to other administrative regions of Ukraine:

- 1) due to global climate changes, some species of land molluscs, previously found only in the south of Ukraine, began to be increasingly recorded in its other parts, up to the northernmost administrative regions (BALASHOV & MARKOVA 2023a, 2023b; GURAL-SVERLOVA & RODYCH 2023, etc.);
- 2) the distribution area of *H. lucorum* in Crimea itself has expanded (see above), covering many locations of mountainous Crimea that are attractive to tourists (Fig. 3);
- 3) until 2014, Crimea was one of the favourite summer holiday destinations for residents of other regions of Ukraine;
- 4) the large size and unusual shell colouration of Crimean specimens of *H. lucorum* makes them attractive even to persons not interested in zoology;



**Fig. 4.** *H. lucorum* from Crimea (A, B) and populations founded by individuals from Crimea (C, D): A – Bakhchysarai, 2010 (SMNH NANU, No. 3140); B – Sevastopol (Frontove), 2002 (SMNH NANU, No. 1317); C – Melitopol, Zaporizhzhia region, 2020 (SMNH NANU, No. 4915); D – Kyiv, 2023. Photos by N. Gural-Sverlova (A–C) and O. Shestopalova (D).

5) interest in keeping snails at home is growing, primarily this concerns Achatinidae and other exotic species, but also large representatives of the fauna of Ukraine.

Despite this, the first introduced populations of *H. lucorum*, recorded in 2010 in Ordzhonikidze (now Pokrov), Dnipropetrovsk region (BALASHOV et al. 2013) and in 2011 in Odesa (KHLUS & TKACHUK 2012) could not have been founded by individuals from Crimea.

This was reliably evidenced by their shell colouration, with wide, often fused dark spiral bands, characteristic of many introduced European populations of *H. lucorum*, for example, from Poland (SZPALEK et al. 2023: figs 2, 3; ZAJĄC et al. 2023: fig. 2), Slovakia (ČEJKA & ČAČANÝ 2014: fig. 1), Hungary (PÁLL-GERGELY et al. 2019: fig. 1), German (HENKEL 2013: fig. 1); Austria (FISCHER et al. 2008: fig. 1), Spain (SALGADO et al. 2010: figs 2, 3), France (ALLEMANT & BLANC 1992; MIENIS & RITTNER 2010: fig. 1; BERTRAND & SANÈGRE 2015: fig. 1), England (PALMER 2010; WHITEHEAD 2014: fig. 3) or from the central part of European Russia (STOJKO & BULAVKINA 2010: table XV; EGOROV 2017: figs 2, 3), but not for Crimea (Fig. 4 A, B). Later, in Odesa (Fig. 1E) and Pokrov (1F), specimens of *H. lucorum* with the same shell colouration, not typical for Crimea, were found. This may indicate the formation of stable populations of unknown origin there.

Since specimens with the shell colouration described above can be found in different parts of the present range of *H. lucorum* (Fig. 5 A–D), their discovery in several localities of Ukraine does not usually indicate the origin of such populations. The exceptions are Chortkiv, where the snails were deliberately brought from France, and quite possibly Kerch in the very east of the Crimean Peninsula. In 2005, at a gathering point in the north of Kerch, purchasing snails collected from nature, several dozen *H. lucorum* individuals of different ages with such shell colouration were found (LEONOV 2006). The discovery of an introduced species in a port city is not unexpected and theoretically could have been caused by its importation from different countries. However, it is impossible to ignore that only the Kerch Strait separates this location from the Krasnodar region of Russia, where such colouration form of *H. lucorum* is very common, see Fig. 5D, as well as numerous observations in the citizen science database (iNATURALIST 2024).

Theoretically, specimens of *H. lucorum* with this form of shell colouration could also be released into the environment from snail farms, as we recently showed for *Cornu aspersum* (O.F.Müller, 1774) (GURAL-SVERLOVA & GURAL 2021). But now *C. aspersum* is a popular species for farming in Ukraine (DANILOVA 2022) while the possibility of farm breeding of *H. lucorum* and the native species *Helix albescens* Rossmässler, 1839 was only tested in Crimea (RYEZNİK & POPOV, 2010). Outside Ukraine, *H. lucorum* is usually collected from nature and has only recently been introduced into heliciculture (LOUW 2024: 13). There is also no evidence of the possible spread of *H. lucorum* in Ukraine through garden centres, which is often recorded for two introduced *Cepaea* species (GURAL-SVERLOVA & GURAL 2024), and recently noted for *C. aspersum* in the Lviv region (personal unpublished observations).

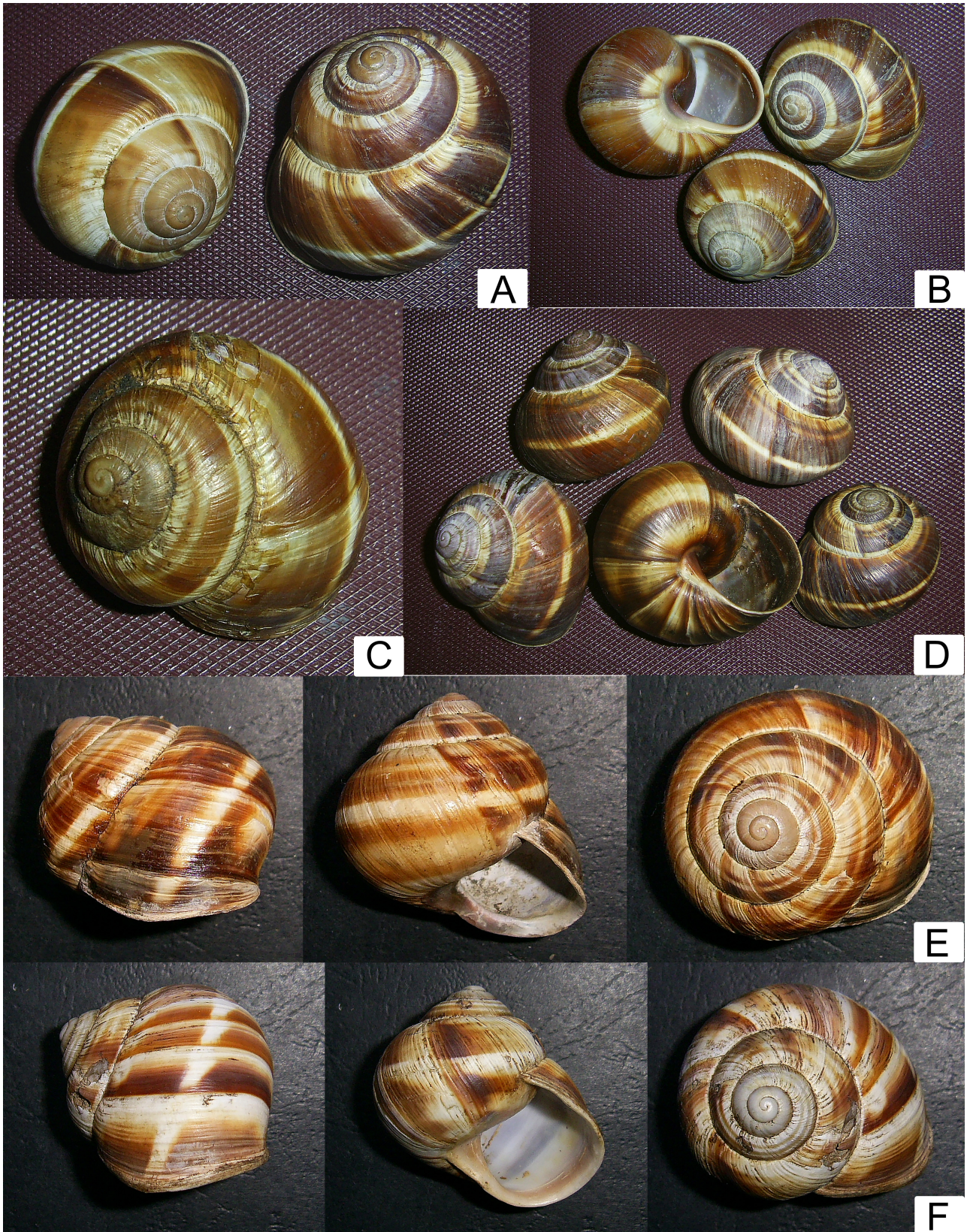
The colouration and, in general, the appearance of the shell, characteristic of *H. lucorum* populations from the mountainous Crimea, cannot be called unique. This has been known for quite a long time: for example, KOBELT (1902–1906: table 354) shows images of two almost identical shells, one of which is designated as *H. taurica* from Crimea, the second as “*Helix radiosa* Ziegler” from Asia Minor (now a synonym for *H. lucorum*). The great external similarity between *H. taurica* and *H. radiosa* was also mentioned by PUZANOV (1925), when describing the malacofauna of the mountainous Crimea. In the monograph by LIKHAREV & RAMMELMEYER (1952), *H. lucorum tauricum* is also mentioned for the Black Sea coast of the Caucasus and Transcaucasia.

However, Turkey, in contrast to the mountainous Crimea, is characterized by high conchological and genetic diversity of *H. lucorum* (KORÁBEK et al. 2018); the first is clearly confirmed, in particular, by numerous photographs in iNATURALIST (2024). A comparison of a snail from Crimea with “other globular-shelled *H. lucorum* forms” from 5 different localities in Turkey (KORÁBEK et al. 2018: fig. 3) is instructive. In most cases, on the ultimate shell whorl in Turkish specimens, dark spiral bands and/or a light gap between them at the shell periphery are more or less clearly visible. Neither of these is typical for Crimea.

In the Caucasus region, including the lowland areas of Ciscaucasia, there is also great variability of the shell colouration in *H. lucorum* (Fig. 5 D–F, as well as numerous images in iNATURALIST 2024). In general, the colouration varies from broad, dark and fused spiral bands (Fig. 5D), characteristic of the nominotypical form of *H. lucorum* (KORÁBEK et al. 2018) to shells with both spiral bands and radial streaks clearly visible (Fig. 5F). The last colouration variant in Armenia was repeatedly observed by the first author of this article. It looks like an intermediate variant between the nominotypical form (see above) and the colouration characteristic of the mountainous Crimea (GURAL-SVERLOVA et al. 2018).

Thus, if *H. lucorum* was introduced into Ukraine outside Crimea directly from the Caucasus or even from Turkey, the founded populations would most likely differ in appearance from those from Crimea. This could be expressed, for example, in greater variability in the shell colouration or more noticeable spiral banding, even in combination with distinct radial streaks. Therefore, the currently known records of *H. lucorum* in the Zaporizhzhia region (GURAL-SVERLOVA et al. 2018; iNATURALIST 2024) and in Kyiv (iNATURALIST 2024) can be confidently interpreted as the result of relatively recent introduction from Crimea. By the way, the introduced population of another representative of the same genus, *Helix albescens* Rossmässler, 1839, widespread in the south of Ukraine, was discovered in Kyiv almost 20 years earlier (BALASHOV & VASYLIUK 2007).

The shell colouration variability in *H. lucorum* from the mountainous Crimea is manifested mainly in the degree of expression of dark radial streaks. These streaks are formed not randomly but before places where the shell growth temporarily stops. Therefore, an increase in their number on the shell may indicate unfavourable environmental con-



**Fig. 5.** Shells of *H. lucorum* from different parts of Europe (A–C) and the Caucasus region (D–F): A – Montana, Bulgaria, 2014 (SMNH NANU, No. 3571); B – Moscow, Russia, 2015 (SMNH NANU, No. 4436); C – Penza, Russia, 2005 (SMNH NANU, No. 2840); D – Abinsk, Krasnodar region, Russia, 2014 (SMNH NANU, No. 3624); E – Jandari, Georgia, 2010 (SMNH NANU, No. 3467); F – Nerkin Hand, Armenia, 2016 (SMNH NANU, No. 3886). Photos by N. Gural-Sverlova.

ditions, for example, frequent dry periods. The presence of long time periods favourable for living activity of snails leads to the formation of large monochrome fragments on the shells of Crimean *H. lucorum* (GURAL-SVERLOVA et al. 2018). PUZANOV (1925) mentions one specimen of *H. lucorum* with distinct spiral bands on the ultimate shell whorl and almost completely absent radial streaks, collected in 1924 in the Laspi valley, i.e. in the zone of compact habitat of the Crimean form of this species (indicated by a light circle with a blue border in Figure 3). However, this shell is shown in such a position that it is impossible to assess its shape, and its colouration also does not fully correspond to the usual colouration of the nominotypical form of *H. lucorum* (KORÁBEK et al. 2018). KESSLER's (1861: 223) earlier assertion that the "normal form" of *H. lucorum* was more common in the mountainous Crimea than "taurica" variety was based on an erroneous identification of *H. albescens*, which was widespread there (PUZANOV 1925). It may also be mentioned that this is not the only erroneous identification of molluscs by KESSLER (1861), who specialized in studying birds and then fish.

The introduction is often accompanied by a limitation of genetic and phenotypic diversity caused by a limited number of founding individuals of new populations (founder effect). In land snails, it can lead to the complete absence of some colouration traits or their combinations that are common in their natural ranges (GURAL-SVERLOVA & GURAL 2022) and, conversely, to the frequent occurrence of rarer and local traits (HOWE 1898). It is obvious that the introduction of *H. lucorum* to Crimea led to the formation of populations that represent an extreme form of the wide conchological variability of this species (NEUBERT 2014: figs 30–55; GURAL-SVERLOVA et al. 2018: fig. 1). The opposite extreme of this continuous variability is demonstrated by most introduced European populations of *H. lucorum* (KORÁBEK et al. 2018), including some recent records of this species in Ukraine, indicated by blue circles in Figure 3.

In addition to colouration, the extreme variants of the conchological variability in *H. lucorum* mentioned above also have some differences in the shell shape, which is more depressed in the nominotypical form of the species (KORÁBEK et al. 2018). However, in our analysis, we deliberately focused on the shell colouration. First, the shell shape is not always easy to estimate from photographs in databases or even in publications. Second, it can be variable even within the same population, so images of single specimens are not always informative. Third, the shell size and shape depend not only on genetics but also on living conditions, and therefore may change somewhat in introduced populations.

The introduction of *H. lucorum* from the mountainous Crimea to another part of Ukraine was first described based on a sample collected in 2017 in Melitopol, Zaporizhzhia region (GURAL-SVERLOVA et al. 2018). Later, another sample (Fig. 4C) and two separate shells of *H. lucorum*, collected in 2017–2020 at different sites of the same settlement, were also transferred to the malacological collection of SMNH NANU. In 2022, a photograph of one specimen of *H. lucorum* with the same colouration, taken

in 2016 in Zaporizhzhia (see Material and methods), was posted in the database iNATURALIST (2024). There is so far no other evidence of the spread of the Crimean form of *H. lucorum* in the Zaporizhzhia region, although this could well have been facilitated by the territorial proximity to the Crimean peninsula and the warm climate. Since 2023, images of some specimens of *H. lucorum* with similar shell colouration from Kyiv began to appear in the same database, taken almost exclusively in a small area bounded by Mechnikov, Marianenko and Klovskiy Uzviz streets. The spread of *H. lucorum* in Ukraine outside of Crimea occurs slowly and from different sources, unlike the populations from the mountainous Crimea, which have a common origin and similar appearance. These sources definitely include Crimea and France (one documented case), and quite possibly the Caucasus region, i.e. areas that are not parts of the natural range of *H. lucorum*. Multiple sources are not unusual for species that disperse by anthropochory, whose spreading routes can be very complicated. In the case of Western Ukraine, most likely from the Balkans via France, which was possibly colonized via Italy. *H. lucorum* has been known in France since 1883, when it was brought from Italy to the vicinity of Lyon (MIENIS & RITTNER 2010). (MIENIS & RITTNER 2010).

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