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ALIEN MOLLUSKS OF CRIMEAN ORIGIN IN OTHER PARTS OF UKRAINE: PRESENT DISTRIBUTION AND CHRONOLOGY OF ITS DISCOVERY

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Alien Mollusks of Crimean Origin in Other Parts of Ukraine: Present Distribution and Chronology of Its Discovery. Gural-Sverlova, N. V. & Gural, R. I. — Known records of five species of land snails of Crimean origin, *Brephulopsis cylindrica* (Menke, 1828), *B. bidens* (Krynicki, 1833), *Mentissa gracilicosta* (Rossmässler, 1836), *Monacha fruticola* (Krynicki, 1833), *Helix albescens* Rossmässler, 1839, in Ukraine outside the Crimea were analysed. It was found that at least single species from this list are now reliably registered in more than half of the administrative regions of Ukraine. Maps for *B. cylindrica*, *M. fruticola*, and *H. albescens* were compiled. The data systematised in the article can become the basis for monitoring the further spread of the analysed species in Ukraine.
Key words: land mollusks, Gastropoda, introduced species, anthropochory, Ukraine.

Introduction

Today, a number of alien species of land mollusks can be found in every region of Ukraine (Balashov, 2016; Balashov & Gural-Sverlova, 2012; Gural-Sverlova, 2018; Gural-Sverlova et al., 2018; Son, 2010; Sverlova et al., 2006). The spread of these species outside their natural ranges has been facilitated by human activities. The composition, distribution and chronology of discovery of such species were analysed in the most detail for the west of the country (Gural-Sverlova & Gural, 2021). Also, recently there have been publications devoted to the expansion of the ranges of some species (Balashov & Markova, 2023 b; Gural-Sverlova et al., 2021, 2022; Gural-Sverlova & Gural, 2023; Vychalkovskaya, 2008) and even genera (Balashov & Markova, 2023 a; Balashov & Sverlova, 2007; Gural-Sverlova & Gural, 2017; Gural-Sverlova & Rodych, 2023; Gural-Sverlova et al., 2019) in Ukraine or wider areas of Eastern Europe.

One of the most striking trends in the spread of alien land mollusks in Ukraine is the gradual movement of some species from south to north, facilitated by the intensification of transport and trade connections, global climate changes and the specific microclimate of settlements. This trend has been clearly demonstrated especially for the genera *Monacha* (Balashov & Markova, 2023 a; Gural-Sverlova & Gural, 2023) and *Xeropicta* (Gural-Sverlova & Gural, 2017). Some species known only from the south of Ukraine or only from the Crimea until almost the end of the 20th century now successfully survive in the north of the country, for example in the city of Kyiv and the Kyiv Region (Balashov 2008; Balashov & Markova, 2023 a, b; Balashov & Sverlova, 2007), and even further north, in Belarus (Ostrovsky, 2023; Rabchuk & Zemoglyadchuk, 2011).

In this paper we analyse the present distribution and the chronology of discovery in different administrative regions of 5 species of terrestrial mollusks of Crimean origin, all or at least part of whose known records in Ukraine outside the Crimea are the result of anthropochory: *Brephulopsis cylindrica* (Menke, 1828), *B. bidens* (Krynicki, 1833), *Mentissa gracilicosta* (Rossmässler, 1836), *Monacha fruticola* (Krynicki, 1833) and, according to recent research (Korábek et al., 2023), *Helix albescens* Rossmässler, 1839. None of them were recorded in the Northern Black Sea region of Ukraine in the Pleistocene (Kunitsa, 1974). Such an analysis has never been carried out for *H. albescens*, and the ranges of *B. cylindrica* and *M. fruticola* have recently expanded so rapidly that the maps published not long ago (Gural-Sverlova & Gural, 2020 b: fig. 2; Vychalkovskaya, 2008: fig. 1) have already lost their relevance. The need for such an analysis is further aggravated by the fact that in recent years, more and more finds of alien species in Ukraine have been recorded not in scientific publications, but in citizen science databases (iNaturalist, 2024; UkrBIN, 2024), where they are not always accompanied by correct identifications.

Helicopsis filimargo (Krynicki, 1833), previously mentioned in Ukraine only for the mountainous Crimea and the environs of Odesa (Schileyko, 1978), according to a recent genetic study (Balashov et al., 2021), is also widespread in the south and east of Ukraine east of the Dnipro River. According to this study, *H. filimargo* "probably originated in Crimea and expanded from there into the Black Sea Lowland and the Donetsk Upland". However, the mentioned publication does not describe conchological features that allow reliably differentiating *H. filimargo* from other species of the genus found in the east of Ukraine and adjacent areas of Russia (Balashov et al., 2021: fig. 1). Considering the large intraspecific shell variability in *Helicopsis*, it is difficult to establish to which species belong their earlier literary mentions for Ukraine, including fossil records (Kunitsa, 1974). Areas for which genetically confirmed finds of *H. filimargo* are known (Balashov et al., 2021: fig. 1) may be part

Fig. 1. Known records of *Brephulopsis cylindrica* in Ukraine outside Crimea: black circles indicate material of the State Museum of Natural History in Lviv (mainly) and other personally examined samples; white circles — other sources of information (see Material and Methods). Different localities within the same settlement or in its immediate vicinity are shown with one symbol.

Fig. 2. Known records of *Monacha fruticola* in Ukraine outside Crimea; symbols are similar to fig. 1.

of the natural range of this species, and evidence of its obvious transportation by people over long distances has not yet been documented. Therefore, we did not include *H. filimargo* in this review, the main purpose of which is to analyse trends in the expansion of the ranges of land mollusks of Crimean origin, caused precisely by anthropochory.

Material and Methods

One of the important sources of information used were the results of our own long-term research of land mollusks from different parts of Ukraine, during which we had the opportunity to study the collections of different persons (see Acknowledgments). Many materials collected by us personally or donated by others are stored in the malacological collection of the State Museum of Natural History of the National Academy of Sciences of Ukraine in Lviv (Gural-Sverlova, Gural, 2020 a), hereinafter referred to as SMNHL. In particular, the museum collection well represents shelled species of land mollusks of the western part of Ukraine and the steppe zone of Ukraine outside Crimea (Gural-Sverlova, 2018). At the beginning of 2022, it was significantly replenished with samples of land mollusks from the north-western Azov Sea region (Gensytskyi, 2021).

Literary sources published in different time periods were used: the beginning of the 20th century (Lindholm, 1908), the middle of the 20th century (Likharev & Rammelmeyer, 1952), the second half of the 20th century (Korniushin, 1980, 1986; Schileyko, 1978), the beginning of the 21st century (Balashov, 2013, 2016; Balashov et al., 2013, 2018; Balashov & Markova, 2023 a; Vychalkovskaya, 2008). Observations from two citizen science databases (iNaturalist, 2024; UkrBIN, 2024) were also critically analyzed if they did not duplicate other data, see above. Of these, those observations were selected that were accompanied by sufficiently high-quality photographs of mollusks or their shells that allowed reliable identification of species. A list of such observations used for distribution maps of three species or mentioned in the main text of the article is given below.

Brephulopsis cylindrica

Dnipropetrovsk Region, Dnipro, 07.10.2023, 48.485721N 34.939251E (iNaturalist 186524107); Marianivka, 10.07.2021, 47.999997N 33.303392E (iNaturalist 86648461); Novooleksandrivka, 09.06.2021, 48.352028N 35.015897E (UkrBIN 202949).

Donetsk Region, Makiivka, 22.04.2012, 48.092614N 37.921868E (iNaturalist 83494962);

Kharkiv Region, Chuhuiv, 12.11.2023, 49.826509N 36.698266E (iNaturalist 90769199);

Kherson Region, Beryslav, 10.08.2021, 46.838158N 33.422602E (iNaturalist 106798010); Henichesk District, 12.06.2020, 46.148941N 34.806290E (UkrBIN 158941); Kakhovka District, 24.10.2020, 46.701366 N 33.405319 E (iNaturalist 63406175);

Kirovohrad Region, Kropyvnytskyi, 02.06.2022, 48.489779N 32.197437E (iNaturalist 119868757);

Kyiv Region, Boiarka, 27.06.2022, 50.309096N 30.316555E (iNaturalist 124306850);

Luhansk Region, Luhansk, 24.08.2022, 48.587982N 39.342361E (UkrBIN 261689);

Mykolaiv Region, Nova Odesa District, 23.09.2023, 47.331508N 31.790749E (iNaturalist 186677401); Sebine, 15.05.2018, 47.197786N 31.859317E (iNaturalist 14352345);

Odesa Region, Avanhard, 01.08.2023, 46.467694N 30.614157E (iNaturalist 176922591); Biliaivka District, 29.09.2022, 46.616718N 30.585535E (iNaturalist 136941146); Bolhrad, 24.09.2023, 45.674778N 28.605541E (iNaturalist 184649985); Frumushika-Nova, 03.09.2023, 46.297964N 29.413054E (iNaturalist 181532759); Khomynka, 01.10.2022, 46.712799N 30.440081E (iNaturalist 137168476); Kryzhanivka, 21.07.2021, 46.557858N 30.789875E (iNaturalist 88320748), 26.08.2023, 46.564622N 30.789353E (iNaturalist 180303873); Lyman District, 09.05.2020, 46.634501N 31.154905E (iNaturalist 45370428), 27.06.2023, 46.623352N 30.886422E (iNaturalist 169855787), 11.09.2020, 46.605971N 31.053016E (UkrBIN 216595); Rozdilna District, 02.05.2023, 46.691847N 30.480812E (iNaturalist 159716959); Sarata, 17.08.2021, 46.017631N 29.675494E (iNaturalist 91500868); Tarutyne District, 16.08.2021, 46.2974N 29.414179E (iNaturalist 91403065); Tatarbunary, 15.06.2023, 45.825561N 29.605611E (iNaturalist 167506467);

Poltava Region, Kremenchuh, 23.07.2021, 49.096451N 33.407190E (UkrBIN 212480);

Rivne Region, Rivne, 22.07.2022, 50.627122N 26.25357E (iNaturalist 127646675);

Zaporizhzhia Region, Berdiansk District, 18.07.2017, 46.756001N 36.523442E (iNaturalist 105734284); Stepanivka Persha, 16.08.2020, 46.46807N 35.522542E (iNaturalist 56603297); Yakymivka District, 17.07.2020, 46.383929N 35.371217E (UkrBIN 173247).

Outside Ukraine: Belarus, Minsk, 20.12.2021, 53.859255N 27.597623E (iNaturalist 103370112), 04.08.2023, 53.953744N 27.683704E (iNaturalist 176607381), 09.08.2023, 53.953853N 27.684584E (iNaturalist 177483193).

Monacha fruticola

Cherkasy Region, Cherkasy, 26.04.2023, 49.424741N 32.062402E (UkrBIN 285913), 29.04.2023, 49.438343N 32.087068E (iNaturalist, 157714258);

Dnipropetrovsk Region, Dnipro, 17.07.2022, 48.415253N 35.035911E (iNaturalist 26853165), 04.05.2023, 48.414819N 35.037171E (iNaturalist 159836786), 09.06.2023, 48.413014N 35.032622E (iNaturalist 166550073), 26.10.2023, 48.487758N 34.915992E (iNaturalist 188989730); Dnipropetrovsk District, 17.04.2018, 48.534069N 34.800577E (iNaturalist 186332674); Kamianske, 30.04.2022, 48.526268N 34.56601E (iNaturalist 113781867); Kryvyi Rih, 17.07.2022, 48.026201N 33.474706E (iNaturalist 127366461);

Kherson Region, Hryhorivka, 30.04.2021, 46.299591N 33.744735E (iNaturalist 102673433); Novovorontsovka District, 30.04.2021, 47.451565N 33.929176E (iNaturalist 76913304); Skadovsk, 24.04.2021, 46.109874N 32.905032E (iNaturalist 78880066), Velyki Kopani, 04.07.2021, 46.507241N 32.994108E (iNaturalist 97354741);

Kirovohrad Region, Kropyvnytskyi, 28.05.2023, 48.50048N 32.232113E (iNaturalist 164364768);

Luhansk Region, Luhansk, 16.05.2018, 48.523934N 39.360917E (UkrBIN 228994); Starobilsk, 21.05.2021, 49.284418N 38.897173E (iNaturalist 79796543), 10.06.2021, 49.273936N 38.914156E (iNaturalist 82406895), 15.09.2021, 49.263915N 38.923709E (iNaturalist 94940554);

Mykolaiv Region, Kazanka, 22.07.2022, 47.831214N 32.828547E (iNaturalist 127360601); Nova Odesa District, 23.09.2023, 47.331344N 31.790512E (iNaturalist 186679053);

Odesa Region, Kryzhanivka, 02.07.2019, 46.557848N 30.789587E (iNaturalist 49366063): Lyman District, 11.09.2020, 46.605971N 31.053016E (UkrBIN 216581), 02.01.2021, 46.563048N 30.808191E (iNaturalist 67528932), 14.04.2023, 46.553776N 30.837602E (iNaturalist 154841916); Maiaky, 31.05.2019, 46.412674N 30.265408E (UkrBIN 116527); Rozdilna District, 04.09.2022, 46.804256N 30.474497E (UkrBIN 263510), 04.09.2022, 46.804192N 30.474846E (UkrBIN 263511); Tatarbunary, 17.06.2023, 45.826768N 29.609021E (iNaturalist 168190423);

Zaporizhzhia Region, Andriivka, 04.05.2021, 48.003459N 35.165216E (iNaturalist 106551983, 106552513); Huliaipole District, 08.05.2021, 47.702803N 36.240475E (UkrBIN 198297); near Natalivka, 21.05.2021, 47.836353N 35.330594E (iNaturalist 104966269); Semenivka, 30.04.2018, 46.874192N 35.415334E (UkrBIN 66685).

Helix albescens

Dnipropetrovsk Region, Chervoni Pody, 03.07.2019, 47.93686N 33.507313E (iNaturalist 193518424); Dnipro, 28.05.2017, 48.513883N 35.139196E (iNaturalist 69612242), 24.08.2022, 48.415253N 35.035911E (iNaturalist 132178865), 18.09.2022, 48.415278N 35.03604E (iNaturalist 136789324), 01.06.2023, 48.412947N 35.031492E (iNaturalist 165194482), 06.10.2023, 48.487392N 34.918909E (iNaturalist 186454858), 12.06.2023, 48.466182N 35.005741E (UkrBIN 313736), etc.; Kamianske, 25.05.2021, 48.53735N 34.571819E (iNaturalist

80470084), 30.04.2022, 48.53323N 34.581505E (iNaturalist 113856293); Kryvyi Rih, 10.07.2021, 47.942124N 33.449799E (iNaturalist 86391029), 14.07.2021, 47.938974N 33.460723E (iNaturalist 126854752), 19.07.2022, 47.916456N 33.435104E (iNaturalist 126984975), 13.06.2023, 47.921714N 33.336114E (iNaturalist 167215434), etc.; Marhanets, 01.07.2022, 47.64891N 34.61052E (iNaturalist 126612691), 21.05.2023, 47.657793N 34.61801E (iNaturalist 162876612); Novooleksandrivka, 30.10.2020, 48.352239N 35.017325E (UkrBIN 183583); near Novoselivka, 20.08.2020, 48.599649N 34.014337E (UkrBIN 174438); Vilnohirsk, 23.09.2021, 48.49103N 34.069135E (iNaturalist 95844564);

Donetsk Region., Amvrosiivka, 09.06.2021, 47.793575N 38.480259E (iNaturalist 82295518); Bilenke, 11.06.2021, 48.774182N 37.630926E (iNaturalist 85975709); Kalmiuske, 01.12.2023, 47.667157N 38.083591E (iNaturalist 194731964); Makiivka, 22.04.2012, 48.092673N 37.92304E (iNaturalist 83494966);

Kharkiv Region, Krasnohrad, 23.07.2022, 49.378482N 35.469883E (iNaturalist 127507483); Zolochiv,17.07.2022, 50.26863N 35.975135E (iNaturalist 126619469);

Kherson Region, Berislav District, 10.08.2021, 46.817931N 33.326903E (iNaturalist 106798003); Bilozerka District, 06.03.2019, 46.735008N 32.858316E (iNaturalist 153672770); between Henichesk and Henicheska Hirka, 16.04.2017, 46.142445N 34.815338E (iNaturalist 186433095), 12.06.2020, 46.148941N 34.806290E (UkrBIN 158932); Kakhovka District, 30.05.2020, 46.706425N 33.406593E (iNaturalist 47950717), 30.05.2020, 46.703579N 33.406647E (iNaturalist 47950233); Nova Kakhovka, 27.06.2021, 46.760786N 33.353992E (iNaturalist 92398580); Osokorivka, 09.06.2021, 47.443469N 33.938646E (iNaturalist 82326187);

Kirovohrad Region, Kropyvnytskyi, 05.05.2021, 48.498622N 32.252122E (iNaturalist 774340550), 19.08.2022, 48.47511N 32.299564E (iNaturalist 131444211), 22.05.2023, 48.501912N 32.243929E (iNaturalist 163800541), 04.07.2023, 48.50048N 32.232113E (iNaturalist 171342525);

Kyiv Region, Chervone Zarichchia,12.04.2021, 50.320869N 31.73882E (iNaturalist 96673009);

Luhansk Region, Luhansk, 15.04.2019, 48.571158N 39.318646E (iNaturalist 22546156), 15.04.2019, 48.571156N 39.318655E (UkrBIN 105664–105668);

Mykolaiv Region, Matviivka, 26.06.2023, 47.010507N 31.910601E (iNaturalist 169555299); Ochakiv District, 31.07.2018, 46.619525N 31.797224E (iNaturalist 185715505); Parutyne, 31.07.2018, 46.71332N 31.908019E (iNaturalist 185721295);

Odesa Region, Fontanka, 14.04.2023, 46.553782N 30.837608E (iNaturalist 154842002); near Kholodna Balka, 21.01.2023, 46.620101N 30.591211E (iNaturalist 147036635); Lyman District, 02.11.2023, 46.708149N 31.167187E (iNaturalist 189793397), 02.11.2023, 46.708507N 31.167733E (iNaturalist 189791987); Rozdilna, 08.07.2022, 46.860304N 30.075837E (iNaturalist 125408990); Rozdilna District, 04.09.2022, 46.804319N 30.474406E (UKrBIN 263509); near Ruska Slobidka, 09.08.2023, 46.845441N 30.577154E (iNaturalist 177996368);

Poltava Region, Hradyzk, 16.08.2023, 49.233056N 33.131944E (UkrBIN 313162–313165); Kremenchuk, 14.05.2022, 49.058385N 33.405738E (iNaturalist 116952837); Poltava, 14.09.2019, 49.603493N 34.4982E (iNaturalist 92474096), 11.04.2022, 49.60351N 34.498245E (iNaturalist 111095885);

Zaporizhzhia Region, near Azov, 13.09.2018, 46.776002N 36.498617E (iNaturalist 148960530); Berdiansk, 27.08.1999, 46.724251N 36.841502E (iNaturalist 149544782), 14.08.2018, 46.632511N 36.759829E (UkrBIN 88173); Berdiansk District, 19.04.2018, 46.75611N 36.523485E (iNaturalist 151027339–151027341, 151027346); near Huliaipole, 28.05.2020, 47.691059N 36.235859E (UkrBIN 155480); Kamianka-Dniprovska, 19.05.2018, 47.497016N 34.41283E (iNaturalist 24988766); Melitopol District, 25.04.2021, 46.789614N 35.302355E (iNaturalist 77458653); Prymorsk, 19.07.2019, 46.720219N 36.391561E (iNaturalist 186396679), 22.07.2021, 46.71912N 36.369431E (iNaturalist 186422639); 23.07.2021, 46.722415N 36.374238E (iNaturalist 186422642); Yakymivka District, 29.03.2017, 46.593879N 35.275394E (iNaturalist 150515126).

Results and Discussion

Brephulopsis cylindrica (Menke, 1828)

Despite the fact that by the middle of the 20th century, the rercords of *B. cylindrica* were known not only in the south of Ukraine outside the Crimean peninsula (see below), but also in Moldova, the vicinity of Novorossiysk, Anapa and Sukhumi (Likharev & Rammelmeyer, 1952), the natural range of this species is usually considered limited to the Crimea (Schileyko, 1984; Vychalkovskaya, 2008). In particular, there is no fossil evidence of the presence of *B. cylindrica* in the Northern Black Sea region (Kunitsa, 1974).

Already at the beginning of the 20th century, some finds of *B. cylindrica* were described from Odesa (collected in 1902), as well as from the territory of the present Kherson

(St. Gregory Biziukiv Monastery near Chervonyi Maiak) and Zaporizhzhia (Kamianka-Dniprovska) Regions (Lindholm, 1908). With the exception of the port city of Odesa, these sites were located along the Dnipro River, and since the 1950s, along the banks of the Kakhovka Reservoir. It is interesting that in the monographs on land mollusks of the former Soviet Union published later (Likharev & Rammelmeyer, 1952; Schileyko, 1984), *B. cylindrica* is mentioned for Ukraine only from Crimea and Odesa. In 1978, *B. cylindrica* was found in Askania-Nova (Korniushin, 1986), Kherson Region, along with two more species of land mollusks brought from the Crimea: *Oxychilua deilus* (Bourguignat, 1857) and *Monacha fruticola*, see below.

Now *B. cylindrica* can be considered widespread in the south of Ukraine (Gural-Sverlova, 2018), especially along the coasts of the Black and Azov seas and along the lower reaches of the Dnipro River, northward to Zaporizhzhia (fig. 1). The northernmost known finds of this species in Ukraine have so far been made in Kyiv (Vychalkovskaya, 2008) and Rivne (iNaturalist, 2024); outside Ukraine — in Minsk (Belarus), where this species is recorded locally since the end of 2021 (iNaturalist, 2024).

In western Ukraine, a large population of *B. cylindrica* was first recorded on the grassy slopes of the stadium of the Ivan Franko National University of Lviv in 1998 (Sverlova et al., 2006). Since that time, the species has been found, although in much smaller numbers, at two more sites of Lviv distant from each other and from the stadium. In one of these cases, the snails were found near the city's main railway station, which may indicate they were brought in by rail. Besides Lviv, *B. cylindrica* was registered in 2014 in the Podilski Tovtry National Natural Park near the village of Bila, Chemerivtsi District, Khmelnytskyi Region (Balashov et al., 2018), and in 2022 in Rivne (iNaturalist, 2024).

Brephulopsis bidens (Krynicki, 1833)

Until now, data on only three known localities of *B. bidens* outside Crimea have been published (Gural-Sverlova et al., 2018): 1) Kherson Region, Chaplynka, 1990; 2) Odesa Region, Kodyma District, Tymkove, 1996; 3) Zaporizhzhia Region, Mykhailivka District, at the railway embankment near Burchak, 2017. Among the materials on which the dissertation of Gensytskyi (2021) was written, we found a small sample of *B. bidens* from another locality: Kherson Region, Genichesk District, Stokopani, forest belt between fields, 2020, 46.28899 N 34.97079 E. In the dissertation itself, *B. bidens* is mentioned for the Zaporizhzhia Region only according to literature data (Gural-Sverlova et al., 2018).

Currently, samples of *B. bidens* from Chaplynka and Tymkove are stored in the collection of land mollusks of the Schmalhausen Institute of Zoology in Kyiv (Balashov, 2016), samples from Burchak and Stokopani — in SMNHL. Images of two shells from Burchak are shown in Gural-Sverlova et al. (2018: fig. 2).

Mentissa gracilicosta Rossmässler, 1836

All *Mentissa* species are endemic to the Mountainous Crimea. In 1994, Andrii Shklyaruk found *M. gracilicosta* in Odesa near the Mother-in-Law Bridge (Pioneer Park, now Greek Park, or Greek Square). A sample of *M. gracilicosta* from this locality, collected in 1999, is deposited in SMNHL (Gural-Sverlova & Gural, 2020 a). Perhaps the species was brought to Odesa from Crimea along with grape seedlings (Sverlova et al., 2006). It is significant that in the same biotope other species of land mollusks were found, previously known in Ukraine only from Crimea, namely *Cecilioides raddei* (Boettger, 1879) and *Phenacolimax annularis* (Studer, 1820). It can be assumed that there was a joint unintentional introduction of several species.

Monacha fruticola (Krynicki, 1833)

The natural range of *M. fruticola* is apparently limited to Crimea. Previously it was also mentioned for Asia Minor (Schileyko, 1978), although this could refer to other *Monacha* species (Hausdorf, 2000). In this case, the only reliable record of *M. fruticola* outside Ukraine was made in 2016 in Armenia (Gural-Sverlova et al., 2017) in summer cottages near Yerevan (Dzoraghbyur, Kotayk Region). In Ukraine outside Crimea, the earliest known record of this species was made in 1959 in Odesa and its vicinity (Schileyko, 1978). Until 2018, all known findings of *M. fruticola* were limited to the south of Ukraine (table 1). Then this species was recorded much further to the north — in the western (in and near Lviv) and central (in and near Kyiv) parts of Ukraine (Balashov, Markova, 2023 a; Gural-Sverlova, Gural, 2020 b).

Table 1. Chronology of discovery of analysed species in Ukraine outside Crimea

Time periods	Administrative regions	Information sources
	Brephulopsis cylindrica (14 regions)	
Early 20th century	Odesa, Kherson, Zaporizhzhia	(Lindholm, 1908)
1990s	Dnipropetrovsk, Lviv, Mykolaiv	(Gural-Sverlova & Gural, 2020 a) and other personally studied materials
2000s	Donetsk, Kyiv	(Gural-Sverlova & Gural, 2020 a; Vychalkovskaya, 2008)
2014	Khmelnytskyi	(Balashov et al., 2018)
2021	Poltava	(UkrBIN, 2024)
2022	Kirovohrad, Luhansk, Rivne	(iNaturalist, 2024; UkrBIN, 2024)
2023	Kharkiv	(iNaturalist, 2024)
	Brephulopsis bidens (4 localities in 3 regions)	
1990	Kherson	(Balashov, 2016)
1996	Odesa	(Sverlova et al., 2000)
2017	Zaporizhzhia	(Gural-Sverlova et al., 2018)
	Mentissa gracilicosta (one locality in one region)	
1994	Odesa (only Odesa city)	(Sverlova et al., 2000, 2006)
	Monacha fruticola (11 regions)	
1959	Odesa	(Schileyko, 1978)
1978	Kherson	(Korniushin, 1986)
1990s	Mykolaiv	(Gural-Sverlova & Gural, 2020 a) and other personally studied materials
2000s	Zaporizhzhia	Personally studied material
2010	Donetsk	Personally studied material
2018	Lviv	(Gural-Sverlova & Gural, 2020 b)
2018	Luhansk	(UkrBIN, 2024)
2020	Kyiv	(Balashov, Markova, 2023 a)
2022	Dnipropetrovsk	(iNaturalist, 2024)
2023	Cherkasy, Kirovohrad	(iNaturalist, 2024; UkrBIN, 2024)
	Helix albescens (11 regions)	
Early 20th century	Odesa, Kherson	(Lindholm, 1908)
Mid 20th century	Mykolaiv, Zaporizhzhia	(Likharev & Rammelmeyer, 1952)
1980s	Donetsk	(Gural-Sverlova & Gural, 2020 a)
2006	Kyiv	(Balashov & Vasyliuk, 2007)
2011	Luhansk	(Balashov, 2013)
2017	Dnipropetrovsk	(iNaturalist, 2024)
2019	Poltava	(iNaturalist, 2024)
2021	Kirovohrad	(iNaturalist, 2024)
2022	Kharkiv	(iNaturalist, 2024)

Most of the known records of *M. fruticola* outside Crimea were made in Kherson, Mykolaiv, Odesa, and Zaporizhzhia Regions (fig. 2). In particular, *M. fruticola* is not only widespread, but also a mass species of land snails both in the southern (Gensytskyi, 2021) and northern (Gural-Sverlova et al., 2018) parts of the Zaporizhzhia Region. In contrast to *B. cylindrica* (fig. 1), only a few records of *M. fruticola* are known so far in the Donetsk Region (fig. 2).

Helix albescens Rossmässler, 1839

H. albescens is now widespread in southern Ukraine, including Crimea, and occurs also in some areas of the Caucasian region. Results from a recent genetic study indicate that this species is most likely of Crimean origin (Korábek et al., 2023), similar to the four land snail species described above. However, unlike them, the Caucasus may also be part of the natural range of *H. albescens*. According to Korábek et al. (2023), "it is possible that *H. albescens* was present in the Caucasus already before the Last Glacial". At the same time, "the extent of the native distribution of *H. albescens* on the East European Plain is unclear… Thus, *H. albescens* is now spreading northwards and it is possible that much of its distribution in the East European Plain is the result of recent expansion, possibly largely human-assisted".

Similar to *B. cylindrica* (see above), the first known records of *H. albescens* in Ukraine outside Crimea were described at the beginning of the 20th century (table 1). Lindholm (1908) mentions several specimens of *Helicogena obtusata* (Rossmässler, 1837), now a synonym for *H. albescens*, collected in Odesa and on the Dnipro River bank near Havrylivka village in the present Beryslav District of the Kherson Region. In the middle of the 20th century, this species was also mentioned for the administrative centres of the Mykolaiv and Kherson Regions, as well as for Melitopol in the south of the Zaporizhzhia Region (Likharev & Rammelmeyer, 1952). The same set of settlements (Odesa, Mykolaiv, Kherson, Melitopol) is repeated several decades later by Schileyko (1978). At the end of the 20th century, *H. albescens* was recorded both in anthropogenic biotopes of Mykolaiv and its environs, and in shrub thickets, sometimes in open meadow sites of the coastal areas of the Mykolaiv Region (Kramarenko & Sverlova, 2001).

The earliest sample of *H. albescens* from eastern Ukraine, stored at SMNHL (Gural-Sverlova & Gural, 2020 a), was collected in 1987 in one of the city parks of Donetsk. We did not find any literary references to earlier records of *H. albescens* in this part of Ukraine, however, focused study of land mollusks began here also relatively recently (Gural-Sverlova et al., 2012). Apparently, the most interesting finds of *H. albescens* were made at the beginning of the 21st century in floodplain forests in the south of the Lugansk Region (Balashov, 2013). *H. albescens* was recorded there twice together with a relict species of Caucasian origin, *Elia novorossica* (Retowski, 1888). In addition to land mollusks, the Donetsk Upland could be a refugium for a number of invertebrate and plant species (Gural-Sverlova & Martynov, 2009).

While the nature of the range of *H. albescens* (native or recently expanded as a result of human activity) in southern Ukraine is difficult to determine, the lately noted movement of this species to the north (table 1), up to the Kyiv, Poltava and Kharkiv Regions (fig. 3) is clearly caused by relativelly recent introductions, intentional or accidental. In administrative regions not bordering the Black or Azov Seas, *H. albescens* is more often observed in regional centres (Dnipro, Kyiv, Poltava, Kropyvnytskyi) and other large settlements (for example, Kryvyi Rih in the Dnipropetrovsk Region). One of the northernmost known records, made in Kyiv in 2006, was described in a separate publication (Balashov & Vasyliuk, 2007).

Fig. 3. Known records of *Helix albescens* in Ukraine outside Crimea; symbols are similar to fig. 1.

In general, at least single species of land mollusks of Crimean origin, analysed in this paper, have now been reliably registered in more than half of the administrative regions of Ukraine (fig. 4, table 2). Predictable, a larger number of such species were recorded in the south of Ukraine, especially in the Odesa, Kherson and Zaporizhzhia Regions (fig. 4). Outside the steppe zone of Ukraine, the Kyiv Region is in the lead, which is caused by the large capital city as well as the intensity of malacological research and a larger number of amateur naturalists posting their observations in citizen science databases.

Despite the fact that three of the analysed species of land mollusks (*B. cylindrica*, *M. fruticola*, *H. albescens*) are currently quite widespread in Ukraine, their penetration into many administrative regions happened relatively recently. This may be indirectly evidenced by the dates of their first records (tables 1, 2). The only exceptions are such southern regions, close to the Crimean peninsula, as Odesa, Kherson and Zaporizhzhia ones (table 2), where single records of *B. cylindrica* and *H. albescens* were known already at the beginning of the 20th century. It is significant that these finds were made in a port city (Odesa) or along the Dnipro River, which was also an important transport route. The colonization the coastal

Table 2. Chronology of the first known records of analysed species in different administrative regions of Ukraine outside Crimea

Time periods	Administrative regions
Early 20th century	Kherson, Odesa, Zaporizhzhia
Mid 20 century	Mykolaiv
1980s	Donetsk
1990s	Dnipropetrovsk, Lviv
2000s	Kyiv
2010s	Khmelnytskyi, Luhansk, Poltava
2020–2023	Cherkasy, Kharkiv, Kirovohrad, Rivne

Fig. 4. Number of analysed species recorded in different administrative regions of Ukraine outside Crimea.

areas of southern Ukraine by some species of Crimean origin (as a result of natural expansion of species ranges or introductions) then increased the likelihood of their further transportation by people to more distant territories.

Conclusions

Two of the five analysed species of land mollusks of Crimean origin (*B. cylindrica*, *M. fruticola*) are now also known in all parts of Ukraine outside Crimea, at least from single records in recent years. *B. cylindrica* occurs in some settlements not only in the north of Ukraine, but also much further north, in Minsk, Belarus. A third species, *H. albescens*, is also gradually expanding its range in Ukraine, although it has not yet been discovered in the west of the country. *B. bidens* has so far been registered in four localities of Odesa, Kherson and Zaporizhzhia Regions, one of which is mentioned for the first time in this article. For *M. gracilicosta*, endemic to the mountainous Crimea, a single introduction into Odesa has been described.

The data systematised in the article can become the basis for monitoring the further spread of the analysed species of land mollusks in different parts of Ukraine. In addition to mollusks of Crimean origin, Crimea could be a source of introduction of some other species, autochthonous or alien to the Crimean peninsula itself, to other administrative regions of Ukraine. These will be reviewed in a separate publication.

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