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Research article

Cepaea hortensis (O. F. Müller, 1774) (Gastropoda, Eupulmonata, Helicidae) – a new introduced land snail species for the Bulgarian fauna

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Abstract: The article presents a new introduced snail – *Cepaea hortensis* (Müller, 1774) for the fauna of Bulgaria. A total of three colour morphs were present at the locality. The species has been genetically confirmed.

Keywords: allochthonous species, colour morphs, Sofia City

Introduction

According to the summarised data provided by Egorov (2015) and Gural-Sverlova & Gural (2022), *Cepaea hortensis* is a common species, widely distributed in Central and Western Europe. In Bulgaria's neighbouring countries, the species is known from Romania (Gheoca, 2019) and Serbia (Gojšina et al., 2025). Until the discovery of *Cepaea nemoralis* (Linnaeus, 1758) in the capital, Sofia (approximate coordinates: N42.69336 E023.33256, 552 m), by Gashtarov (2025), the genus *Cepaea* was not known for Bulgarian fauna (Fig. 1). This does not include *Caucasotachea vindobonensis* (C. Pfeiffer, 1828), which has been referred to in numerous publications as belonging to the genus *Cepaea* Held, 1838 (Damjanov & Likharev, 1975; Dedov, 1998; Irikov & Erőss, 2008). *Cepaea hortensis* is a polymorphic land snail (Gheoca, 2019), and the introduction of random colour morphs to new localities often leads to the absence of some morphs or a concentration of rarer variants (Gural-Sverlova & Gural, 2022).

Materials and methods

The specimens were hand-collected by A. Bobeva in a hedge in an urban environment in the city of Sofia, ul. Dimitar Ginchev, N42.67007 E023.35410, 571 m, on 21 May 2025, 5 adult specimens. Snails were photographed using an Olympus Tough TG-5 digital camera. Samples were fixed in 70% ethanol, tissues for molecular studies were stored in 99% ethanol. The samples have been deposited in the invertebrate collection of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (IBER-BAS).

Molecular identification

Total DNA from tissue sample of one of the studied specimens was isolated via DNeasy® Blood & Tissue Kit according manufacturer's instructions. Modified forward LCO1490puc (5'TTTCAACWAAT-CATAAAGATATTGG3') and reverse HCO2198puc (5'TAAACTTCWGGRTGWCCAAARAATCA3')

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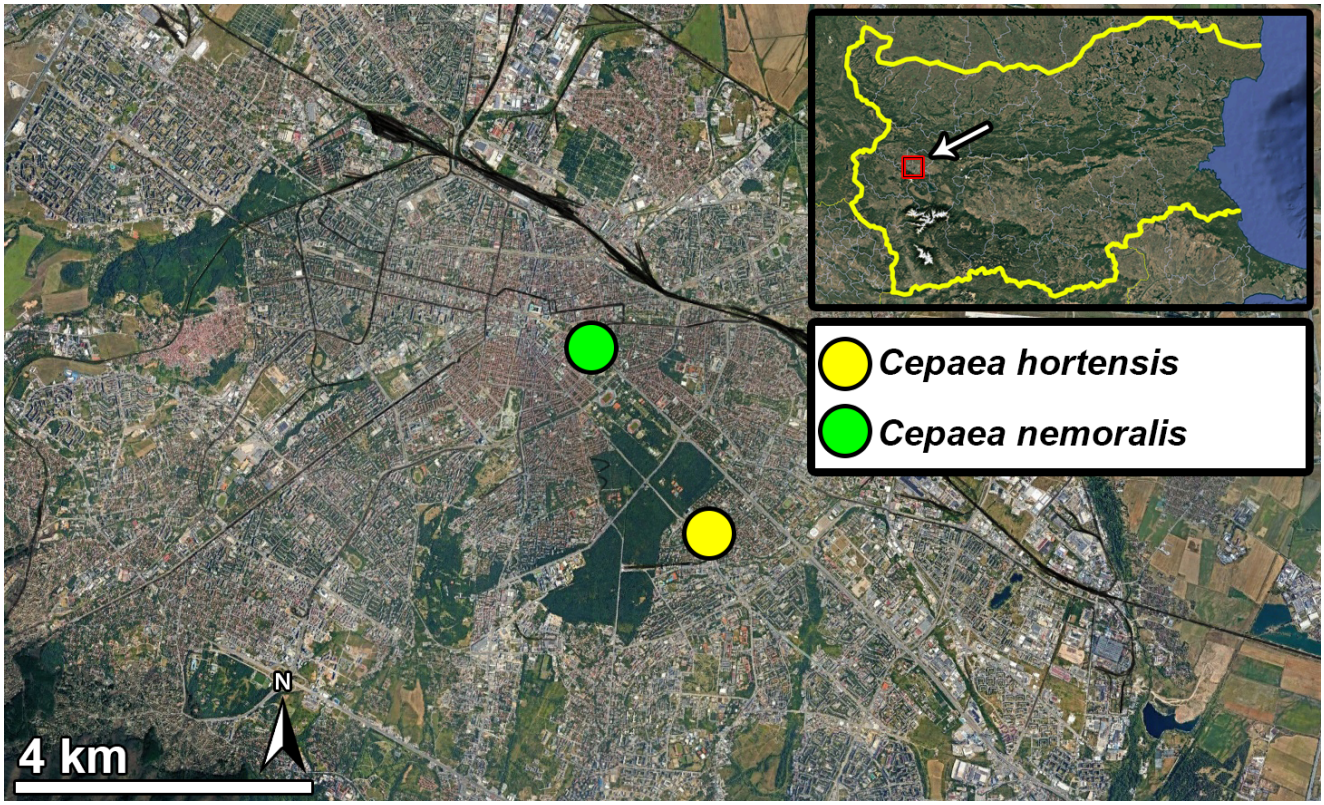


Fig. 1. Distribution map of *Cepaea* species in Bulgaria.

primers were used to amplify the mitochondrial cytochrome oxidase subunit I (COI) barcoding region. The following temperature regime: 5 min at 95℃, followed by 35 cycles of 90 sec at 95℃, 60 sec at 50℃ and 90 sec at 72℃, a final extension was performed for 10 min at 72℃. PCR products were purified and sequenced with the forward and reverse primers by Macrogen Europe B.V. Obtained electropherograms were processed with CodonCode Aligner (CodonCode, Dedham, MA, USA) and the species identity was proved by comparison of the obtained sequence to the available barcodes in the Gen-Bank DNA database. The newly obtained sequence for *C. hortensis* was deposited in the GenBank under accession number PZ786303.

Results

A large population of *C. hortensis* has been recorded in the city of Sofia, inhabiting an artificially planted hedge on Dimitar Ginchev Street (Fig. 1, 2A). A total of five specimens representing the three colour morphs present at the locality were collected. The morphs are: yellow, pink and banded (Fig. 2B).

Discussion

According to Simov et al. (2016), the urban environment is the main stage for the pathways of introduction of alien species, and such urban populations may become a reservoir of individuals ensuring their future successful invasion. In the process of forming "urbano-cenoses", a large part of the autochthonous species disappears, others adapt, sometimes to drastically changed conditions, and many foreign elements enter and spread in cities, favoured by these changed conditions (Luniak, 1996). For terrestrial snails, one of the main routes for the introduction of allochthonous species is the import of ornamental plants and planting materials (Sverlova, 1997; Egorov, 2015). Gural-Sverlova & Gural (2022) considered that the rapid spread of *C. hortensis* in the largest city of Western Ukraine (Lviv), as well as in other settlements of the Lviv region, was facilitated by planned landscaping with ornamental shrubs, often

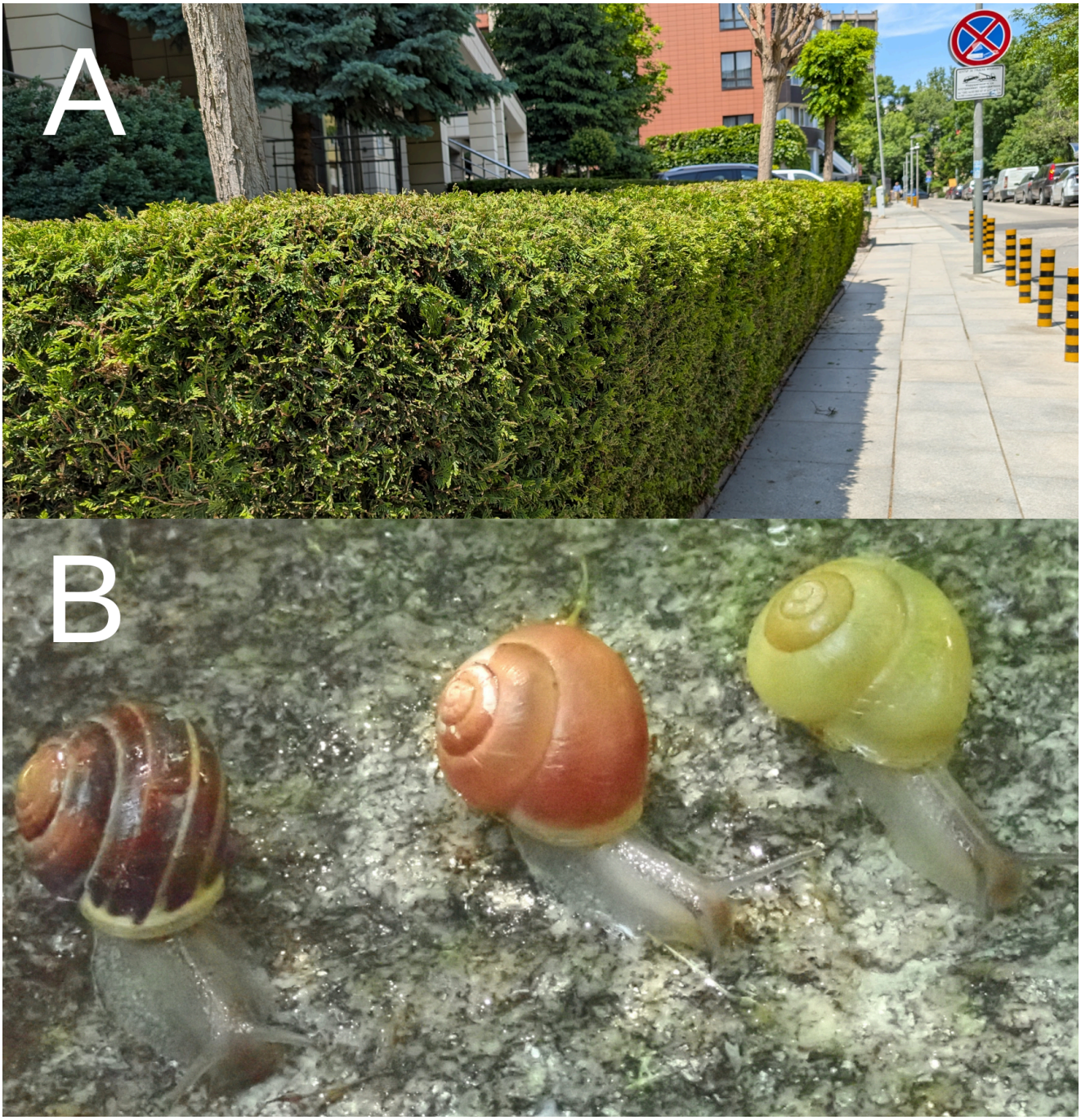


Fig. 2. A. Habitat of *Cepaea hortensis* in Sofia. B. colour morphs.

planted as hedges along streets, near railway stations, hospitals, sanatoriums, etc. We consider that *C. hortensis* was recently introduced to Sofia, Bulgaria via ornamental plants.

Sverlova (2000) examined the polymorphism of the introduced species *C. hortensis* in the city of Lviv and concluded that the frequency of phenotypic forms in different parts of the city, despite some peculiarities, is similar to that in natural populations. Later, Gural-Sverlova & Gural (2022) found that populations formed by the descendants of the primary introduction of *C. hortensis* into Western Ukraine were characterised by a reduced phenotypic composition. This was manifested in the absence not only of pink or brown shells, but also of yellow-striped ones, common in other parts of the country.

According to Gheoca (2019) the populations of *C. hortensis* in the city of Sibiu, central Romania, showed a wide range of variation in the frequencies of shell colours and banding morphs. This variation was not related to habitat or plant cover, and there was no evident geographical structure in the patterns. The observed patterns most likely reflect the effects of passive dispersal by humans, genetic drift and founder effects.

The three morphs of the species observed in Sofia (compared with the many diverse variations; see Egorov, 2015, 2018; Gural-Sverlova & Gural 2021, 2022) are most likely the result of random selection during the introduction process. *Cepaea hortensis* is well adapted to anthropogenic environments (Gheoca, 2019), and in future the genetic potential of the transferred specimens may lead to the manifestation of other morphs.

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Conflicts of interest

No potential conflict of interest has been reported by the authors, reviewers, or subject editor.

Author' contributions

(using CrediT)

Ivailo Dedov: conceptualisation, data curation, formal analysis, investigation, validation, visualisation, writing—original draft; Aneliya Bobeva: data curation, formal analysis, investigation, methodology, software; Vukašin Gojšina: investigation, visualisation, writing—review and editing.

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