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RESEARCH ARTICLE

Detection of the invasive land snail *Caucasotachea vindobonensis* (helicidae) in the Mordovia State Nature Reserve (European Russia)

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Abstract

A non-native terrestrial gastropod, *Caucasotachea vindobonensis*, was recorded for the first time in the Mordovia State Nature Reserve (Pushta settlement, Temnikovsky District, Republic of Mordovia, European Russia). A single specimen was found near the Reserve's visitor center; its shell dimensions and morphology correspond to those typical of the species. The record expands knowledge of the species' distribution in the central part of the Russian Plain. The most likely pathway of introduction is accidental transport by motor vehicles, although intentional transport by visitors is also possible. Because the specimen may already be fertilized, establishment of a viable population within the protected ecosystem is possible. A single record does not indicate an invasion, since a non-native species becomes invasive only at high abundance and with a negative impact on native ecosystem components; eradication is therefore not necessarily required, but regular monitoring of the Reserve is needed to detect potential spread at an early stage and to assess its impact on local biocenoses.

Keywords

Native range, Protected Area, invasive species, Caucasotachea

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Introduction

The widespread dispersal of non-native plant and animal species is currently occurring on a large scale, posing threats to native species within ecosystems. The consequences of the introduction of invasive species are diverse (Ruchin et al. 2023; Viciani, Alberti 2024; Olenev, Grigorkina 2026; Ruchin, Esin 2026). Some have already become agricultural pests, others pose a threat as potential intermediate hosts of helminths, while still others become established in natural ecosystems and cause changes to them (Schikov 2021; Benediktov, Shikov 2022). The spread of non-native terrestrial gastropods is a striking example of this process. Among the most aggressive invasive molluscs are the giant African land snail *Lissachatina fulica* (Férussac, 1821), the Turkish mountain snail *Helix lucorum* (Linnaeus, 1758), and the Spanish slug *Arion vulgaris* (Moquin-Tandon, 1855). *H. lucorum*, native to Anatolia, the Caucasus, and the Balkans, has advanced substantially north and west across Europe in recent decades: the species has been recorded in Poland (Szpalek et al. 2023; Zając et al. 2023) and Denmark (Mika et al. 2026), while twelve-year monitoring of a colony in Prague documented the displacement of the native *Helix pomatia* (Doležal 2021). The Spanish slug *A. vulgaris* is considered one of the most dangerous invasive species in Europe owing to its high fecundity and resistance to climatic stress, causing large-scale damage to horticulture and agricultural crops, with population densities in invasive foci often exceeding 10–20 individuals per square metre (Dörler et al. 2021); the slug also acts as a vector of plant pathogens and parasitic nematodes of animals, as confirmed by findings in Moscow parks (Ivanova et al. 2022). These examples show that invasive gastropods possess a pronounced capacity for naturalisation in anthropogenically disturbed landscapes, requiring constant monitoring of passive introduction pathways and the development of population control measures (Schikov 2021). Of particular concern is the penetration of non-native species into Protected Areas, where their occurrence may threaten reference ecosystems and rare native species. Non-native species are regularly recorded in nature reserves and biosphere reserves. For example, 89 non-native animal species, including two mollusc species, have been recorded in the Khomutovskaya Steppe Nature Reserve (Martynov 2021). 41 non-native species have been recorded in the Black Sea Biosphere Reserve. At the same time, the authors note that undisturbed ecosystems within Protected Areas are generally more resistant to biological invasions than the transformed landscapes surrounding them (Korolesova et al. 2019). Therefore, rather than immediate intervention, the most appropriate approach is to establish regular monitoring to enable timely assessment of the population dynamics and spread of the newly recorded species, as well as its potential impact on the reserve's natural biocenoses. The aim of this study is to describe the land snail *Caucasotachea vindobonensis* (C. Pfeiffer, 1828) discovered in the settlement of Pushta (Mordovia State Nature Reserve, Temnikovsky District, Republic of Mordovia, European Russia), with particular emphasis on the species' range and known cases of invasion.

Until 2015, *C. vindobonensis* was considered by researchers to be a member of the genus *Cepaea* Held, 1838. Molecular phylogenetic analysis of molluscs belonging to the subfamily Helicinae revealed that, despite their strong external similarity, including comparable shell shape and coloration, *Cepaea vindobonensis* belongs to the genus *Caucasotachea* (Neiber, Hausdorf 2015; Neiber et al. 2016).

The shell sculpture of *C. vindobonensis* is distinctly striated or even ribbed rather than smooth. The shell is low-globular, beige, whitish, or yellowish in coloration and almost invariably bears 4–5 dark spiral bands. The aperture has a lip with reflexed margins, which may be either dark or light in color. Shell height (SH) is 17–21 mm, and shell width (SW) is 20–25 mm. The umbilicus is closed or reduced to a narrow slit (Shileyko 1978; Shikov 2023). *C. vindobonensis* reaches reproductive maturity only by the end of its second year of life, with a maximum lifespan of up to seven years (Staikou 1998). However, a lifespan of three years is more commonly reported (Gural-Sverlova, Gural 2012; Balashov 2016). During hot summer days, these snails rest on the leaves and stems of tall plants or on tree trunks. Hibernation begins in late October or early November, while emergence from hibernation occurs in March. In addition, their association with anthropogenic habitats and several biological characteristics, particularly their ability to attach themselves to various objects, facilitate their dispersal by humans, a phenomenon common among many terrestrial molluscs (Cowie, Robinson 2003).

The native range of the Austrian snail extends from the Balkan Peninsula, Crimea, and the North Caucasus in the southeast to Austria, Poland, and the Czech Republic in the west. Local and relatively isolated populations (island groups) extend as far as western Pomerania (Pokryszko et al. 2004; Kajtoch et al. 2017). In Russia, the Central Russian Upland and its southern part (Belgorod Region) represent the northeastern limit of the species' natural range (Snegin, Tyshchenko 2017).

Materials and methods

A single specimen of *C. vindobonensis* was found in the center of the settlement of Pushta, near the visitor center of the Mordovia State Nature Reserve (Temnikovsky District, Republic of Mordovia, European Russia; 54°42.36′ N, 43°13.31′ E; ca 120 m a.s.l.) on 18.08.2026. The specimen was photographed and identified following Shileyko (1978) and Shikov (2023). Shell height (SH) and shell width (SW) were measured with a vernier caliper (Shan, Guangdong, China; model 121-102) to the nearest 0.1 mm. The number of whorls, shell sculpture, coloration, and umbilicus condition were described. Published data were analyzed to characterize the species' taxonomic position, native range, and known cases of anthropochorous dispersal, including Belarus, the Moscow and Tver regions, the Southern Urals, and North America.

The specimen was photographed and released; no voucher was deposited.

Results

A single specimen of *C. vindobonensis* was found in the center of the settlement of Pushta, near the visitor center of the Mordovia State Nature Reserve (Fig. 1). The shell is low-globular, beige-yellow in coloration with dark spiral bands, distinctly ribbed sculpture, and a closed umbilicus. The shell has 5 whorls. Shell height (SH) is 18.5 mm and shell width (SW) is 22.3 mm; these dimensions fall within the range reported for the species (SH 17–21 mm, SW 20–25 mm) and correspond to the parameters typical of Central European populations (Shileyko 1978; Shikov 2023).



Figure 1. Austrian snail (*Caucasotachea vindobonensis*) in the settlement of Pushta (Mordovia State Nature Reserve).

The aperture has a lip with reflexed margins. The species has not previously been recorded in the Mordovia State Nature Reserve; this finding expands current knowledge of the distribution of *C. vindobonensis* in the central part of the Russian Plain.

Discussion

The specimen from Pushta agrees with this diagnosis: the shell sculpture is distinctly striated or even ribbed rather than smooth; the shell is low-globular, beige-yellow with 4–5 dark spiral bands; the aperture has a lip with reflexed margins; the

umbilicus is closed or reduced to a narrow slit; and the shell dimensions (SH 17–21 mm, SW 20–25 mm) correspond to the parameters reported for the species (Shileyko 1978; Shikov 2023).

The native range of the Austrian snail extends from the Balkan Peninsula, Crimea, and the North Caucasus in the southeast to Austria, Poland, and the Czech Republic in the west, with local and relatively isolated island populations reaching as far as western Pomerania (Pokryszko et al. 2004; Kajtoch et al. 2017). In Russia, the Central Russian Upland and its southern part (Belgorod Region) represent the northeastern limit of the species' natural range (Snegin, Tyshchenko 2017). Populations of *C. vindobonensis* in the southern part of the Central Russian Upland occur under conditions of substantial isolation, as evidenced by the high degree of differentiation among the groups studied. Principal component analysis based on Nei's genetic distances and Wright's F-statistics revealed a pronounced division of the populations in the study area into two clusters, likely associated with historical features of landscape formation; estimates of effective population size indicate the high viability of most of the populations examined, while some groups appear markedly depressed, as reflected in their low levels of genetic diversity and effective population size (Snegin et al. 2024; Adamova et al. 2024). The Bekaryukovsky Bor Nature Monument is home to one of the largest peripheral populations of the protected land snail *C. vindobonensis* in the northeastern part of its range; allozyme analysis revealed a trend toward decreasing genetic diversity and low viability of this marginal population, which may lead to its extinction, particularly in the event of environmental changes (Snegin, Tyshchenko 2021).

At the same time, *C. vindobonensis* demonstrates a high capacity for human-mediated dispersal in regions where it is not native. Anthropochorous spread of the species in Europe has been confirmed by molecular genetic analysis of populations (Kajtoch et al. 2017). The Austrian snail was introduced into Belarus relatively recently, and its distribution there is currently localized, being restricted to urban habitats in the southern part of the republic (Ostrovsky 2022). Alien populations are known from the central part of the Russian Plain, specifically in the Tver and Mos-cow regions (Egorov 2014), as well as from North America (Hausdorf et al. 2021). In 2023, the snail was recorded in the Southern Urals, in the vicinity of Krasnoufimsk (Shikov 2023; Shishkov 2023). In 2007, *C. vindobonensis* was recorded in the city of Penza, where it was found in an abandoned, shrub-overgrown garden plot, on lawns, in stands of ruderal grasses, and near a railway embankment; a large population became established in one of the city's residential neighborhoods, attracting yellow-necked mice (*Apodemus flavicollis* (Melchior, 1834)), which migrated from the suburban Arbekovsky Forest and actively fed on the molluscs, as evidenced by numerous feeding sites containing fragmented shells (Stoyko, Bulavkina (Bezina) 2010). In 2009, the species was recorded in the settlement of Inzhavino, Tambov Region, in an abandoned site overgrown with shrubs.

The biological characteristics of *C. vindobonensis* – its ability to attach to vertical surfaces, prolonged life cycle, and tolerance of anthropogenic landscapes – facili-

tate its inadvertent transport by humans, a phenomenon generally characteristic of many terrestrial molluscs (Cowie, Robinson 2003). The most likely pathway of introduction into the settlement of Pushta is accidental transportation by motor vehicles, since vehicles carrying equipment and machinery regularly arrive at the Reserve from different regions, and large-scale festivals attracting several thousand visitors are periodically held at the visitor center. Given the species' inherent ability to move upward along vertical surfaces and to attach to tree trunks, various structures (fences and buildings), and vehicles, accidental introduction appears plausible; the snail, which has a conspicuously attractive shell, could also have been transported intentionally by visitors. Since the found specimen may already be fertilized, there is a potential for the establishment of a viable population within the protected ecosystem.

Thus, the occurrence of the species in the settlement of Pushta is not unexpected. The mere presence of a non-native species does not necessarily imply a threat: it becomes invasive only when it reaches high abundance and exerts a negative impact on native components of the ecosystem. Undisturbed ecosystems within Protected Areas are generally more resistant to biological invasions than the transformed landscapes surrounding them (Korolesova et al. 2019), which supports the appropriateness of regular monitoring rather than immediate intervention.

Conclusion

The first record of *C. vindobonensis* in the Mordovia State Nature Reserve expands current knowledge of the distribution of this species in the central part of the Russian Plain. The morphological characters and dimensions of the specimen from Pushta correspond to those reported for Central European populations. Although a single record does not in itself indicate an invasion, and an invasive species does not necessarily require eradication, regular monitoring of the Reserve is necessary to detect any potential spread of the species at an early stage and to assess its possible impact on local biocenoses.

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