ISSN 2755-3531

Vol. 45, no. 3 **Journal of Conchology** 24 February 2025

Published by the Conchological Society of Great Britain and Ireland, established 1874

Rumina decollata (Linnaeus, 1758), Decollate Snail (Eupulmonata: Achatinidae), in Serbia: first record of a Mediterranean snail in the country

Mihailo Vujić & Vukašin Gojšina

Institute of Zoology, Faculty of Biology, University of Belgrade, Serbia, Studentski trg 16, 11000, Belgrade, Serbia
Corresponding author: *Mihailo Vujić (mihailovujic01@gmail.com)*

Abstract. We present the first record of a *Rumina decollata* (Linnaeus, 1758) population in the city of Pančevo, Serbia. The population lives in a small green area with residential buildings, where it was found along a footpath and at the base of buildings. We discuss the habitat and climate at the locality and document the anatomy and morphology of this *R. decollata* population. Finally, we reflect about potential pathways of introduction of this population.

Key words. Achatinoidea, allochthonous species, Balkans, colonisation, introduction, Rumininae

ZooBank identifier. urn:lsid:zoobank.org:pub:5E22BA79-94C4-4C59-986B-A94774B7C69E

DOI. https://doi.org/10.61733/jconch/4540

Introduction

Rumina decollata (Linnaeus, 1758) (family Achatinidae) is a typical Mediterranean terrestrial gastropod species, with a predominantly Western Mediterranean native distribution and encompassing parts of Southern Europe and Northern Africa (Welter-Schultes 2012). Elsewhere, the species has been introduced in Africa: South Africa (Melvill & Ponsonby 1898); Asia: China (Chen & Gao 1987; Beckmann 1989; Bar-Zeev & Mienis 2007), Israel (Singer & Mienis 1993; Bar-Zeev & Mienis 2002), and Japan (Azuma 1982; Mashino 1992; 2001; Matsukuma & Takeda 2009); North America: United States of America (e.g. Fisher 1966; Dundee 1970; Selander & Kaufman 1973; Cowie 2001; Mc Donnell *et al.* 2016; Forman *et al.* 2021; Ports 2021), Bermuda (Simmonds & Hughes 1963; Bieler & Slapcinsky 2000), Mexico (Thompson 2011), and Cuba (Matamoros Torres 2014); South America: Brazil (Simone 2006), Argentina (Reyna & Gordillo, 2018; Rau *et al.* 2022; Pizá *et al.* 2023), and Uruguay (Miquel *et al.* 1995). It is also introduced in some European countries and islands, such as Azores and Madeira (Nobre 1930; Backhuys 1975; Seddon 2008), and United Kingdom (Seddon & Pickard 2005).

The available literature does not recognize the existence of populations in the parts of Europe with a continental climate, although Bohatá & Patoka (2023) demonstrated through modelling that there is a significant area of territory in the European Union that could be potentially suitable for establishing populations of *R. decollata*.

The aim of this study is to report the presence of the Mediterranean snail *Rumina decollata* in Serbia, as well as to discuss the survival of the population under continental climatic conditions, the method of introduction, and potential effects of its presence and dietary behaviour on the native snail fauna.

Materials and Methods

As part of field research on malacofauna conducted on 24 September 2024 in the city of Pančevo (South Banat District), 49 specimens of *R. decollata* were manually collected. The specimens were preserved in 70% ethanol. The shells and genitalia were photographed using a Nikon SMZ800N stereomicroscope equipped with a Nikon DS-Fi2 camera. A Nikon DS-L3 control unit was used to set scale bars. Specimens were identified following the characters described by Carr (2002) and Welter-Schultes (2012). Collected material is stored at the Institute of Zoology, University of Belgrade, Faculty of Biology (IZOO) and in the private collection of VG.

Results

Family Achatinidae Swainson, 1840

***Rumina decollata* (Linnaeus, 1758)**
Figure 1

Material examined. Serbia, Autonomous Province Vojvodina, South Banat District, city of Pančevo, Kotež 2 part, Stevana Šupljikca St. (44°53′05.5″N 020°38′49.2″E), 24 Sept. 2024, leg. V. Gojšina & M. Vujić, 49 specimens (IZOO-MG-017/10 shells; IZOO-MG-018/2 dissected genitalia).

Habitat. The population of *R. decollata* in Pančevo was found in a small park-like area with residential buildings (Fig. 2C), where it lived in cracks in the stony margin of the footpath and around the foundations of concrete buildings (Fig. 2A, B). The substrate is a combination of loam soil, river sand, and organic, undecayed plant material and was partially overgrown with grasses and herbaceous plants, as is characteristic of urban conditions in Serbia. The area is planted with several cultivated species of plants, such as *Picea pungens* Engelm., *Thuja occidentalis* L., *Betula pendula* Roth, and *Yucca gloriosa* L. (Fig. 2C). Throughout the green area we found many empty shells of all age categories. Yet, since we also collected many living specimens of all age categories in a short time, we assume that this population must be large and may be well established. The species co-occurs with brown garden snail, *Cornu aspersum* (O.F. Müller, 1774).

Identification. *Rumina decollata* cannot be confused with any other land-snail species in Serbia because of its characteristic decollated (sub)adult shell (Fig. 1A–D). However, *R. decollata* can be confused with other species of the genus *Rumina*: *R. iamonae* Quintana, 2017, and *R. saharica* Pallary, 1901. *Rumina iamonae* is endemic to the island of Menorca (Balearic Islands, Spain) and differs from *R. decollata* most obviously by the much longer vagina (Cardona Quintana 2017). The usually smaller-shelled *R. saharica* is more easily distinguished from *R. decollata* because the internal structure of the vagina of *R. decollata* has longitudinal, crenulated lamellae (Fig. 1C), while these lamellae are straight in *R. saharica* (Carr 2002).

Description. All specimens collected from Pančevo belong to the "dark morph", consistent with Prévot *et al.* (2014). The specimens show the usual shell morphology, as described by Carr (2002) and Weltes-Schultes (2012). That is, fresh shells were brownish with decollated apical whorls and a solid, whitish apertural lip. Genital anatomy was also consistent with the Carr's (2002) description of it. The penis is roughly as long and as thick as the vagina, and with the penial retractor muscle apically inserted. The apical part of the penis is weakly swollen. Inside the penis there are two longitudinal pilasters, and the vagina has characteristic crenulated lamellae within. Based on 20 decollate specimens (non-decollate specimens were not measured), shell height ranged from 20.17 to 26.50 mm, while width ranged from 8.23 to 10.65 mm.

Discussion

Rumina decollata is a typical Mediterranean species (Welter-Schultes 2012), whose presence in Serbia can only be explained as an introduction. The closest populations of *R. decollata* in the Balkans are along the Adriatic coast, such as Montenegro and Croatia (Štamol 2010; Bank & Neubert 2017). Climatic suitability modelling has shown that there is a significant probability of populations becoming established over a wide area of non-Mediterranean parts of the European Union (Bohatá & Patoka 2023), including countries that border Serbia (Hungary, Romania, and Bulgaria; Bohatá & Patoka 2023). Climate change in Serbia is making the climate more similar to the Mediterranean type, as reflected in the intrusion of subtropical characteristics, including increasing temperatures and precipitation. (Vuković *et al.* 2018). Thus, the survival of *R. decollata* populations in Serbia is not unexpected. Moreover, Pančevo is geographically near Belgrade and its heat island (Anđelković 2003; Milovanović *et al.* 2020), which provides additional climatic conditions that favour survival of *R. decollata*. The heat island of Belgrade is characterized by a higher temperatures year-round, compared to the city's surroundings; the winter maximum is 1.4 °C, and the summer minimum is 0.9 °C (Milovanović *et al.* 2020). The current climate type of Pančevo according to the Köppen-Geiger climate classification (for the period 1991–2021) is Cfa, humid subtropical climate. Considering that the limiting factor for the Mediterranean species *R. decollata* can be the minimum temperature, it is important to note that no month in Pančevo in the year has an average temperature below 0 °C (the lowest in January, 1 °C), while three months have an average minimum temperature below 0 °C (in January –2.2 °C; in February –1 °C; in December –0.3 °C) (Climate Data 2025). Milovanović *et al.* (2020) found that temperature anomaly in Belgrade to be statistically significant and noted that it is without any practical consequence. However, it is certain that this temperature anomaly can be important for the survival of non-native species. Accordingly, the city of Belgrade is also the main commercial and transport centre

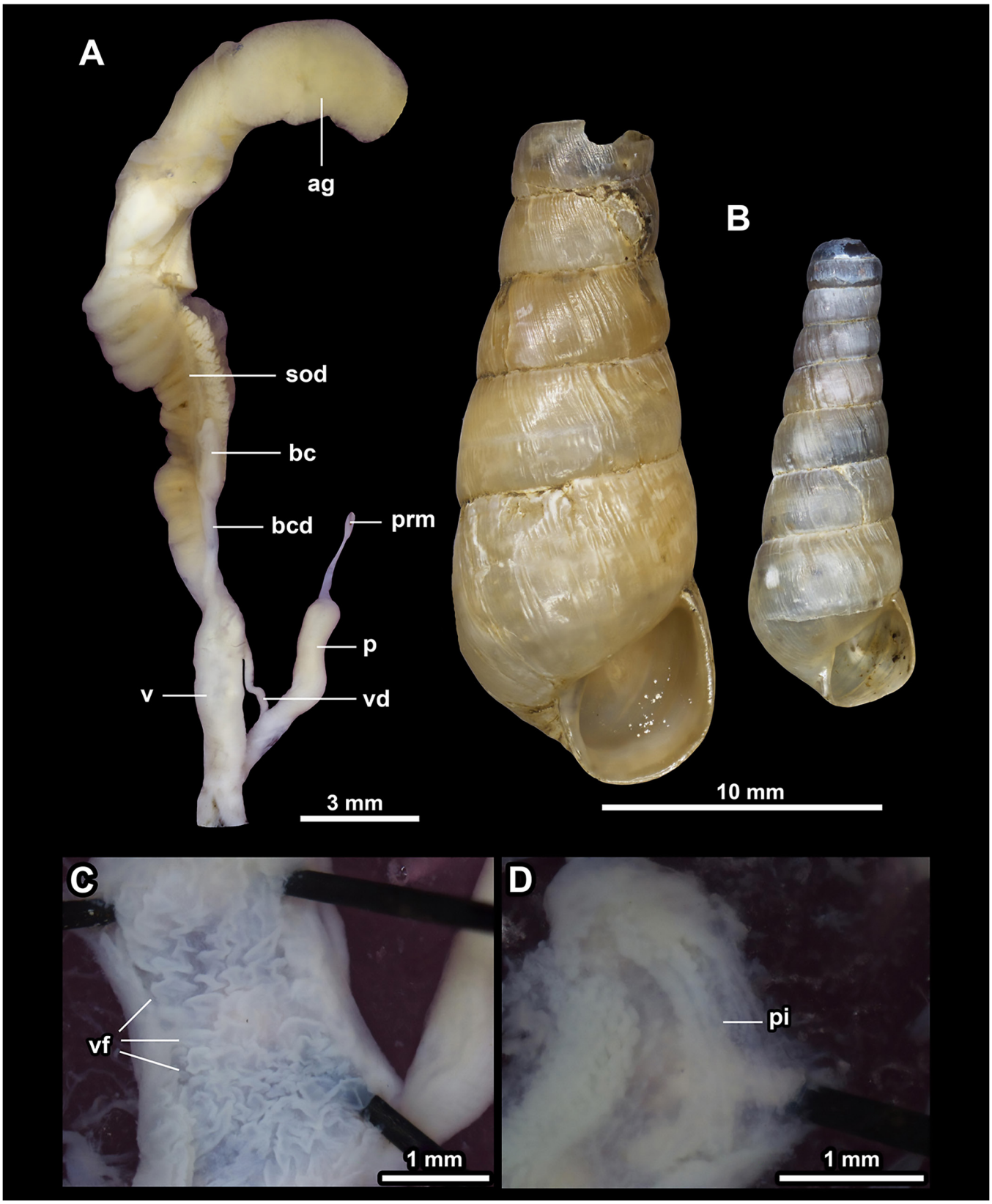

Figure 1. *Rumina decollata* from Serbia. **A**, external genital structures: ag = albuminous gland, bc = bursa copulatrix, bcd = bursa copulatrix duct, sod = spermoviduct, v -vagina, vd = vas deferens, p = penis, prm = penial retractor muscle. **B**, shells (adult shell on the left, juvenile shell on the right). **C**, internal structure of vagina: vf = vaginal folds (crenulated lamellae). **D**, internal structure of penis: pi = penial pilaster.

Figure 2. The aggregation of living specimens of *Rumina decollata* and habitat in Serbia. **A**, **B**, aggregation of living *R. decollata*. **C**, habitat of *R. decollata* in the city of Pančevo, Serbia.

of Serbia, which makes it a place where the first records of allochthonous species are often noted (e.g. Šeat *et al.* 2020; Gojšina *et al.* 2022; Vujić & Vesović 2022; Urošević *et al.* 2023)

The introduction pathway of *R. decollata* in Serbia is unclear and cannot be definitively established. However, several potential pathways for its introduction can be hypothesized:

(i) Pet trade. Bohatá & Patoka (2023) examined the invasive potential of ornamental snails in the European Union, including *R. decollata*. They concluded that the species has significant potential for establishing populations in Europe, considering climatic suitability. However, we do not believe that the pet trade is a possible, or at least likely, method of introduction of this species at the locality in Serbia, given that an extensive search of the internet and social media, using key words, did not yield information to indicate that this species has ever been brought into Serbia for the pet trade. The species, however, can be found on the European Union online market.

(ii) Biological control. *Rumina decollata* is a well-known biological control agent against agricultural pest snails (Cowie 2001). The species was, for example, introduced to California, USA, to control *Cornu aspersum*. However, we do not think that *R. decollata* was introduced into Serbia as biological control agent because the newly discovered population is in the immediate vicinity of any agricultural land. Additionally, we found no data indicating that *R. decollata* has ever been for sale in the Serbia as a biological control agent. The presence of *C. aspersum* in the same place should not be regarded as a reason for introduction but rather as supporting evidence of the climatic conditions that have contributed to the survival and establishment of the *R. decollata* in Serbia.

(iii) Ornamental plant trade. Numerous allochthonous invertebrate species, including terrestrial snails, are spread by the ornamental plant trade (e.g. Turóci *et al.* 2023). This is a plausible pathway for the *R. decollata* population in Pančevo since this area was planted with ornamental plants, including species that are typical of the areas where *R. decollata* is native. Such plant species include *Ficus carica* L. and *Punica granatum* L.

(iv) Anthropochory. The native range of *R. decollata* encompasses coastal areas of Europe and the Balkan Peninsula (Welter-Schultes 2012), which are popular summer destinations among tourists from Serbia. Tourism and human travelling contribute significantly to the spread of alien snail species, and in particular xerophilous species (Gojšina *et al.* 2022; Gural-Sverlova *et al.* 2022). This could apply to *R. decollata*, too. Yet, it is possible that anthropochory occurred via the transportation of sand, stones, live snails from the Mediterranean to Serbia, or accidentally packed in camping tent equipment.

Carr (2002) has shown that shell height in *R. decollata* ranges from 19.3 mm to 52.2 mm, while width ranges from 8.9 mm to 19.7 mm. In *R. saharica*, height ranges from 17.7 mm to 33.7 mm and width ranges from 7.1 mm to 9.4 mm. Therefore, even though *R. saharica* is on average more slender, there is a significant amount of size overlap between the two taxa which is why this character cannot solely be used for reliable distinction between the species. Even though the size of our specimens largely overlaps with those measured by Carr (2002), shell width of several specimens was a bit less than 8.9 mm, which is presented as the smallest value in *R. decollata* by Carr (2002).

Prévot *et al.* (2014) showed that all introduced populations belong to the so-called dark morph, given that *R. decollata* has both light and dark morphs. Our results are consistent with those of Prévot *et al.* (2014) since they belong to the dark morph.

To the best of our knowledge there are no published reports documenting serious negative impacts of *R. decollata* introductions on local malacofaunas and habitats. However, there are some reports on (potentially) negative impact on native species and crops, e.g. concern regarding the negative impact on the native snail *Helminthoglypta walkeriana* (Hemphill, 1911) in the United States (Tupen & Roth 2001), declaring it as invasive species in Japan (Matsukuma & Takeda 2009), or declaring it as crop pest (e.g. Matsukuma & Takeda 2009; Matamoros Torres *et al.* 2017). Despite these reports, we do not expect that the introduction of this species in Serbia is a major threat.

Acknowledgements

This study was financially supported by the Serbian Ministry of Science, Technological Development and Innovation (Contract No. 451-03-66/2024-03/200178). The authors are thankful to Albert Forai (Pančevo, Serbia) for his help in finding the population of *R. decollata* and to two reviewers, for their useful comments which improved the initial version of the manuscript

References

Anđelković G. 2003. The basic characteristics of the Belgrade's heat island. *Bulletin of the Serbian Geographical Society* **83** (1): 15–30.

Azuma M. 1982. *Colored Illustrations of the Land Snails of Japan*. Hoikusha Publishing, Osaka 343 pp. [In Japanese.]

Backhuys W. 1975. *Zoogeography and Taxonomy of the Land and Freshwater Molluscs of the Azores*. Backhuys and Meesters, Amsterdam, 475 pp.

Bank RA, Neubert E. 2017. Checklist of the land and freshwater Gastropoda of Europe. http://www.molluscabase.org/aphia.php?p=sourcedetails&id=279050. Accessed on 2025-02-22.

Bar-Zeev UJ, Mienis HK. 2007. A record of *Rumina decollata* (Gastropoda, Subulinidae) from a second area in China. *Tentacle* **15**: 10–11.

Bar-Zeev UJ, Mienis HK. 2002. The pilgrim snails of Terra Sancta. *Holy Land Spring* **2002**: 11–12.

Beckmann KH. 1989. *Rumina decollata* (Linnaeus, 1758) in China (Gastropoda Pulmonata: Subulinidae). *Schriften zur Malakozoologie aus dem Haus der Natur – Cismar* **2**: 62.

Bieler R, Slapcinsky J. 2000. A case study for the development of an island fauna: recent terrestrial mollusks of Bermuda. *Nemouria* **44**: 1–99.

Bohatá L, Patoka J. 2023. Invasion potential of ornamental terrestrial gastropods in Europe based on climate matching. *Diversity* **15** (2): 272. doi: 10.3390/d15020272

Cardona Quintana J. 2017. Descripción de *Rumina iamonae* sp. nov. (Pulmonata: Subulinidae), un nuevo gasterópodo endémico de Menorca (Islas Baleares, Mediterráneo Occidental). *Spira* **6**: 129–135.

Carr R. 2002. Geographical variation of taxa in the genus *Rumina* (Gastropoda: Subulinidae) from the Mediterranean region. *Journal of Conchology* **37** (5): 569–577.

Chen DN, Gao JX. 1987. On a new species of land snail from China (Stylommatophora: Subulinidae). *Acta Zootaxonomica Sinica* **12** (1): 20–22.

Climate Data. 2025. Pancevo Climate (Serbia). https://en.climate-data.org/europe/serbia/vojvodina/pancevo-25897/. Accessed on 2025-02-22.

Cowie RH. 2001. Can snails ever be effective and safe biocontrol agents? *International Journal of Pest Management* **47** (1): 23–40. doi: 10.1080/09670870150215577

Dundee DS. 1970. Introduced Gulf Coast molluscs. *Tulane Studies in Zoology and Botany* **16**: 101–115.

Fisher TW. 1966. *Rumina decollata* (Linnaeus, 1758) (Achatinidae) discovered in southern California. *The Veliger* 9 (1): 16.

Forman SL, Hockaday W, Liang P, Ramsey A. 2021. Radiocarbon age offsets, ontogenetic effects, and potential old carbon contributions from soil organic matter for pre-bomb and modern detritivorous gastropods from central Texas, USA. *Palaeogeography, Palaeoclimatology, Palaeoecology* **583**: 110671. doi: 10.1016/j.palaeo.2021.110671

Gojšina V, Páll-Gergely B, Vujić M, Dedov I. 2022. First record of the genus *Xeropicta* Monterosato, 1892 (Gastropoda: Eupulmonata: Geomitridae) in Serbia. *Folia Malacologica* **30** (1): 47–53. doi: 10.12657/folmal.030.008

Gural-Sverlova NV, Pisaryev SM, Gural RI. 2022. Further and further east: steppe land snail, *Xerolenta obvia* (Gastropoda, Geomitridae), expands its range in Ukraine. *Zoodiversity* **56** (5): 403–412. doi: 10.15407/zoo2022.05.403

Mashino K. 1992. *Rumina decollata* (Linnaeus) occurred in Ube City, Yamaguchi Prefecture. *Chiribotan* **23** (2): 55–56.

Mashino K. 2001. Dispersion of *Rumina decollata* in Ube, Yamaguchi Prefecture. *Chiribotan* **32**: 32–34.

Matamoros Torres M. 2014. Malacofauna representative agroecosystems in the western provinces of Cuba. *Fitosanidad* **18** (1): 23–27.

Matamoros Torres M, Villalón EM, Martínez DA, Zaldívar NC, Zulueta KC, Mejías DR, Rodríguez DM. 2017. Influence of relative humidity and temperature in poblational density of *Rumina decollata* (L.) (Gastropoda: Subulinidae) at Nursery Organoponic Alamar. *Fitosanidad* **21** (2): 61–65.

Matsukuma A, Takeda S. 2009. An invasive snail *Rumina decollata* (Linnaeus, 1758) in Japan, with records of quarantine by the Plant Protection Station, Ministry of Agriculture, Forestry and Fisheries, Japan during 1997–2007. *Bulletin of the Kyushu University Museum* **7**: 35–85.

Mc Donnell R, Santangelo R, Paine T, Hoddle M. 2016. The feeding behaviour of *Rumina decollata* (Subulinidae: Gastropoda) raises questions about its efficacy as a biological control agent for *Cornu aspersum* (Helicidae: Gastropoda). *Biocontrol Science and Technology* **26** (3): 331–336. doi: 10.1080/09583157.2015.1111298

Melvill JC, Ponsonby JH. 1898. A contribution towards a check-list of the non-marine molluscan fauna of South Africa. *Journal of Molluscan Studies* **3** (3): 166–184. doi: 10.1093/oxfordjournals.mollus.a065163

Milovanović B, Radovanović M, Schneider C. 2020. Seasonal distribution of urban heat island intensity in Belgrade (Serbia). *Journal of the Geographical Institute "Jovan Cvijic", SASA* **70** (2): 163–170.

Miquel SE, Parent H, Scarabino F. 1995. Achatinoidea introducidos en la Argentina y el Uruguay (Mollusca: Gastropoda: Stylommatophorida). *Neotrópica* **41**: 26–75.

Nobre A. 1930. *Materiais para o estudo da fauna dos Açores*. Instituto de Zoologia da Universidade do Porto, Porto, 108 pp.

Pizá J, Spagnuoli JG, Dop NS, Cazzaniga NJ. 2023. From the Mediterranean to Yungas and Patagonia. Dispersal of the non-native gastropod *Rumina decollata* in Argentina. *Biologia* **78** (3): 865–871. doi: 10.1007/s11756-022-01293-3

Ports MA. 2021. Terrestrial snails and slugs of Nevada, USA: an overview of taxa, biogeography, and habitat affinities. *Western North American Naturalist* **81** (3): 407–426. doi: 10.3398/064.081.0309

Prévot V, Jordaens K, Backeljau T. 2014. Predominance of a single phylogenetic species in colonization events among a sextet of decollate land snail, *Rumina decollata* (Mollusca: Pulmonata: Subulinidae), species. *Genome* **57** (3): 161–167. doi: 10.1139/gen-2013-0187

Rau AI, Beltramino AA, Serniotti EN, Pizá J, Caffetti JD, Vogler RE. 2022. The exotic snail *Rumina decollata* (Linnaeus, 1758) (Gastropoda, Achatinidae, Ruminidae) in Argentina: new records, range extension, and areas of origin of Argentine populations. *Check List* **18** (1): 91–102. doi: 10.15560/18.1.91

Reyna P, Gordillo S. 2018. First report of the non-native snail *Rumina decollata* (Linnaeus, 1758) (Subulinidae: Gastropoda) in Córdoba (Argentina): implications for biodiversity and human health. *American Malacological Bulletin* **36** (1): 150–152. doi: 10.4003/006.036.0108

Seddon M. 2008. The landsnails of Madeira. an illustrated compendium of the landsnails and slugs of the Madeiran Archipelago. *BIOTIR Report* **2**: 1–204.

Seddon M, Pickard M. 2005. Another Mediterranean landsnail found in UK. *Journal of Conchology* **38** (6): 714.

Selander RK, Kaufman DW. 1973. Self-fertilization and genetic population structure in a colonizing land snail. *Proceedings of the National Academy of Sciences of the USA* **70** (4): 1186–1190.

Simmonds FJ, Hughes IW. 1963. Biological control of snails exerted by *Euglandina rosea* (Ferussac) in Bermuda. *Entomophaga* **8** (3): 219–222.

Simone LRL. 2006. *Land and Freshwater Molluscs of Brazil*. EGB–FAPESP, São Paulo, 390 pp.

Singer BS, Mienis HK. 1993. *Rumina decollata* an interesting visitor to the coast of Israel. *Levantina* **76**: 5–18.

Šeat J, Nadaždin B, Šćiban M. 2020. *Acrosternum heegeri* (Heteroptera: Pentatomidae) in Serbia. *Acta Entomologica Serbica* **25** (1): 77–81. doi: 10.5281/zenodo.3871640

Štamol V. 2010. A list of the land snails (Mollusca: Gastropoda) of Croatia, with recommendations for their Croatian names. *Natura Croatica* **19** (1): 1–76.

Thompson FG. 2011. An annotated checklist and bibliography of the land and freshwater snails of Mexico and Central America. *Bulletin of the Florida Museum of Natural History* **50**: 1–299. doi: 10.58782/flmnh.bnej7351

Tupen J, Roth B. 2001. Further spread of the introduced decollate snail, *Rumina decollata* (Gastropoda: Pulmonata: Subulinidae), in California, USA. *The Veliger* **44** (4): 400–404.

Turóci Á, Hutchinson JM, Schlitt B, Reise H, Rapala M, Páll-Gergely B. 2023. Five new introduced terrestrial slugs in Hungary. *BioInvasions Records* **12** (3): 711–729. doi: 10.3391/bir.2023.12.3.08

Urošević A, Maričić M, Šević M, Vučić T, Mirč M, Tomović L, Anđelković M. 2023. Note on the further spread of the Kotschy's Gecko (*Mediodactylus kotschyi*) in Serbia with pholidosis description. *Herpetology Notes* **16**: 533–537.

Vujić M, Vesović N. 2022. The first arrival of the Chinese sand roach *Polyphaga* cf. *plancyi* (Blattodea: Corydiidae) in Europe. *Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa"* **65** (2): 163–172. doi: 10.3897/travaux.65.e97208

Vuković AJ, Vujadinović MP, Rendulić SM, Đurđević VS, Ruml MM, Babić VP, Popović DP. 2018. Global warming impact on climate change in Serbia for the period 1961-2100. *Thermal Science* **22** (6 Part A): 2267–2280. doi: 10.2298/tsci180411168v

Welter-Schultes FW. 2012. *European Non-marine Molluscs, a Guide for Species Identification: Bestimmungsbuch für europäische Land-und Süsswassermollusken*. Planet Poster Editions, Göttingen, 757 pp.

Manuscript submitted: 26 October 2024
Revised manuscript accepted: 21 February 2025
Editor: Robert Forsyth