



First Record of a Surviving and Reproducing Population of *Cornu aspersum* (O. F. Müller, 1774) (Gastropoda: Helicidae) in Bulgaria outside Snail-farms

Ivailo K. Dedov¹, Ulrich E. Schnepapat² & Regula Cornu³

¹ Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2 Gagarin Street, 1113 Sofia, Bulgaria; E-mail: idedov@gmail.com

² Sennereiweg 8, CH-7074 Churwalden-Malix, Switzerland; E-mail: u.schnepapat@gmail.com

³ Raschärenstrasse 16, CH-7000 Chur, Switzerland; E-mail: regula.cornu@bluewin.ch

Abstract: In the course of collecting activities in the city of Sofia during autumn 2014, the snail species *Cornu aspersum* (O. F. Müller, 1774), hitherto not known as a proven member of the Bulgarian malacofauna, was found. The population was confirmed stable and reproducing in 2015 and 2018. The locality is the first in Bulgaria outside of snail-farms cultivating the common garden snail.

Introduction

The common garden snail *Cornu aspersum* (O. F. Müller, 1774) occurs in the Mediterranean region, Atlantic coastal regions up to the Netherlands and on the British Isles. It has been introduced in historical times to Greece, the British Isles and central Europe, and nowadays almost worldwide (WELTER-SCHULTES 2012). *Cornu aspersum* was reported for the Bulgarian fauna by PETRBOK (1941) for the cities of Varna and Plovdiv, without information about the habitats and the numbers of collected specimens. According to the summarizing work for the gastropod fauna of the Balkan Peninsula by JAECKEL et al. (1957), the species inhabits Thrace. DAMJANOV & LIKHAREV (1975) cited the information by PETRBOK (1941) and JAECKEL et al. (1957) without confirming the occurrence of the species with original data for Bulgaria. This information was repeated uncritically by DEDOV (1998) and IRIKOV & ERÖSS (2008) but, despite the highly active collecting efforts during the last 30 years across Bulgaria, the species has not been confirmed for the country, including in Varna and in Plovdiv.

Materials and Methods

The first specimens were found during daytime on 5 October 2014. Locality: Sofia, centre of the city area, district of “Pette Kyosheta”, nearby the fence of the Sofia District Court, General Mihail D. Skobelev Blvd., ruderal plants dominated by *Prunus laurocerasus* L. (Fig. 1). Coordinates: 42.688184° 23.315274°, altitude: 561 m, two live adult specimens and one empty but fresh shell as well some juveniles and subadult live specimens not counted and collected. Coll.No.2045, leg. Dedov, Schnepapat, Knechtle-Glogger; 16 October 2015, same spot, observed Dedov, Schnepapat, Stoyanov, Cornu, four live adult; 22 July 2018, same spot, two live adult specimens, observed Dedov.

Results

In the centre of the city of Sofia, in the same habitat, in 2014, 2015 and 2018 up to 10 live specimens of *C. aspersum* were found or observed (Fig. 2). Habitat: the spot, where the species was repeatedly found, was a big concrete plate in a ruderal vegeta-



Fig. 1. The locality of *Cornu aspersum* (O.F. Muller, 1774) in Sofia, Bulgaria.

tion and cherry laurel strip along General Mihail D. Skobelev Blvd. of a maximum size 120 x 10 m. To what extent the species might also populate the adjacent green area belonging to the property of the Sofia District Court, behind the surrounding fence, remains unknown. However, it would be only a maximum habitat size of 120 x 60 m. The vegetation consisted of sparse grasses and few herbaceous plants. Besides few undetermined green bushes in the habitat strip, the vegetation was totally dried up in July 2018, as well before in October 2014 and October 2015. Accompanying gastropod species on the spot: *Arion fasciatus* (Nilsson, 1823), *Deroceras cf. reticulatum* (O. F. Müller, 1774), *Helix lucorum* L., 1758 and *Oxychilus draparnaudi* (H. Beck, 1837).

Discussion

Cornu aspersum had not been found either in the city areas of Sofia, Varna and Plovdiv or in other sites across Bulgaria despite the regular collecting efforts of malacologists (I. K. Dedov, D. Georgiev, L. Zapryanov, U. E. Schneppat, F. Knechtle-Glogger, I. Stoyanov, R. Cornu) in the last 30 years. A dedicated study on the gastropod fauna of Sofia (DEDOV & PENEV 2000) has not registered the presence of this species. In 2014, in a single spot locality in the centre of the city Sofia, a reproducing population of the common garden snail has been found. The date of introduction of the first specimens remains unknown but the population has survived for a minimum of four years. In recent decades, *C. aspersum* has been imported to Bulgaria and reproduced in farms for commercial purposes. Due to its thermophilic nature and relatively low surviving rate during the cold winters, the species has not been found outside of snail-farms in Bulgaria until now. We

consider the present finding as a new introduction. This is the first reliable information that *C. aspersum* inhabits the country outside snail-farms.

Higher temperatures in the urban environments (compared to their surroundings) as well as general soil and air droughts in the cities (BLUME 1989, KLAUSNITZER 1990, McDONNELL et al. 1997) explain the adaptation and survival of thermophile and drought-resistant species like *C. aspersum* in the city of Sofia. Its surviving as a stable population in the city centre could be considered in the context of the global trend of increasing numbers of thermophilic and drought-resistant species in cities and decrease of the mesophilic and hydrophilic species (CZECHOWSKI et al. 1981, PILIPIUK 1981, PISARSKI 1982, STERZYNSKA 1982). As in Bulgaria, reproducing populations of *C. aspersum* have been established in the biggest city in the Czech Republic, Prague, believed to be the first observation of overwintering populations of this species in the country (JUŘIČKOVÁ & KAPOUNEK 2009). In the Republic of North Macedonia, *C. aspersum* has also been recorded in the capital city, Skopje (CVETKOVSKA-GJORGIEVSKA et al. 2019). Originally deriving from North Africa (GUILLER & MADEC 2010), *C. aspersum* is distributed almost worldwide, including northern parts of Europe (WELTER-SCHULTES 2012). It shows a long historical process of gradual adaptation and expansion into new territories. According to SIMOV et al. (2016), nowadays the urban environment is the main stage of the pathways of introduction of alien species and recently established populations of alien species in urban environments may become a reservoir of individuals ensuring their future successful invasion. Introduced thermophilic species as *C. aspersum* initially seem to survive in “oases” with appropriate climatic conditions. After some generations on this spot, they adapt to the local conditions and expand into new territories. The differences in thermal sensitivity among the populations of *C. aspersum* have been commented by GAITA 'N-ESPITIA et al. (2013). According to their results, the differences in thermal sensitivity among populations of *C. aspersum* is following a latitudinal pattern, which is likely a result of a combination of thermodynamic constraints (“hotter is better”) and thermal adaptations to their local environments (generalist-specialist trade-offs).

It is interesting how the species has been introduced into the centre of a metropolis like Sofia. Very likely, the reason can be an introduction with building materials or trading with live snails and their accidental or deliberate release in the city. Introduction of *C. aspersum* from the Mediterranean Region is



Fig. 2. *Cornu aspersum* (O. F. Muller, 1774), Bulgaria, Sofia, 5 October 2014.



Fig. 3. *Cantareus apertus* (Born, 1778) found in a package of spinach from a supermarket, Bulgaria, Sofia, spring 2019.

also possible. It could have happened with vegetables, fruits or ornamental plants. In support of such statement is the finding of live *Cantareus apertus* (Born, 1778) in a package of spinach from a supermarket in Sofia, imported from Italy in the spring of 2019 (Coll.No.2046) (Fig. 3). So far, this specimen is the first known to be found in Bulgaria.

Acknowledgements: We thank the editor-in-chief and the reviewers of the journal for their helpful remarks.

References

- BLUME H. P. 1989. General characteristics of urban soils. UNESCO Program der Mensch und Die Biosphäre 30: 23–46. Berlin, German National Committee of the UNESCO Man and the Biosphere Programme.
- CVETKOVSKA-GJORGIEVSKA A., DEDOV I., HRISTOVSKI S., LANGOUROV M., LAZAREVSKA S., PRELIK D. & SIMOV N. 2019. New records of allochthonous, invasive and pest invertebrate species from the Republic of Macedonia. *Ecologica Montenegrina* 20: 56–70.
- CZECHOWSKI W., KUBICKA A. & STAREGA W. 1981. Harvestmen (Arachnoidea, Opiliones) of Warsaw and Mazovia. *Memorabilia Zoologica* 34: 111–118.
- DAMJANOV S. & LIKHAREV I. 1975. Fauna Bulgaria IV, Gastropoda terrestria. Sofia: Bulgarian Academy of Sciences, 425 p. (in Bulgarian).
- DEDOV I. 1998. Annotated checklist of the Bulgarian terrestrial snails. *Linzer Biologische Beiträge* 30 (2): 745–765.
- DEDOV I. & PENEV L. 2000. Species composition and origins of the terrestrial gastropod fauna of Sofia City, Bulgaria. *Ruthenica* 10 (2): 121–131.
- GAITÁN-ESPITIA J. D., BELÉN ARIAS M., LARDIES M. A. & NESPOLO R. F. 2013. Variation in thermal sensitivity and thermal tolerances in an invasive species across a climatic gradient: lessons from the land snail *Cornu aspersum*. *PLoS ONE* 8 (8): e70662. doi:10.1371/journal.pone.0070662
- GUILLER A. & MADEC L. 2010. Historical biogeography of the land snail *Cornu aspersum*: a new scenario inferred from haplotype distribution in the Western Mediterranean basin. *BMC Evolutionary Biology* 10: 18 <http://www.biomedcentral.com/1471-2148/10/18>
- IRIKOV A. & ERŐSS Z. 2008. An updated and annotated checklist of Bulgarian terrestrial gastropods (Mollusca: Gastropoda). *Folia Malacologica* 16 (4): 199–207.
- JAECKEL S. H., KLEMM W. & MEISE W. 1957. Die Land- und Süßwasser-Mollusken der nördlichen Balkanhalbinsel. *Abhandlungen und Berichte des Museums für Tierkunde und Völkerkunde zu Dresden* 23 (2): 141–205.
- JUŘIČKOVÁ L. & KAPOUNEK F. 2009. *Helix (Cornu) aspersa* (O.F. Müller, 1774) (Gastropoda: Helicidae) in the Czech Republic. *Malacologica Bohemoslovaca* 8: 53–55.
- KLAUSNITZER B. 1990. Urban Ecology. Moscow: Publishing House “Mir”. 248 p. (in Russian).
- MCDONNELL M., PICKETT S. T. A., GROFFMAN P., BOHLEN P., POUYAT R. V., ZIPPERER W. C., PARMELEE R. W., CARREIRO M. M., & MEDLEY K. 1997. Ecosystem processes along an urban-to-rural gradient. *Urban Ecosystems* 1: 21–36.
- PETRBOK J. 1941. Posttertiaria nonmarina mollusca bulgarica. *Věstník Královské české společnosti nauk. Třída mathematicko-přírodovědecká* 1941: 1–39. (In Czech).
- PILIPIUK I. 1981. Earthworms (Oligochaeta, Lumbricidae) of Warsaw and Mazovia. *Memorabilia Zoologica* 34: 69–77.
- PISARSKI B. 1982. Ants (Hymenoptera, Formicoidea) of Warsaw and Mazovia. *Memorabilia Zoologica* 36: 73–90.
- SIMOV N., DEDOV I. K., LANGOUROV M., SCHNEPPAT U. & PAUNOVA L. 2016. The urban environment in the Balkans as a main stage of the pathways of the introduction of invasive alien species. 5th Congress of Ecologists of the Republic of Macedonia with International Participation. Ohrid, Macedonia, 19th – 22nd October 2016, Abstract: pp. 185–186.
- STERZYNSKA M. 1982. Springtails (Collembola) of Warsaw and Mazovia. *Memorabilia Zoologica* 36: 217–234.
- WELTER-SCHULTES F. W. 2012. European non-marine mollusks, a guide for species identification. Göttingen: Planet Poster Editions, 674 p.

Received: 20.12.2020

Accepted: 09.04.2021

