

First record of the pest and parasitic intermediate host snail *Cochlicella barbara* (Linnaeus, 1758) in the south-eastern Anatolia

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Abstract

The objective of the present study is to inform the last distribution of the invasive and harmful species *Cochlicella barbara* (Linnaeus, 1758) in Turkey, as well as to draw attention to the possible danger of this distribution on regional vegetation, agriculture, and parasitism. *C. barbara* was found for the first time in south-eastern of Anatolia in April 2019 in the campus area of the Dicle University in Diyarbakır, Turkey. *C. barbara* is admitted as a harmful organism and classified as an agricultural pest in most of the countries. Species in this genus have been intercepted in postal packages, soil, and cargo as well as can be easily transported with plants, building materials, household goods, etc. Above all, it is an intermediate host of nematode and fluke parasites of livestock. Knowing the distribution of this species will not only contribute to the registration of a new species in the list of gastropods of the region but also facilitate the control of the species across Turkey.

Keywords: *Cochlicella barbara*, Intermediate host, Pest snail, Diyarbakır

Introduction

Around 30.000 to 35.000 terrestrial gastropod species have been reported worldwide. After Arthropoda, Mollusca is known as the second-largest phylum among all animal phyla and the Gastropoda class constitutes the richest group of the mollusks in diversity. In general, gastropods are divided into three groups according to the presence and location of the respiratory organs: Prosobranchia (gills in front of the heart), Opisthobranchia (gills behind the heart) and Pulmonata (gill deficiency, but use a multi-veined mantle for breathing). Because of these properties, they have been able to live in a wide variety of different habitats for millions of years. It is thought that there are around 20.500 terrestrial pulmonates worldwide

(Larbaa and Soltani, 2013). It has been reported that approximately 500 terrestrial gastropod species living in Turkey, nearly 60 of them are slugs (Schutt, 2005). Besides, about 60 species of land snails and slugs inhabit South-eastern Anatolia. Species belonging to the *Ambigolimax*, *Assyriella*, *Buliminus*, *Calaxis*, *Cecilioides*, *Cernuella*, *Chondrula*, *Cryptomphalus*, *Eobania*, *Eopolita*, *Euchondrus*, *Granopupa*, *Helix*, *Lauria*, *Limacus*, *Lindholmia*, *Monacha*, *Orculella*, *Oxyloma*, *Pene*, *Pomatias*, *Pseudochondrula*, *Turanena*, *Vitrea*, *Xeromunda*, *Xeropicta*, *Zebrina*, *Zonitoides*, *Ambigolimax* genus are dwelling in south-eastern Anatolia, particularly in Mardin, Diyarbakır, Siirt, Batman, Urfa districts (Schutt, 2005; Ekin and Şeşen, 2018). There isn't enough data about the final distribu-

Cite this article as:

Ekin, I., Sesen, R. (2020). First record of the pest and parasitic intermediate host snail *Cochlicella barbara* (Linnaeus, 1758) in the south-eastern Anatolia. Int. J. Agric. Environ. Food Sci., 4(1), 57-61

DOI: <https://dx.doi.org/10.31015/jaefs.2020.1.7>

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Received: 11 December 2019 Accepted: 05 February 2020 Published Online: 15 March 2020

Year: 2020 Volume: 4 Issue: 1 (March) Pages: 57-61

Available online at : <http://www.jaefs.com> - <http://dergipark.gov.tr/jaefs>

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tion of terrestrial gastropods and their damage to agriculture and human health not only in south-eastern Anatolia but also in Turkey. With this study, it is also aimed to raise awareness of some harmful gastropods such as *Cochlicella barbara* in advance by drawing attention to possible damages of the species.

C. barbara is an invasive species and capable of rapid reproduction. It is known worldwide by different names such as banded conical snail, pot-bellied snail, potbellied helicellid, small pointed snail, small conical snail, tower snail, conical Mediterranean snail. The geographical distribution of this species is generally the European coastal regions around the Mediterranean. In Turkey, presence of this species previously reported in Marmara Region (İstanbul - Üsküdar, Yeşilköy; Çanakkale - Kilitbahir), Mediterranean Region (Antalya - Lara; Adana - Karataş), Aegean Region (Muğla - Bodrum), eastern Black Sea Region (Trabzon - Esiroğlu, Maçka, Değirmendere) (Figure 2) (Schutt, 2005). However, it is the first time this species has been found in the south-eastern Anatolian region. So far, this species has not been observed in the Central Anatolia Region, Eastern Anatolia Region and Western Black Sea Region of Turkey.

This paper aims to provide information about the presence of *C. barbara*, an invasive and potential parasite carrier species in south-eastern Anatolia, and to draw attention to the potential hazards of the species to regional vegetation, agriculture, and other gastropod species.

Material and Methods

C. barbara was collected from the agricultural lands around Diyarbakır (Geographic coordinates of Diyarbakır are 37°54' 36.00" N - 40°14' 24.00" E; Elevation above sea level is 674 m, 2211 ft.) and the settlements on the banks of the Tigris, in April 2019. It was observed that these snails have lived in the center of Diyarbakır and the agricultural areas around the city, in some different localities. Even if a population density calculation was not performed, their numbers were quite high. Species identifications were made based on snail morphology and collected specimens compared to those in shell-library databases formed by Şeşen and Schutt in 2005, also Henk MIENIS opinion was taken for the correctness of the identification of the species. In the collected area, the snails have been observed almost everywhere in damp shaded areas, under the leaves, on walls, trees, shrubs, pavements, and empty shells have been found all over the area. The snails were both photographed in their habitats and the laboratory and some of the shells are kept into the boxes for further studies (Figure 1).

Result and Discussion

Morphological features of the species may sometimes show small differences. However, generally, the shell of the species is whitish, greyish or yellowish with brown spots or bands, 7-8 whorls; umbilicus is very narrow but rarely closed. Juveniles slightly keeled. In some habitats, the species is very light yellowish, dorsum with blackish-brown pigments, two dark lines from the sides to the upper tentacles, one dark medial line on the dorsum. Its size is between 4.5-7 x 7-15 mm, usually 5 x 8-10 mm (Schutt, 2005).

Conical snails are known to activate the post-aestivation cycle later than round snails. Life cycles of *C. barbara* which is conical can be annual or biennial. The small size of the snail, which is capable of rapid reproduction, means that it is widely spread through the transport of infested plants, vegetables, fruits or other commodities. It lives for approximately one year. Mating occurs in the spring with egg-laying continuing through summer and autumn. Eggs hatch soon after in autumn and early winter, or during the following winter (Herbert, 2010).

The geographical distribution of this species is generally the European coastal regions around the Mediterranean (including Algeria and Egypt). The species has recently spread to the inner parts of Europe, for example to Albania, Belgium, Croatia, France, Greece, Italy, Israel, Netherlands, Portugal, Spain, and Great Britain (Kerney and Cameron, 1979; Cook, 1997; Morondo et al., 1992; Herbert, 2010). *C. barbara* is native to western Europe, particularly the Mediterranean Region. However, it has been reported to be distributed in California, Azores, Bermuda, South Africa, Japan, Australia, New Zealand, and South Africa. The snails can be found in dry areas near the sea, specifically in dunes and sometimes inland. The species prefers areas with relatively dry Mediterranean climates, especially near the coast. It invades cultivated and barren areas in gardens, forests, suburbs, and cultivated areas by creating numerous individuals in favorable conditions and mostly spend more time under grass (Herbert, 2010). Additionally, in a study of *Lauria cylindracea*, *Anion hortensis*, *C. barbara*, *Pupoides albilabris*, and *Xerotricha conspurcata* including their distribution to Los Angeles, Orange, and Riverside counties in California, it was emphasized that *C. barbara* easily adapted to the metropolises and spread fast (Vendetti et al., 2018).

C. barbara is registered as a harmful organism by Australia, Japan, the United States, Chile, and Korea. The agricultural ministries of America, Australia, and South Africa have accepted this creature as an agricultural pest and offered serious

control methods. *C. barbara*, *C. conoidea*, and *C. ventricosa* are considered a hitchhiker pest as having been found in ships, vehicles, and containers. They are intercepted in cars, postal packages, soils, cargos (Godan, 1983) and can be easily transported with plants, building materials, and household goods. The presence of *Cochlicella spp.* can be estimated by chewing or rasping damage to plants, presence of eggs, juveniles and adults, empty snail shells, mucus and slime trails, and feces like a ribbon (Herbert, 2010). These harmful species can cause serious damage to grain and oilseed production and polluted crops during harvesting; this may result in reduced or even rejected consignment quality (Roth and Hertz, 1997; Baker, 2002). They may cause direct feeding damage to canola in early winter, just as they attack pastures and other crops in southern Australia (Baker, 1986; 2002; Gu et al., 2007; Suzanne and Kerrie, 1999). *C. barbara* can cause appreciable agricultural and horticultural damage when population densities are high. Densities of over 1,000 snails/m² have been recorded in New Zealand. Damage to legume-based pastures has been reported in south-eastern Australia (Herbert, 2010).

C. acuta and *C. barbara* are known to be intermediate hosts of nematodes and trematodes which infect man and domestic animals and fluke parasites of livestock. Prevention and early intervention are essential. The harmful effects of the species

can be best monitored by a combination of cultural and chemical control. Their natural predators are carnivorous beetles (Godan, 1983; Morrondo et al., 2005). *C. acuta* is an intermediate host of both *Müllerius capillaris* (Müller) and *Cystocaulus ocreatus* Davtian, lungworms of sheep (Godan, 1983). *C. barbara* can act as an intermediate host for *Protostrongylus rufescens* (sheep lungworm) (Herbert, 2010). Sheep are naturally infected by bronchopulmonary nematodes on pasture. Adult mollusks are found to be higher than juvenile ones and increased the frequency and intensity of the nematode infection (Morrondo et al., 1992). Larvae development of *Nematoda, Protostrongylidae* in *C. barbari*, were studied in detail and possible impact on infection of infected small ruminants was reported northwest Spain (Morrondo et al., 2005). *Brachylaima cribbi* is a terrestrial trematode of birds and mammals that selects land snails as the first and second intermediate hosts. The presence of *B. cribbi* sporocysts in 6,432 terrestrial snails collected from eight geographic regions of Australia was investigated in a study. Four snail species, *Theba pisana*, *Cer-nuella virgata*, *C. acuta*, and *C. barbara* were found to be the first natural intermediate hosts of this nematode (Andrew and David, 2003).



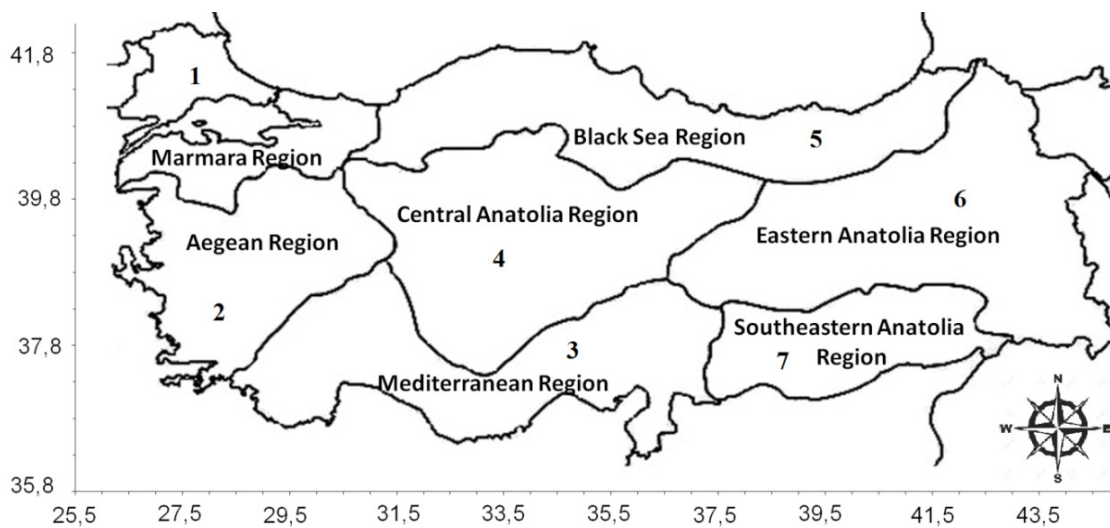
Figure 1. *Cochlicella barbara* from the center and around Diyarbakır, Turkey.

Systematic of *Cochlicella barbara*

Phylum: Mollusca
 Class: Gastropoda
 Subclass: Heterobranchia
 Infraclass: Euthyneura
 Subterclass: Tectipleura
 Superorder: Eupulmonata
 Order: Stylommatophora
 Suborder: Helicina
 Infraorder: Helicoidei
 Superfamily: Helicoidea
 Family: Geomitridae
 Subfamily: Geomitrinae
 Genus: *Cochlicella*
 Species: *C. barbara* (Linnaeus, 1758)

Synonyms of *Cochlicella barbara*

Bulimus ventricosus (Draparnaud, 1801)
Cochlicella ventricosa (Draparnaud, 1801)
Helix barbara (Linnaeus, 1758)
Helix bulimoides (Moquin-Tandon, 1855)
Helix ventrosus (A. Férussac, 1821)
Prietocella barbara (Linnaeus, 1758)



Coordinates of Turkey are 38°57' 26.43"N - 35°14' 26.67"E

Figure 2. Distribution of *C. barbara* in Turkish regions. The species has been reported to be distributed in regions 1, 2, 3, 5; Marmara Region (İstanbul - Üsküdar, Yeşilköy; Çanakkale - Kilitbahir), Mediterranean Region (Antalya - Lara; Adana - Karataş), Aegean Region (Muğla-Bodrum), Black Sea Region (Trabzon - Esiroğlu, Maçka, Değirmendere) (Schutt 2005). The first time, the distribution of the species is seen in 7 numbered region (Diyarbakır) (Geographic coordinates of Diyarbakır are 37°54' 36.00" N - 40°14' 24.00" E) (Elevation above sea level: 674 m, 2211 ft.)

Conclusion

As a result, the distribution of this species is very fast and easy. If the necessary precautions are not taken and the necessary community awareness is not established, it can cause diseases that can be transmitted from animals to humans and can cause serious harm to agriculture. Since 2005, there is no evidence of any studies about the last distribution of the species in Turkey. Unless serious and extensive research is not done, the current distribution of the species and disease spreading potential cannot be learned. As soon as possible, adequate information should be reported about *C. barbara*, which is considered as a risk factor.

Compliance with Ethical Standards**Conflict of interest**

The authors declare that for this article they have no actual, potential or perceived the conflict of interests.

Author contribution

The contribution of the authors is equal. All the authors read and approved the final manuscript. All the authors verify that the Text, Figures, and Tables are original and that they have not been published before.

Ethics committee approval

Ethics committee approval is not required.

Funding

No financial support was received for this study. Self-sponsored for research work.

Data availability

Not applicable.

Consent for publication

Not applicable.

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