

First record of the pointed snail *Cochlicella acuta* (O. F. Müller, 1774) from Iraq

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Abstract

The pointed land snail, *Cochlicella acuta* (O. F. Müller, 1774), belonging to the Family Geomitridae, was recorded for the first time at multiple sites across Erbil City, Iraq, between November 2023 and October 2024, during which average monthly temperatures ranged from 3 to 44°C. Specimens were collected by hand from grasses and soil surfaces at various locations, and this species was additionally detected in imported black mulberry fruit (*Morus nigra*), suggesting a potential pathway of introduction through agricultural trade. Species identification was rigorously confirmed through two complementary approaches: detailed morphological analysis based on shell characteristics, including height, width, whorl count, coiling direction, sculpture, and coloration, and molecular identification via DNA barcoding of the mitochondrial Cytochrome C Oxidase subunit I (COI) gene. The obtained sequence showed 99.43% similarity to a reference sequence available in GenBank, confirming the species identity. This finding represents the first documented record of *C. acuta* in Iraq and highlights the need for strengthened phytosanitary and quarantine measures to prevent the further introduction and spread of non-native gastropod species into the country.

Keywords: *Cochlicella acuta*, land snail, DNA barcoding, morphology, Iraq

Introduction

Terrestrial gastropods have recently been identified as significant economic pests worldwide, posing serious and persistent threats to sustainable agriculture (Kumar, 2020). The pointed land snail, *Cochlicella acuta* (O. F. Müller, 1774) (Gastropoda: Geomitridae), is one of the most

prevalent mollusk pests, causing damage to various crops, including grain, canola seedlings, legume-based pastures, citrus plantations, palm trees, leafy vegetables, and ornamental plants (Baker, 2002; Gu et al., 2007). Additionally, this species serves as an intermediate host for trematodes and nematodes that can infect humans and domestic animals (Butcher & Grove, 2006; Godan, 1983).

DNA barcoding is a molecular marker-based tool that enables the rapid, effective, and reliable identification of organisms. It also aids in understanding the systematic and evolutionary relationships between different species. The Mitochondrial Cytochrome C Oxidase 1 gene (COI) serves as a universal barcode for animals and can be particularly useful in identifying land snails. This is due to the morphological similarities among various species, as well as the variations that can occur both within species and among juvenile stages (Blacket et al., 2016). *Cochlicella acuta* snail is originally native to coastal regions of the Mediterranean and Atlantic coasts of Southwestern Europe (Kerney & Cameron, 1979). However, due to human activities, it has spread and is now found in various parts of the world. This species can tolerate warm, sunny, and dry environments over relatively long periods, indicating its potential for widespread distribution (Godan, 1983). This species is widely distributed across neighbouring countries of Iraq, including Turkey (Örstan et al., 2005), Iran (Ahmadi & Javadi, 2012), Lebanon (Bößneck, 2011), Jordan (Neubert et al., 2015) and Egypt (Ali, 2017). However, there have been no documented records of this species in Iraq. This research aims to provide the first documented appearance of *C. acuta* in Erbil City, Iraq, using both morphological and molecular characteristics to confirm its presence.

Martial and methods

Study area

Samples of land snail *C. acuta* were collected by hand from grasses and soil surfaces from different sites in Erbil City, Iraq, between November 2023 and October 2024 (Fig. 1). Snails were also collected from imported black mulberry fruit (*Morus nigra*). They were kept at the proper temperature and oxygen aeration in a box, then immediately transferred to the Advanced Zoology Lab, Biology Department, Salahaddin University-Erbil, Iraq.

Specimen identification

To confirm the identification of species or subspecies, all the following morphological

characteristics were utilised: height, width of shell, aperture, number of whorls, the direction of shell coiling, shell sculpture, and color. The shells were measured using a caliper with an accuracy of 0.1 mm. Sample identification was performed based on the key features described by (Kerney & Cameron, 1979), (Godan, 1983), and (Neubert et al., 2015).

DNA extraction, amplification, and DNA sequencing

DNA was extracted from the entire bodies of life snails, which were crushed between two pieces of clean foil made of aluminium (Carmona et al., 2013). The extraction used a commercially available kit: DNAeasy Blood and Tissue kit (Qiagen, Germany), following the manufacturer's protocol. Mitochondrial DNA Cytochrome Oxidase subunit I (*COI*) gene (680-710 bp) was used for DNA barcoding. The primer pairs employed were: LCO1490: (5'-GGTCAACAAATCATAAAGATATTGG-3') and HCO2198: (5'-TAAACTTCAGGGTGACCAAAAAATCA-3') (Folmer et al., 1994). Master mix (Ampliqon PCR Enzymes & Reagents, Denmark) was utilised to amplify the partial sequences of the (*COI*) gene performed in 25 µl, which included: master mix (12.5 µl); 0.2 µM of each primer; DNA (2 µl); and ddH₂O (7.5 µl), and with a PCRmax Alpha thermal cycler (UK). PCR reaction proceeded as follows: 5 min at 95 °C; five cycles of 30 sec at 95 °C, 40 sec at 45 °C and 1 min at 72 °C; followed by 35 cycles of 30 sec at 95 °C, 40 sec at 51 °C and 1 min at 72 °C then final cycle of 5 min at 72 °C. Gel purification kit (QIAquick Gel Extraction, Qiagen, Germany) was used to purify PCR products according to the manufacturer's instructions.



Figure 1. Location of pointed snails collected from Erbil City, Iraq

Bidirectional DNA sequencing was carried out by an ABI 3730XL nucleotide sequence analyzer provided by Macrogen Inc. (Korea). The ClustalW algorithm, available through the MUSCLE program within EMBL-EBI (<https://www.ebi.ac.uk/jdispatcher/msa/muscle>), was used to edit and align the sequence. Database searches for sequence similarity were conducted using the (blastn) tool (<https://blast.ncbi.nlm.nih.gov/Blast.cgi>), and the obtained sequences were compared with homologous sequences previously published in GenBank.

Results

The current research involved collecting species of land snails belonging to Family Geomitridae, Order Stylommatophora, from many sites in Erbil City, Iraq, as well as from imported black mulberry fruit (*Morus nigra*). The mean temperatures from November 2023 to October 2024 fluctuated from 4 to 44 °C. *Cochlicella acuta* (O. F. Müller, 1774) has been documented in Iraq for the first time.

Synonyms

According to the database recorded within the MolluscaBase database (2025), Synonyms for *Cochlicella acuta* are as follows:

Bulimus acutus (O. F. Müller, 1774)· unaccepted > superseded combination

Bulimus acutus var. *nigrescens* J. W. Taylor, 1883· unaccepted (junior synonym)

Cochlicella (*Cochlicella*) *acuta* (O. F. Müller, 1774) alternative representation

Cochlicella acuta var. *obesa* Pallary, 1918 unaccepted (original combination)

Cochlicella meridionalis Risso, 1826 unaccepted (junior synonym)

Cochlicella turricula Risso, 1826 unaccepted (junior synonym)

Helix (*Cochlicella*) *acuta* O. F. Müller, 1774 unaccepted

Helix acuta O. F. Müller, 1774 unaccepted (original combination)

Helix bifasciata Pulteney, 1799 unaccepted

Description

The snail is typically pointed and narrow-shelled with a high spire, giving it an elongate-conical appearance. Whorls (8-11) that are slightly convex. The shell measures approximately 10 to 20 mm in height and 4 to 7 mm in width. The shell exhibits variability in colour and background, ranging from whitish-creamy to pale brownish with spiral brown bands or stripes across the entire shell. The spire gradually tapers but ends in a blunt apex. The oval aperture is characterised by a thin lip that lacks dentition, and narrow, open umbilicus is partially covered.

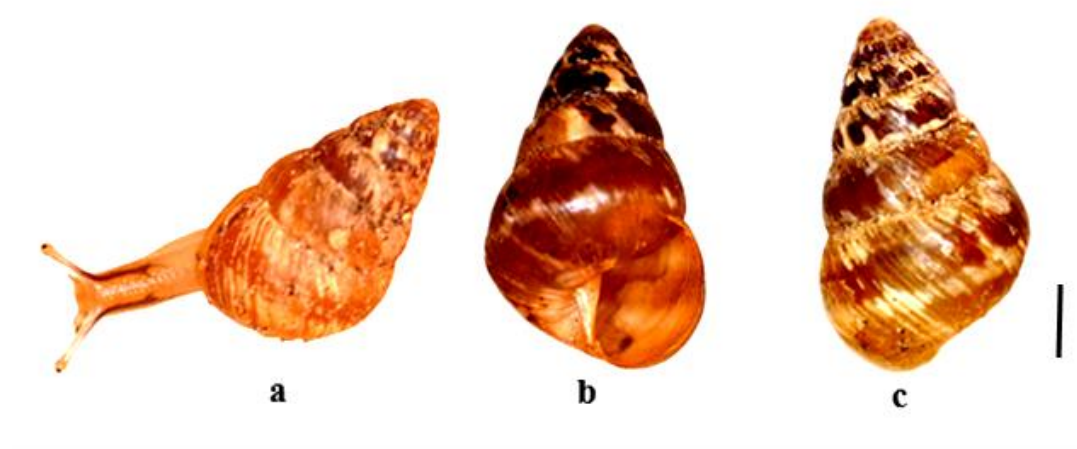


Figure 2: *Cochlicella acuta*; a. whole mount; b. shell, ventral view; c. shell, dorsal view (Scale bar=0.3 mm).

DNA analysis

The partial mtDNA *COI* gene of the terrestrial snail was sequenced. The sequence present in GenBank was used to compare the result, thereby confirming the identity of this species and correlating with its morphological characteristics. The sequence data for *Cochlicella acuta* has been submitted to the GenBank database under accession number PQ721285. This sequence reveals a 99.43% similarity with the reference sequence corresponding to accession number MK228702, which is also available in the GenBank database.

Discussion

This study aims to report the presence of *Cochlicella acuta* in Iraq for the first time. No prior research has been conducted on this species within the country. Consequently, this study is regarded as the first documentation of *C. acuta* in Iraq, particularly in Erbil City. The description and measurements of the present specimens observed closely align with those previously reported for *C. barbara* in Erbil City, Iraq (Bashê & Al-Qassab, 2024). *Cochlicella acuta* has been introduced to the horticultural environment of Iraq, potentially through imported crops, ornamental plants, and seedling trade; therefore, the quarantine authority must implement stricter measures to prevent the infiltration of non-native species into the country.

This species is typically restricted to Mediterranean coastal ecosystems rather than regions with a more continental climate. The ability of *C. acuta* to establish stable populations requires further observations (Neubert et al., 2015). Furthermore, it has been reported that this species is non-native and has been introduced to Turkey (Örstan et al., 2005).

Cochlecilla acuta generally shares a similar external appearance to the shells of *Cochlicella barbara* and *Cochlicella conoidea*. However, it can be distinguished by its more elongated shell, which features more whorls, a pointed shell, and less broadness at its base (Herbert, 2010; Welter-Schultes, 2012). Invasive alien gastropods are a prevalent taxonomic group globally and often cause considerable impacts on both aquatic and terrestrial ecosystems (Jiang et al., 2022). Their effects arise from several factors, including their ravenous feeding habits, high reproductive rates, tolerance for a variety of environmental conditions, high dispersal abilities, and competitive interactions with the native gastropods and other Indigenous fauna species (Joshi, 2007; Riley et al., 2008).

As a consequence of growing human activities, a considerable number of species have been introduced into areas beyond their native habitats, frequently leading to substantial declines in biodiversity alongside significant economic and social impacts (Seebens et al., 2021). It was

estimated that at least 175 terrestrial gastropod species have successfully established populations beyond their native environments (Capinha et al., 2015). This species exhibits shell polymorphism, characterised by variations in banding pattern, the opacity of extra-band areas of the shell, and the overall ground colour. Three distinct banding morphs of the shell have been observed: a discontinuously opaque unbanded form with a sandy background appearance, a heavily banded form with a dark background, and a continuously opaque form with a few bands that are white with a dark background appearance. Research has indicated that variations in shell morphs correspond to specific habitat types of the snail (Lewis, 1977).

Furthermore, genetic diversity has been reported among individuals of *C. acuta* collected from different locations in Western Europe, North-West Africa, and Australia. Three distinct maternal lineages were identified through the analysis of *COI* gene and mitochondrial ribosomal large subunit (16S rDNA) markers (Jourdan et al., 2019). The combined morphological and genetic diversity highlights the complexity and adaptability of this species across different environments.

Conclusion

This study documented the first occurrence of the terrestrial snail *Cochlicella acuta* in different sites in Erbil City, Iraq. Therefore, this finding is significant as it confirms the presence of this species in the country. Due to the presence of this land snail in imported agricultural products, quarantine authorities must take more action to prevent non-native species from being introduced into the country.

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