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# Morphological and Ecological Observations on Freshwater Snail *Pseudosuccinea columella* (Say, 1817) in Baghdad, Iraq

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**Abstract**

This study presents morphological observations on the freshwater snail *Pseudosuccinea columella* collected from an urban freshwater habitat in Baghdad, Iraq. A total of 30specimens were collected from a home garden in the Al-Karkh district and preserved in 70% alcohol for morphological identification. The snails were examined with a dissecting microscope, and the measurements of shell height and Width, number of whorls, and size of apertures were recorded. The shells were fragile, translucent, and horn-colored, with three convex whorls and an ovoid aperture. These results are consistent with previous descriptions, although Slight variations in measurements were observed, possibly due to local environmental conditions. The detection of *P. columella*, a known intermediate host of *Fasciola hepatica*, raises concern about the possible transmission of fascioliasis in Baghdad. The presence of this species in an urban environment suggests its ability to adapt to diverse ecological conditions and human-modified habitats. Moreover, the introduction of this snail may be associated with the movement of aquatic plants or irrigation water. This discovery highlights the need for further molecular and epidemiological studies to assess infection rates and distribution patterns, as well as to develop targeted strategies to control this invasive species.

**Keywords:** *Pseudosuccinea columella*, First report, Baghdad, Fascioliasis**.**

## 1. Introduction

The freshwater snail *Pseudosuccinea columella* (Say, 1817) is a pulmonate snail belonging to the phylum Mollusca, class Gastropoda, superorder Hygrophila, and family Lymnaeidae[1]. This species is native to North America but has successfully expanded its distribution worldwide due to its high ecological adaptability and tolerance to different environmental conditions[2]. Currently, it has been detected in Europe, Africa, South America, Oceania, and several island ecosystems, where it frequently occurs as an invasive species[2-4].

*Pseudosuccinea columella* typically colonizes stagnant or slow-flowing freshwater bodies such as ponds, irrigation canals, rice paddies, and natural wetlands. It is often observed on submerged vegetation or floating plant parts, where it feeds on algae and organic detritus[5]. This ecological flexibility enables it to survive in different habitats and to colonize new environments quickly[2]. From a parasitological perspective, *P. columella* is a well-documented intermediate host of the liver fluke *Fasciola hepatica*, a trematode responsible for fascioliasis, a zoonosis of global importance affecting humans and livestock[6,7]. The transmission of *F. hepatica* involves a complex life cycle that requires specific snail hosts for larval development. Interestingly, *P. columella* populations exhibit variable susceptibility to *F. hepatica* infection, with some populations exhibiting natural resistance to the parasite, as reported in Cuba[8]. This resistance is linked to genetic and environmental factors and has implications for disease control strategies[9]. Recent reports have documented the spread of the species into new regions. For example, *P.*

*columella* was detected for the first time in Malawi in 2023, which represents a significant geographical expansion within Africa[7]. In South Africa, field surveys have revealed a wide distribution in the UMgungundlovu district, with its occurrence strongly correlated with environmental parameters such as water pH and temperature[10]. These results emphasize the potential of this species to alter the local epidemiology of fascioliasis as it invades new ecosystems. Malacological studies conducted in Iraq have mainly focused on terrestrial gastropods, such as *Cochlicella barbara* and *Eobania vermiculata*. Only a limited number of studies have addressed freshwater molluscs in Iraqi aquatic systems. However, none of these studies have reported the occurrence of *Pseudosuccinea columella* in Iraq[11].

In addition to its ecological adaptability, *P. columella* is characterized by a high reproductive potential. The species is capable of rapid population growth due to its relatively short life cycle and high fecundity. Such reproductive success facilitates its establishment in new habitats and contributes to its ability to colonize diverse freshwater ecosystems[12].

Mollusc biodiversity in Iraq remains poorly documented despite the country's diverse freshwater ecosystems, including rivers, marshes, and irrigation canals. Freshwater molluscs, particularly gastropods, play an important ecological role and serve as indicators of environmental conditions[13]. However, available data on their distribution, diversity, and ecological status are limited and fragmented[14]. Therefore, documenting mollusc diversity contributes to filling a significant knowledge gap and provides baseline information that may support future ecological, environmental, and epidemiological studies in Iraq.

The main objective of this study is to provide morphological documentation of *P. columella* collected from a freshwater habitat in Baghdad, Iraq. The study focuses on describing the shell morphology and habitat characteristics of the collected specimens to support accurate species identification. These observations provide preliminary information about the presence of this species in an urban freshwater environment and contribute to the limited knowledge of freshwater molluscs in Iraq.

## 2.Materials and Methods

### 2.1. Study area and specimen collection

The specimens of *Pseudosuccinea columella* were collected from a private home garden in Al-Karkh district, Baghdad, Iraq. The site consisted of moist soil with stagnant water suitable for the growth of aquatic vegetation and potential habitats for freshwater snails. Sampling was conducted in the early morning hours to maximize snail activity as suggested by [5]. A total of 30 live specimens were collected by hand using sterile forceps and placed in clean, labelled plastic containers filled with local water to minimise stress during transport to the laboratory[2].

Habitat characteristics recorded during sampling included water stagnation, presence of aquatic vegetation, substrate type, and general environmental conditions of the site. The habitat consisted of shallow stagnant water with moist soil and aquatic plants, which provide suitable microhabitats for freshwater snails.

Upon arrival at the laboratory, specimens were carefully rinsed with distilled water to remove any debris or adhering plant material. All specimens were preserved in 70% ethanol to preserve their morphological characteristics for later examination and identification, using standard malacological preservation techniques[5].

### 2.2. Morphological identification

The identification of the collected snails was based on the external shell morphology using a stereoscopic dissecting microscope (10–40x magnification). Classification was performed according to the taxonomic keys described by [2] and [5] and focusing on diagnostic characters specific to *P. columella*.

The following morphological characters were recorded for each specimen:

-Shell dimensions

Shell length (SL): measured from the apex to the distal edge of the aperture.

Shell width (SW): measured at the widest part of the shell.
Length and width of the aperture: measured with a precision caliper (±0.01 mm).
Measurements were taken three times to ensure accuracy, and the average values were used for the analysis[15].
-Number and direction of whorls
The total number of whorls was counted by looking at the shell from the apex to the aperture. The direction of the whorls (dextral or sinistral) was also determined, which is an important taxonomic feature[16].
-Colour and shape of the shell
The overall colour, transparency and pigmentation patterns were documented under natural light. The shape and inclination of the aperture were carefully described, as these features help to distinguish *P. columella* from closely related lymnaeid species[3].
-Photography and documentation
Specimens were photographed using a dissecting microscope equipped with a digital imaging system, and all micrographs include scale bars for size reference. The images were taken from different angles (dorsal and ventral) to capture diagnostic morphological features. Each photo included a millimetre scale to ensure accurate size calibration[17]. The final identification was made by comparing the recorded morphological data and photographs with published descriptions and identification keys in standard malacological works such as [2] and [18].
Morphological descriptions from studies documenting *P. columella* in different countries[19,20].

### 2.3. Data collection and analysis

All data related to shell measurements, colouration, whorl counts, and habitat characteristics were recorded in a standardized data sheet. Descriptive statistics, including mean, standard deviation, and range, were calculated for the shell measurements using Microsoft Excel 2021. In this way, a detailed morphological profile of the collected population was created, following similar approaches as used by [8] and [21].

## 3.Results

Thirty specimens of *Pseudosuccinea columella* were studied to develop a more in-depth morphological profile of this species, which is newly recorded for Iraq. Shell measurements and diagnostic features are recorded in **(Table 1)**. The variability in morphology of the shells was restricted; therefore, there was a high degree of similarity among the specimens within the population that was examined. The overall height of the shells measured 14-15 mm (14.50 ±0.05 mm) and the overall width measured 6-8 mm (7.00 ±0.11 mm), and these two measurements remained relatively consistent among all examined specimens (**Table 1**). The lengths and widths of the apertures were approximately 9 mm and 5 mm respectively; therefore, these two measurements remained constant throughout all specimens. Most specimens had three whorls that were convex in shape, which is a diagnostic characteristic of this species. The qualitative characteristics of the examined specimens were essentially identical as well. The shells were thin, fragile, translucent, and brown with a horny appearance. The shell surface had smooth growth lines with a flat suture. The apex of the shell was pointed and somewhat curved but was the key diagnostic feature of the species *P. columella*. The aperture shape of the shells was ovoid, with an acute upper edge and rounder lower edge (**Figures 1** and **2**). The consistent expression of both quantitative and qualitative characters supports the taxonomic identification of the specimens as *Pseudosuccinea columella*. The observed morphological stability further confirms the validity of this species as a new record for the Iraqi malacofauna.

**Table 1.** Morphological and descriptive statistics of *Pseudosuccinea columella*.

| Character | Description / Range | Mean ± SE |
|---|---|---|
| Shell height (mm) | 14–15 | 14.50 ± 0.05 |
| Shell width (mm) | 6–8 | 7.00 ± 0.11 |
| Aperture length (mm) | ≈ 9 | 9.00 ± 0.05 |
| Aperture width (mm) | ≈ 5 | 5.00 ± 0.04 |
| Number of whorls | 3 | 3.00 ± 0.00 |
| Shell colour | Horny brown | 100% of specimens |
| Shell thickness | Thin, fragile | 100% of specimens |
| Shell transparency | Translucent | 100% of specimens |
| Shell surface sculpture | Smooth growth lines | 100% of specimens |
| Suture shape | Flat | 100% of specimens |
| Shell apex | Pointed, slightly curved | 100% of specimens |
| Whorl shape | Convex | 100% of specimens |
| Aperture shape | Ovoid | 100% of specimens |
| Upper aperture margin | Sharp | 100% of specimens |
| Lower aperture margin | Rounded | 100% of specimens |
| Habitat | Garden freshwater environment | Recorded |


**Figure 1.** Ventral view of the *Pseudosuccinea columella* shell, illustrating the overall shell shape and the pointed apex. Scale bar = 2 mm.


**Figure 2.** Dorsal view of the *Pseudosuccinea columella* shell, showing the aperture morphology and outer lip. Scale bar = 2 mm.

## 4.Discussion

The current study is the first confirmed record of *P. columella* in Baghdad, Iraq, extending the known geographic distribution of this invasive snail species. The introduction pathway of *Pseudosuccinea columella* into Baghdad, Iraq, remains uncertain. However, based on known dispersal mechanisms of freshwater snails, potential pathways may include the ornamental plant trade, import of agricultural products, or passive dispersal by birds[22]. Understanding these pathways is critical for biosecurity and can inform future monitoring and management strategies to prevent further spread of this invasive species. The observed morphological characteristics are in good agreement with previous descriptions in global studies[23-26]. The fragile, translucent shell with three convex whorls and a pointed apex represents a typical morphological feature of this species.

The specimens collected in Baghdad had shell dimensions at the upper end of the known range for this species. The observed shell height (14–15 mm) is comparable to finds from South America and Europe, where shell heights ranged between 12 and 16 mm[4]. However, the shell width observed in this study (6–8 mm) was slightly larger than the maximum reported by [17]. These variations could be attributed to environmental factors such as water quality, nutrient availability, and temperature differences, which influence the growth and morphology of the shells[27].

The aperture dimensions were also slightly higher than those reported by [2]. These differences may reflect local adaptation to the specific environmental conditions in Baghdad, such as higher water temperatures or different vegetation, which could affect shell development.

The discovery of *P. columella* in Iraq has important ecological and epidemiological implications. This species is a known intermediate host of *Fasciola hepatica*, the causative agent of fascioliasis, a major zoonosis affecting both humans and livestock worldwide[28] [5]. Its presence indicates the potential risk of occurrence or spread of the disease in Baghdad, especially in agricultural areas where livestock are reared and water sources are shared.

The ability of *P. columella* to survive in different environments, including small standing water bodies and even artificial water reservoirs, facilitates its spread as an invasive species[29]. In this study, the specimens were collected in a home garden, suggesting that urban or peri-urban areas may also serve as reservoirs for this snail. This finding emphasizes the need to monitor domestic and agricultural water systems to prevent the establishment of stable snail populations.

Similar reports from other countries confirm these concerns. It was documented the first appearance of *P. columella* in Malawi and associated its introduction with an increased risk of fascioliasis transmission. Similarly, [30] reported widespread distribution in South Africa, where environmental factors such as pH and vegetation were strongly correlated with population density[7].

The measurements are consistent with previous findings by[4], who reported shell heights between 12–16 mm, although slight variations were noted.

However, [5] documented slightly smaller widths, ranging from 3.8 to 6.4 mm, suggesting possible geographical differences between populations.

The shell dimensions of *Pseudosuccinea columella* specimens from Baghdad were generally consistent with previously reported measurements from the region. In this study, the mean shell length ranged from 11.5 to 13.0 mm, and the mean shell width from 6.0 to 7.0 mm. These values are comparable to those reported by[31] in Egypt, who recorded shell lengths of 11.0–12.5 mm and widths of 5.8–6.5 mm, and by[8] in Cuba, with shell lengths of 12.0–13.2 mm and widths of 6.3–7.1 mm. Overall, the similarity in shell dimensions suggests a relatively stable morphological pattern of this species across different geographical locations in the Middle East.

The results also are slightly larger than those of [2], who observed an average aperture length of 6.3 mm and a width of 3.9 mm in African populations.

Although species identification in this study was based on morphological characteristics, we

acknowledge that molecular confirmation is essential in modern taxonomy. Future studies should include sequencing of *COI* or *ITS-2* genes to provide conclusive species assignment and support phylogeographic analyses of *Pseudosuccinea columella* in Iraq.

Iraqi veterinary and public health authorities should implement targeted surveillance and control measures. These include monitoring livestock farms, inspecting irrigation canals, and raising public awareness about invasive mollusc species. Such actions would help prevent potential disease transmission and support regional biosecurity.

## 5.Conclusion

This study documents the first record of *Pseudosuccinea columella* in Baghdad, Iraq. The species was identified on the basis of the most important morphological characteristics, and its occurrence in a new habitat was confirmed. It is important to note that the presence of the snail host in Baghdad does not automatically imply *Fasciola hepatica* transmission. Successful disease transmission also requires the presence of the parasite in local livestock or wildlife reservoirs. Recognizing this distinction ensures a more balanced and realistic assessment of the potential risk. Further studies are recommended to monitor its spread and assess its role in local disease dynamics.

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## Conflict of Interest

The authors declare that they have no conflicts of interest.

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