

ENDEMIC MICROSNAIL *SHEITANOK AMIDICUS* (CAENOGASTROPODA: HYDROBIIDAE) ADDITIONAL LOCATIONS, DISTRIBUTION, SHELL MORPHOLOGY, AND NEAR-THREATENED

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Abstract The endemic microsnail *Sheitanok amidicus* (Schütt & Şeşen, 1991) was investigated to update its distribution and to raise awareness of its near-threatened status. *S. amidicus* specimens from Tüllük village (Paratype) (Devegeçidi Bridge, Diyarbakır), Kozluk town (Batman), Savur town (Mardin) and Elmabahçe village (Mardin) were obtained from the Museum of Zoology, Dicle University, Diyarbakır, Türkiye. Kozluk, Savur and Elmabahçe locations were not specified in the previous studies of collectors Schütt and Şeşen. As a result of the surveys conducted at four springs in 2022, it was observed that the Tüllük spring was filled with construction debris, the Herbik spring (Elmabahçe) had dried up, and the level of water in Kozluk and Savur springs had significantly decreased. Some samples were collected from the Savur and Kozluk springs for comparison and confirmation. The species has an average shell size of 1.2–1.4mm wide and 0.8–1.0mm high and contains 3.5 or 4 highly convex whorls with moderately deep sutures that widen towards the aperture. Since *S. amidicus* lives in shallow springs, it quickly disappears when the source dries up. Notably, the species is in the IUCN Red List of threatened species as a near-threatened category. As a result, this current research could lead to conservation measures to protect the species from extinction. Furthermore, by reporting the colourful images and morphological features of this rare snail, which is the sole species in the genus, recording of the genus will be easier and more accurate.

Key words Endemic, Near-threatened, *Sheitanok amidicus*, SE Türkiye

INTRODUCTION

The presence of 204 Mollusca taxa (164 Gastropoda and 40 Bivalvia species) has been reported in Turkish freshwaters (Gurlek *et al.*, 2019), and caenogastropods are the most notable taxa among them. The number of neritimorph and caenogastropod species distributed in Turkish waters is 80 (Yıldırım & Bahad, 2006). These belong to the neritimorph genus *Theodoxus* (Montfort, 1810) and the caenogastropod genera *Viviparus* (Montfort, 1810), *Valvata* (O. F. Müller, 1773), *Hydrobia* (Hartmann, 1821), *Semisalsa* (Radoman, 1974), *Graecoanatolica* (Radoman, 1973), *Kirelia* (Radoman, 1977), *Belgrandiella* (A. J. Wagner, 1928), *Falsibelgrandiella* (Radoman, 1973), *Islamia* (Radoman, 1973), *Bythinella* (Moquin-Tandon, 1856), *Pseudamnicola* (Paulucci, 1878), *Orientalina* (Radoman, 1978), *Turkorintalia* (Radoman 1973), *Sadleriana* (Clessin 1890), *Horatia* (Bourguignat 1887), *Potamopyrgus* (Stimpson 1865), *Lithoglyphus* (C. Pfeiffer 1828), *Pyrgorientalia* (Radoman 1973), *Falsipyrgula* (Radoman, 1973), *Bithynia* (Leach, 1818), *Melanopsis* (A. Ferussac 1807), *Fagotia* (Bourguignat, 1884), *Melanoides* (Olivier 1804), *Sheitanok* (Schütt and Şeşen 1991) (Yıldırım, 1999).

Two main rivers in Türkiye, the Fırat and the Dicle are located in SE Anatolia, and there are hundreds of streams, creeks and springs that feed these rivers. In the region, the climate is dry and hot in summer and mild and rainy in winter. Due to a lack of precipitation, the forest area is scarce. In this way, these climatic and geographical characteristics have allowed the survival of different species endemic to the region. *Pseudamnicola bilgini* (Schütt & Şeşen, 1993), *P. intranodosa* (Schütt & Şeşen, 1993), *Belgrandiella edessana* (Schütt & Şeşen, 1993), *Orientalina caputlacus* (Schütt & Şeşen, 1993) and *Sheitanok amidicus* (Schütt & Şeşen, 1991) are endemic species to SE Anatolia (Schütt & Şeşen, 1991, 1993, 2006; Şeşen, 1992). Among them, *S. amidicus* has been reported in seven springs in the provinces of Diyarbakır, Mardin, Batman, Adıyaman and Şırnak (formerly known as Siirt) (Schütt & Şeşen, 1991, 2006). It lives in stenothermic springs with almost no vegetation and visual algae (Schütt & Şeşen, 1991, 2006). The species is on the international union for Conservation of Nature (IUCN) Red List of threatened species (near threatened category) (Kebapçı & Seddon, 2014).

To date, few studies on *S. amidicus* have been published, except for for a new species record for

Eastern Anatolia (in German) (Schütt & Şeşen, 1991) and additional populations of the genus by Schütt & Şeşen (2006). The current study aims to (1) publish its additional locations, (2) draw special attention to the species' near-threatened status and (3) report on the species' morphological characteristics.

MATERIAL AND METHODS

Samples

Specimens of *S. amidicus* were obtained from the Museum of Zoology, Faculty of Science, Dicle University, Diyarbakır, Türkiye. The samples are from four locations: (1) Tüllük village,

Devegeçidi Bridge, Diyarbakır (paratype DZM 201 in Türkiye) (coordinates: 38° 03' 54.6" N, 40° 03' 35.1" E), (2) Kozluk, Batman (DZM 212) (coordinate: 38° 12' 00.1" N, 41° 28' 56.1" E), (3) Savur, Mardin (DZM 220) (coordinates: 37° 32' 38.9" N, 40° 53' 03.0" E) and (4) Elmabahce village, Mardin (DZM 221) (coordinates: 37° 29' 21.5" N, 40° 40' 40.8" E) (Fig. 1). Field research in these four locations were conducted in 2022. Some species were collected from Savur and Kozluk springs for comparison and confirmation. Unfortunately, the Tüllük spring had been destroyed (Fig. 5c), and the Elmabahçe spring had dried up (Fig. 6), making it impossible to collect samples from these locations. The photos of the samples were



Figure 1 a Map of Türkiye b Locations of *Sheitanok amidicus*: 1 Tüllük village, Devegeçidi Bridge (Diyarbakır) 2 Kozluk town (Batman) 3 Savur town (Mardin) 4 Elmabahçe village (Mardin).

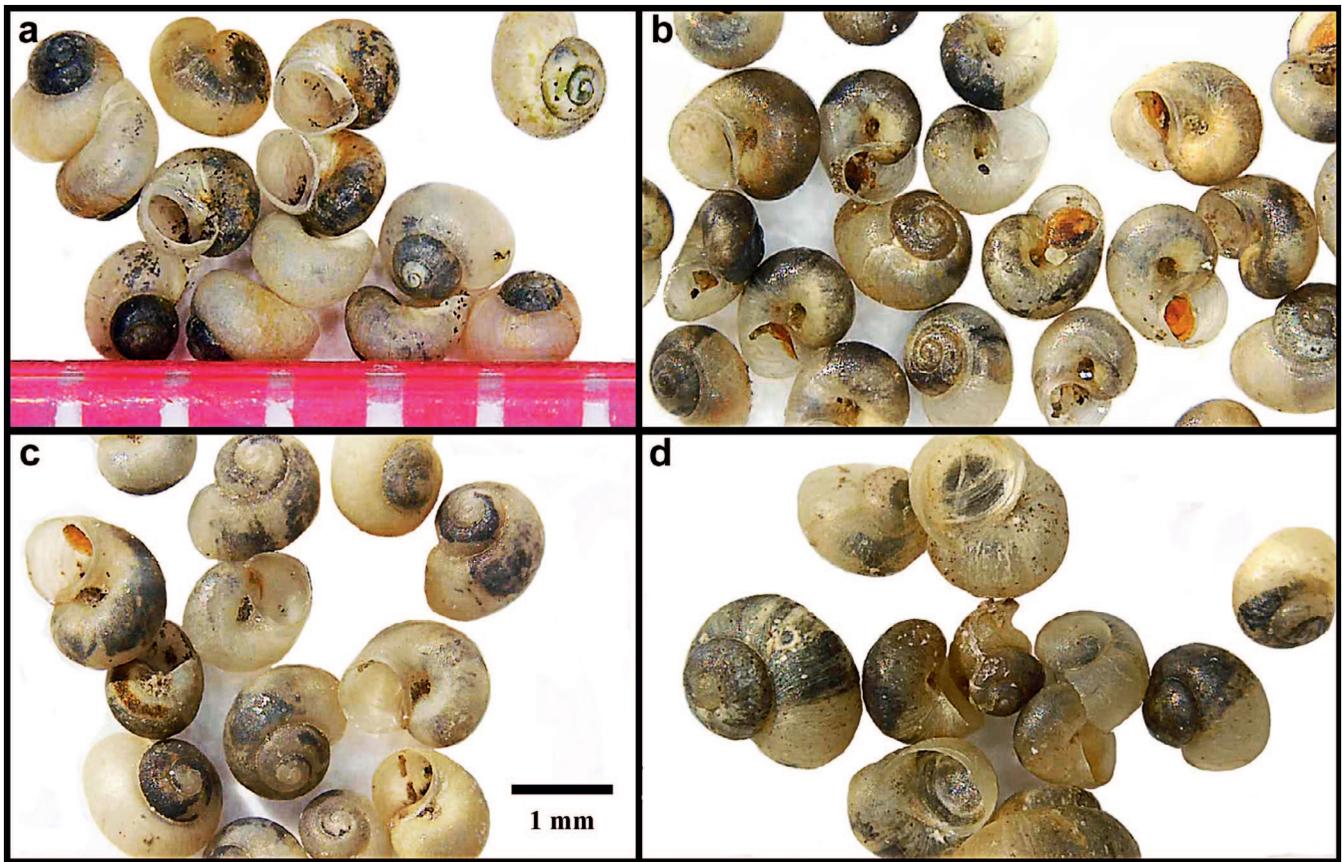


Figure 2 Museum samples of *Sheitanok amidicus*. **a** Specimens (Paratype DZM 201) from Tüllük village, Devegeçidi Bridge, Diyarbakır **b** Specimens from Kozluk, Batman (DZM 212) **c** Specimens from Savur, Mardin (DZM 220) **d** specimens from Elmabahce, Mardin (DZM 221). The distance between two vertical lines on the pink ruler is 1mm. The scale bar is 1mm.

taken with a high-resolution digital microscope camera (Jiusion wifi USB Digital Microscope 50 to 1000×) (Fig. 2, 3).

TAXONOMY

Subclass: Caenogastropoda Cox, 1960

Order: Littorinimorpha Golikov & Starobogatov, 1975

Superfamily: Truncatelloidea Gray, 1840

Family: Hydrobiidae W. Stimpson, 1865

Genus: *Sheitanok* Schütt & Şeşen, 1991

Sheitanok amidicus Schütt & Şeşen, 1991

Holotype SMF 309191 (Senckenberg Museum, Frankfurt, Germany) – not viewed.

Paratypes Paratype DZM 201 Dicle University, Diyarbakır, Türkiye was examined. Other paratypes are in the following collections: Senckenberg Museum, Frankfurt, Germany; The Natural History Museum Vienna, Austria;

Technical University of Darmstadt, University of Hesse, Germany; National Museum of Natural History in Leiden, Holland; Zoology Museum, Dicle University, Diyarbakır, Türkiye (Schütt & Şeşen, 1991). With the collection of Dr Schütt, Dr Giusti, Dr Rijkmsmus, Dr Boeters and Dr Şeşen.

Description The shell is very small, hemispherical, hard-shelled, yellow-brown, translucent and dextrally coiled. It contains 3.5 or 4 well-convex whorls with deep sutures that widen towards the aperture. Embryonal whorls are coarse. Teleoconch whorls with more or less close and coarse striation-like flat ribbing. The last whorl is predominant. The aperture is roundish oval. The peristome is sharp, excurved, and thickened at the columellar lip. The shell has a deep umbilicus. The apex part is rough, and the subsequent helices are very fine, dense and regularly ribbed and run evenly, but the last half of the last whorl is disproportionately wide so that in the body whorl part it is almost the same width

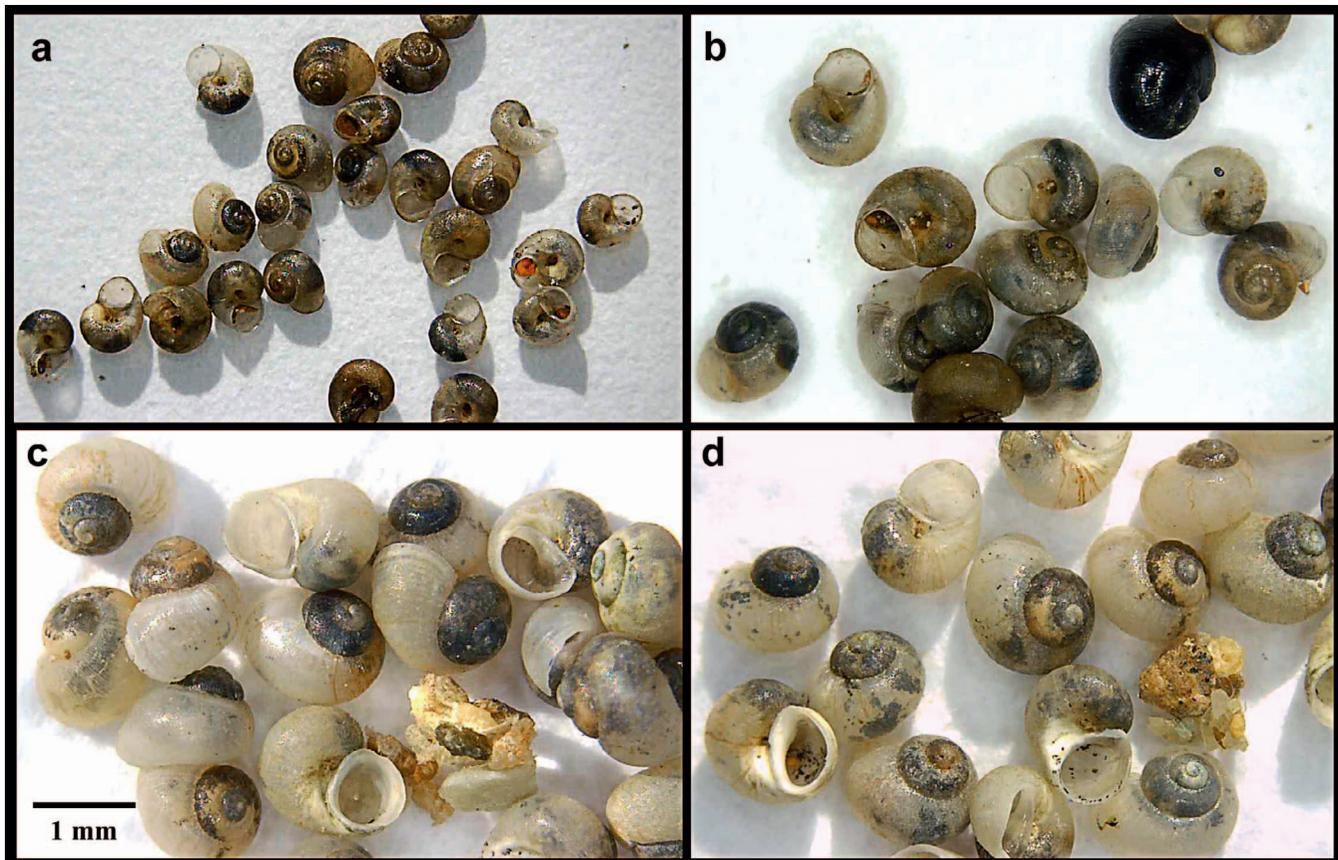


Figure 3 Collected samples of *Sheitanok amidicus*. **a, b** Samples from Kozluk town, Batman **c, d** Samples from Savur town, Mardin. The black species seen in the upper of **b** figure is *Theodoxus sp.*

as the rest of the shell. The last whorl descends somewhat towards the aperture, is a bit roof-like inclined, and the lip becomes to some degree angular towards the bottom of the aperture (Fig. 4). The studied shell (Paratype DZM 201 Dicle University, Diyarbakır) measurements: shell width (sw): 1.3mm; shell height (sh): 0.9mm, body whorl height (bwh): 0.7mm; aperture length (al): 0.6mm; aperture width: 0.5mm (Fig. 4). The operculum is oval, pointed toward the top part thin 2.5 whorls, reddish brown (nearly orange), somewhat convex, 0.4mm high, 0.3mm wide.

Distribution According to Schütt and Şeşen (2006), the species is distributed in seven springs in SE Türkiye listed as:

1. Tüllük village spring (locus types), 30 kilometres north of Diyarbakır, on the road to Elazığ (Fig. 1). The location was destroyed (Fig. 5).

2. The spring 8 kilometres after Cizre, behind a restaurant, Şırnak province.

3. The spring near the Kızılsu stream bridge on the road to Şırnak, 10 kilometres from Cizre, Şırnak province.

4. Şambayat town exit, Şambayat spring on the Adyaman to Gölbaşı road, 9 kilometres from west of Adyaman city.

5. Gribye village spring near Suruç stream in Suruç town, Mardin province.

6. Beşdeğirmen spring in Beşdeğirmen village (Emrud), near Kızıltepe, Mardin province.

7. Yayla (Schiheyla) spring in Sultanköy village, 15 kilometres north of Mardin city (Schütt & Şeşen, 2006).

The locations of the museum samples were not disclosed in Schütt and Şeşen studies.

New locations (Fig. 1):

1. Kozluk town centre near the Alıçlı Creek, in Batman province.

2. Savur town centre, Mardin province, near the Gercüş-Savur road, on the Savur stream.

3. Herbik Spring, Elmabahçe village, in the Mardin province, southwest of Mardin city.

Habitat The species lives in stenothermic springs which are also inhabited by *Theodoxus anatolicus* (Récluz, 1841) and with almost no

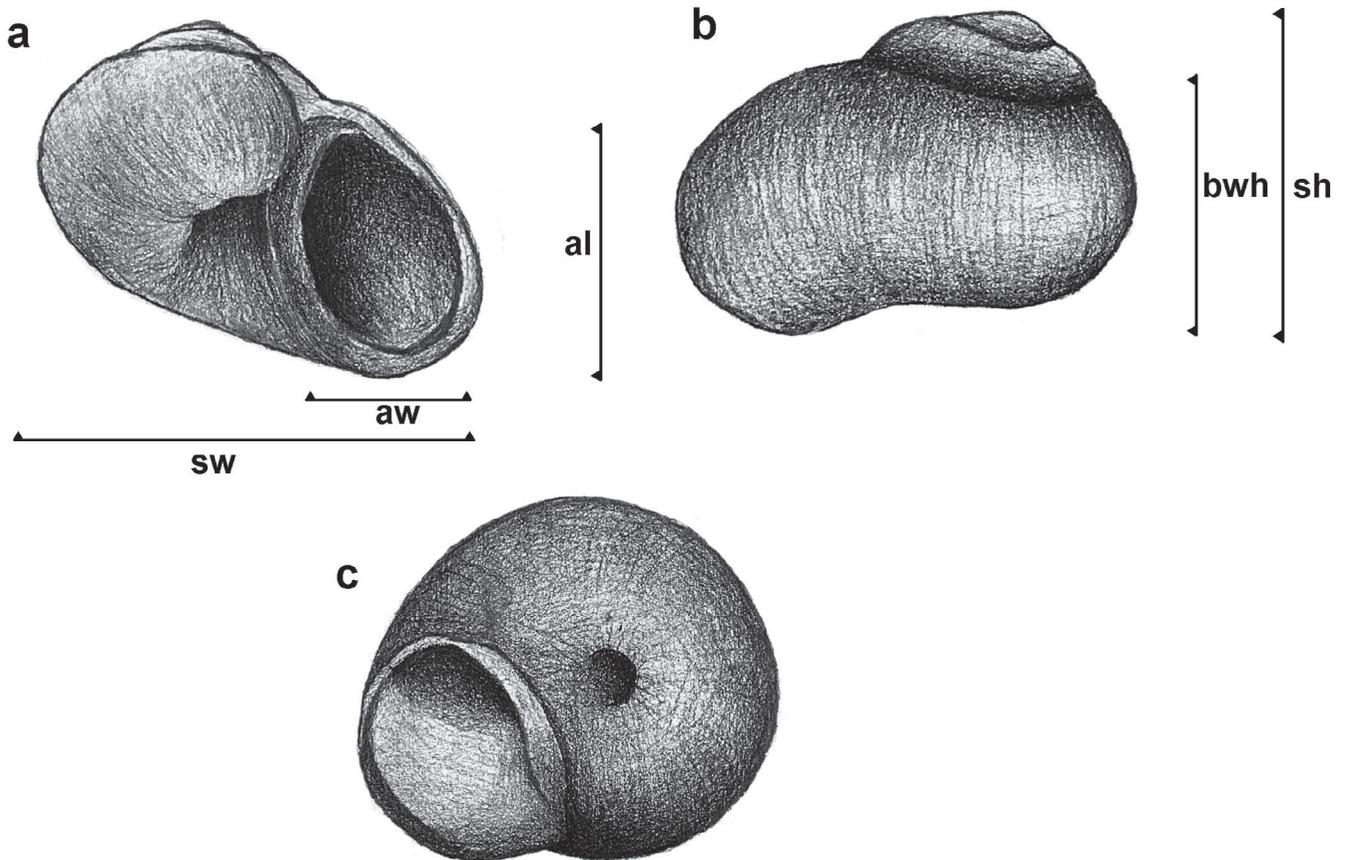


Figure 4 *Sheitanok amidicus*. Diagrams of morphological characteristics of the shell from different aspects. **al** aperture length, **aw** aperture width, **sw** shell width, **bwh** body whorl height, **sh** shell height.

visible vegetation or algae (Schütt & Şeşen, 1991, 2006). It mainly lives in clean spring outlets. Additionally, the species has never been seen with *Pseudamnicola* sp., which is predominant in the region, although they can be found in close proximity.

RESULTS AND DISCUSSION

S. amidicus is the sole species in the genus *Sheitanok*. Shell width and height, aperture length and width, and body whorl height have been studied in detail (Fig. 4). Morphological features of the samples such as operculum, aperture, body whorls, suture, apex, embryonal and teleoconch whorls, peristome, umbilicus and coarse were compared and no differences were observed among the museum specimens (Fig. 2). Furthermore, no differences in the characteristics of the species collected from Savur and Kozluk locations and museum specimens were observed (Figs 2 and 3).

Several factors influence a species' survival in a freshwater habitat, both individually and in

complex interactions. The most significant abiotic influences are temperature, sun radiation, pH, minerals, rainfall amounts, water clarity, and human activities. Human activities are the primary cause of species extinction. Surveys at the locations revealed that Tüllük spring, where the holotype *S. amidicus* once lived, was unfortunately clogged with construction materials (Fig. 5c). In recent years, it has been noticed that houses and facilities have begun to be built in the area. In 2005 (during the fieldwork of the author's doctoral thesis), *S. amidicus*, *Melanopsis* sp. (A. Ferussac 1807) and *Theodoxus* sp. were found at the Tüllük spring (Fig. 5b). *M. praemorsa* and *T. anatolicus* can be seen on the stones and in the water's littoral zone, as shown in Fig. 5b. Because *S. amidicus* is only about one millimetre in size, they are not visible in Fig. 5b. Fig. 6 depicts the most recent state of the Herbiik spring. The waterway through which the spring water flows is dry, as shown in Figs 6b and 6d. The photographs were taken on a rainy day; the presence of some water should not be taken as cause

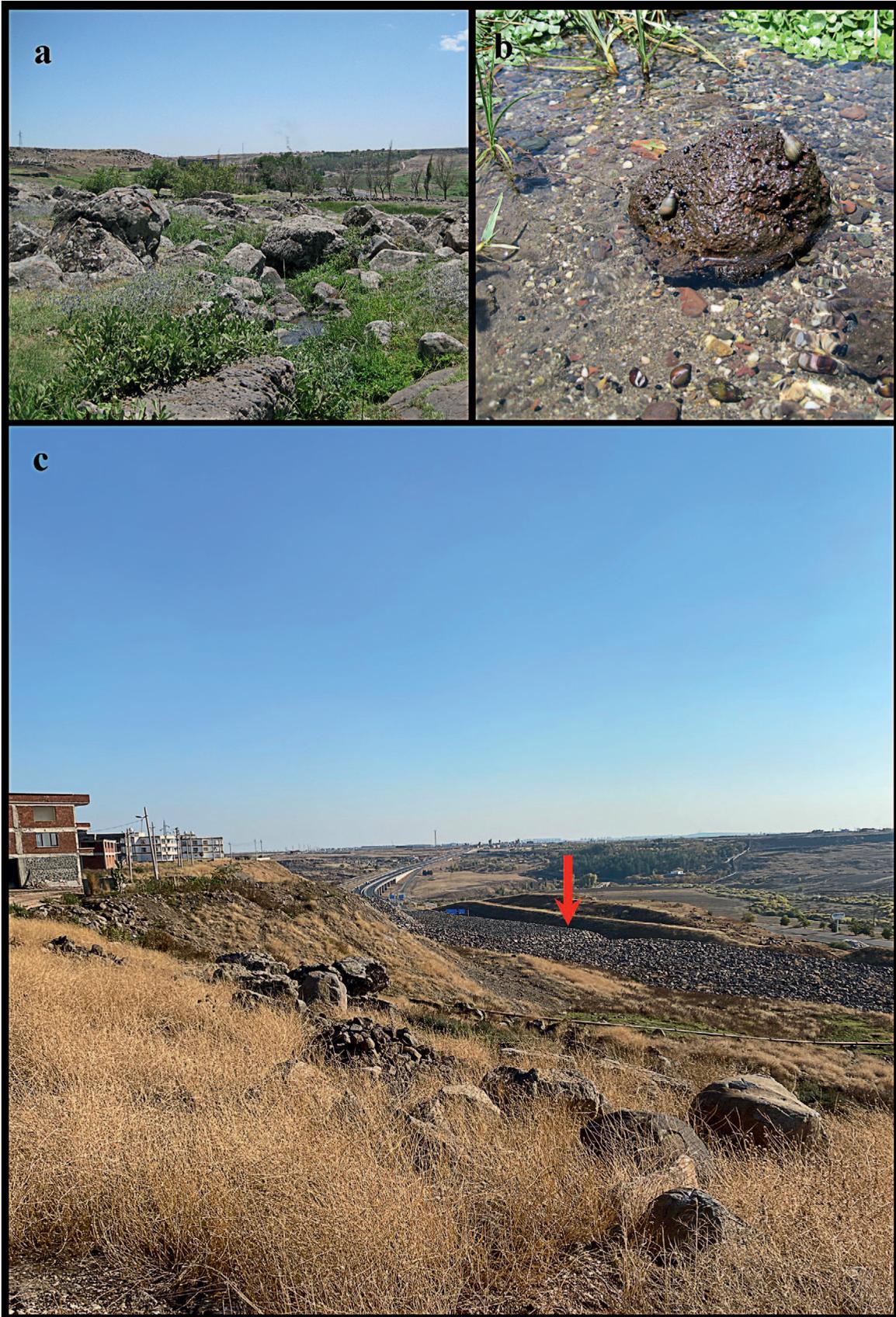


Figure 5 Tüllük spring, Devegeçidi Bridge, Diyarbakır. **a, b** Photographs were taken in 2005 during the author's doctoral fieldwork. **c** Photograph was taken in 2022. The area indicated by the red arrow appears to have been Tüllük spring and was filled with construction debris.



Figure 6 a Herbiik spring (Elmabahçe), b, d the dry waterway of the spring, c the spring is stagnant and covered with algae, and it is completely dry during the summer.

for concern, as the fountain is completely dry in the summer. The spring is also overgrown with vegetation and algae, and the water is stagnant. As previously stated, *S. amidicus* is known to be unable to survive in algal and stagnant springs. Several factors are most likely to blame for the drying out, and the decrease in the water level of Kozluk and Savur springs is probably associated with global warming and climate change.

S. amidicus was recently added to the IUCN Red List of Near Threatened Species in 2013 (Kebapçı & Seddon, 2014). Species may be very sensitive to more frequent droughts. Sudden aquifer losses are noted primarily in areas in the southern part for several species. In addition, most of the springs are used by the villagers as a water source for domestic use. However, the low population densities and lack of irrigation in these villages indicate a lower threat to the species due to water extraction. Because the species is mostly found in small springs in the arid climate zone, climate change may have an impact in the future (Kebapçı & Seddon, 2014).

As a result, by comparing the colourful images and morphological features of this rare species, it will be easier to identify and systematically categorize new records that may belong to this genus. On the other hand, there are no known conservation measures for the species. It is recommended that the other locations be monitored and conserved. If recommendations are not followed, the species could be threatened with extinction in the future.

Compliance with Ethical Standards The author declares no conflict of interest.

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