



NEW RECORDS CONFIRM THREE TERRESTRIAL AND ONE FRESHWATER SNAIL IN NORTHWESTERN AND WESTERN SAUDI ARABIA

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ABSTRACT: New records of snails in underexplored regions of the Kingdom of Saudi Arabia reveal new distributions of three terrestrial taxa and one species of freshwater snail. *Pupoides coenopictus* (Hutton, 1834) is reported for the first time in Tabuk Province. Live populations of *Arabivitrina jansseni* Neubert, 1998 and shells of *Levantina simensi* Neubert, 1998 are reported from Makkah Province. Two oases in Madinah Province were found to harbor the freshwater snail, *Melanoides tuberculata* (O. F. Müller, 1774). All snails and empty shells were imaged, and their geographic data recorded herein.

KEY WORDS: *Arabivitrina*; Gastropoda; *Levantina*; *Melanoides*; *Pupoides*

INTRODUCTION

Malacofaunal records are very limited for the Kingdom of Saudi Arabia (KSA). For the world's 12th largest country in area, with varying geology and arid to hyper-arid climatic conditions, reports about its terrestrial and freshwater molluscs remain scarce, patchy occurrences. MORDAN (1980) recorded 16 gastropods known from collections made in Saudi Arabia during the last two centuries. Later, NEUBERT (1998) further described and compiled all known records for the Arabian Peninsula, encompassing 70 species of terrestrial snails and 27 species of freshwater molluscs including their anatomy, zoogeographical context, conservation status and distributions.

Since these works, new records of malacofauna in Saudi Arabia have included only 5 terrestrial snails and 3 freshwater snails: *Monacha obstructa* (L. Pfeiffer, 1842), *Eobania vermiculata* (O. F. Müller, 1774), *Rumina decollata* (Linnaeus, 1758), *Pupoides coenopictus* (T. Hutton, 1834), and *Ceciloides acicula* (O. F. Müller, 1774) from Ha'il Province (AMR & AL-SHAMMARI 2013). *Bulinus beccarii* (Paladilhe, 1872)

was additionally documented in Ha'il Province (AMR & AL-SHAMMARI 2012) and *Melanoides tuberculata* (O. F. Müller, 1774) and *Melanopsis buccinoidea* (Olivier, 1801) in Tabuk Province (ALOUFI & AMR 2015). Of the 41 species of terrestrial and 16 freshwater molluscs so far recorded for the Kingdom of Saudi Arabia, only 1 terrestrial gastropod, *Xerocrassa seetzeni* (L. Pfeiffer, 1847) and the aforementioned two freshwater species are known from the northwestern region of KSA in Tabuk Province (MORDAN 1980, ALOUFI & AMR 2015). All other malacofaunal occurrences are known from reports documenting the Hejaz historical regions of Madinah, Makkah, and Al-Bahah Provinces as well as from the southwestern KSA Provinces of Azir and Jizan, the north central Province of Ha'il, the central Province of Riyadh and the Eastern Province (MORDAN 1980, NEUBERT 1995, 1998).

The aim of this present work is to document three new records of the terrestrial snails *Pupoides coenopictus*, *Arabivitrina jansseni*, and *Levantina symensi* in



malacologically underexplored regions of Tabuk and Makkah Provinces along with two new records of the global freshwater species, *Melanoides tuberculata*, in

oases in Madinah Province. Notes about their ecology are included.

MATERIAL AND METHODS

The presence of terrestrial and freshwater snails was studied during a week of exploratory hikes in KSA in March 2024. Different landscapes and oases in Tabuk, Makkah and Madinah Provinces were explored. Samples were collected by hand and images of the material in situ were taken with the iPhone 13 Pro Max camera. GPS coordinate data were recorded with the Apple iPhone App Coordinates and Altitude function. Distances referred in this work have been acquired via the Google Maps App. Species' collection localities and GPS coordinate data are presented in Table 1.

Close up images of the shells were taken using a Leica M205 C microscope with the Leica DFC425 camera and the Leica software to handle stacked images.

The map was constructed using QGIS 3.22 Białowieża Free Software (released Oct. 2021).

Names of localities in NEUBERT (1998) and those in Google Maps oftentimes vary in spelling. For ex-

ample, “al-Shafa, SW of Taif” is otherwise known as Ash-Shafa (Makkah Province). When there was a discrepancy in spelling, the towns and localities were cross-checked with Google Maps as well as in Wikipedia. The spellings presented in Google Maps are used in this report.

Material is deposited at the Natural History Museum Bern, Switzerland (NMBE).

Abbreviations of collections listed in this study: BM(NH) – The Natural History Museum, London, UK; IBA – private collection M. IBAÑEZ, La Laguna, Teneriffa, Spain; MHNG – Muséum d'Histoire Naturelle Genève, Switzerland; MNHNP – Muséum National d'Histoire Naturelle, Paris, France; NEUB – private collection E. NEUBERT; NMBE – Natural History Museum, Bern, Switzerland; NNM – Nationaal Natuurhistorisch Museum, Leiden, The Netherlands; SMF – Senckenberg Museum, Frankfurt, Germany; SNMNH – Saudi Arabian National Museum of Natural History, Riyadh, KSA.

Table 1. Locality data of snail occurrences in western Saudi Arabia (KSA), March 2024

Species	Locality	GPS coordinates	Collection cat. nr.
<i>Arabivitrina jansseni</i> Neubert, 1998	Kingdom of Saudi Arabia, Makkah Province, Taif City, Al-Hawaya village	21.1210°N, 40.2585°E, alt. 2,470 m	NMBE 0585604
	Kingdom of Saudi Arabia, Makkah Province, Taif City, Al-Hawaya village	21.1172°N, 40.2578°E, alt. 2,370 m	NMBE 0585601
	Kingdom of Saudi Arabia, Makkah Province, Taif City, Al-Hawaya village	21.1177°N, 40.2576°E, alt. 2,290 m	NMBE 0585600
<i>Levantina symensi</i> Neubert, 1998	Kingdom of Saudi Arabia, Makkah Province, Taif City, Al-Hawaya village	21.1232°N, 40.2600°E, alt. 2,434 m	NMBE 0585605
	Kingdom of Saudi Arabia, Makkah Province, Taif City, Al-Hawaya village	21.1172°N, 40.2578°E, alt. 2,350 m	NMBE 0585599
	Kingdom of Saudi Arabia, Makkah Province, Taif City, Al-Hawaya village	21.1177°N, 40.2576°E, alt. 2,290 m	NMBE 0585598
<i>Melanoides tuberculata</i> (O. F. Müller, 1774)	Kingdom of Saudi Arabia, Madinah Province, Khaybar	25.7434°N, 39.2536°E, alt. 730 m	NMBE 0585603
	Kingdom of Saudi Arabia, Madinah Province, Al-Ula	26.6326°N, 37.9137°E, alt. 692 m	image only
<i>Pupoides coenopictus</i> (Hutton, 1834)	Kingdom of Saudi Arabia, Tabuk Province, Bajdah	28.5685°N, 35.7593°E, alt. 1,089 m	NMBE 0585602

RESULTS

Family Helicidae

Levantina symensi Neubert, 1998

Figs 1–2, 13

Levantina (*Laevihelix*) – KORÁBEK et al. 2022: 161–172, figs 1–2.

Levantina (*Laevihelix*) *symensi* – NEUBERT 1998: 431–431, figs 193–195, 205–206, 211.

Type material. Holotype SMF 311271, paratypes SNMNH-MO 133/1 a and b (a – shell, b – preserved animal), SMF 311272/3 a and b (a – shell, b – preserved animal), SNMNH-MO 134/2 (and many frag-



ments), NEUB (1), Saudi Arabia, Asir mountain region, Jabal Dhaka SW of Taif, 2,340 m, *Juniperus* forest, 4.VI.1995, E. NEUBERT et al. (2015).

Material examined. Description (based on the collected specimens in this study (NMBE 0585598, NMBE 0585605): The shells (N = 6) are medium-sized (width = 24–28 mm)). The surface of the protoconch is finely marked with granules densely aligned in wavy rows, losing distinctness more or less after the first three whorls. One shell is larger and stronger than all the others and mostly faded. All the other shells are very thin and easily breakable.

The shells were found on gravelly granitic substrate under tufts of dry grass, granite stones and grass litter. Nearby vegetation included *Commelina* sp. (Commelinaceae).

Distribution. Asir mountain region and Taif County (Makkah Province). The shells from Al-Hawaya were found about 22 km north of the collection site of non-type material by NEUBERT (1998) at Ash-Shafa.

Family Vitrinidae

Arabivitrina jansseni Neubert, 1998

Figs 3, 5–8, 14

Arabivitrina jansseni – NEUBERT 1998: 385, figs 91–93, 388, figs 101–106, 393 pl. 2; PFARRER et al. 2021: 3, table 1.

Type material. Holotype SMF 311267, paratypes SNMNH-MO 81/67, SNMNH-MO 82/10 (preserved), SMF 311268/43, SMF 311613/10 a and b (a = preserved animals, b = shells), SMF 311614/5



Figs 1–3. *Levantina symensi* Neubert, 1998: 1 – NMBE 0585598, Taif, Al-Hawaya village, 2,290 m, diameter = 26.6 mm; 2 – NMBE 0585605, Taif, 2,434 m, diameter = 25.9 mm. *Arabivitrina jansseni* Neubert, 1998: 3 – NMBE 0585600, Taif, Al-Hawaya village, 2,290 m, diameter = 16.5 mm. Punctate microstructure visible on protoconch of empty juvenile shell

(preserved), NNM (5), BM(NH) 1996282 (5), IBA (3 shells, 2 preserved specimens), Saudi Arabia, Asir mountain region, King Khalid descent near Baha, 2,215 m.

Material examined. Description (based on the collected specimens in this study (NMBE 0585600, NMBE 0585601, NMBE 0585604)): the material consists of 7 empty shells, four teleoconch fragments, 2 empty juvenile shells and one preserved animal (adult). The well-preserved shells are medium sized with an opaque, greenish-horn coloured periostracum. In places where the periostracum is chipping off, the shell underneath is white. The protoconch is small with the onset of the nuclear whorl sunk in below the suture. The protoconch consists of one whorl with micro granulation (not punctations!) arranged in a spiral pattern. The first two whorls on some of the shells present a slight wavy pattern of widely spaced riblets or growth lines. The juvenile individuals have a smooth protoconch consisting of one whorl. Under high magnification, a dense pattern of spiral punctation is clearly visible (Fig. 3).

The fully extended live animal shows a nuanced, light beige colour with the anterior section of the foot tending into gray.

Live individuals and fresh empty shells of *A. jansseni* were found at an elevation of 2,370 m amidst a pile of granite rocks in vegetation of *Commelina* sp. (Commelinaceae), black nightshade (*Solanum nigrum* L. (Solanaceae)) and interspersed grasses on gravelly granitic substrate.

Additionally, two live juveniles were found underneath a broken branch covered by plants of

Chaerophyllum sp. (Apiaceae) and *Solanum nigrum* L. (Solanaceae) at 2,470 m (Fig. 14).

The fringe of periostracum along the apertural rim was dark brown and shiny.

NEUBERT (1998) found this species to be confined to humid habitats with malacophyllic herbs and shrubs and to a lesser degree in arid *Juniperus* forests.

Distribution. *A. jansseni* is known from the northern part of the Asir mountain region in southwestern KSA and from the southeast Taif County region of Makkah Province. The type locality, Baha (= Al Bahah) (Al-Bahah Province) is about 260 km southeast of Al Hawaya (Taif, Makkah Province). The closest occurrence of the species to this present report was recorded south of Bani Sa'ad (Makkah Province) (NEUBERT 1998), approximately 115 km beeline distance from Al Hawaya. These two reports and five others further south (NEUBERT 1998) indicate that the species shows a wider distribution in the mountain regions of Makkah and Al-Bahah Provinces for which Al Hawaya constitutes the westernmost viable extension of the species.

Family Pupillidae

Pupoides coenopictus (Hutton, 1834)

Figs 4, 15–16

Pupa coenopicta HUTTON 1834: 85, 93.

Pupoides coenopictus – PILSBRY 1921: 123, pl. 13 figs 1–3; SCHILEYKO 1984: 194, fig. 113; SEDDON 1992: 151, fig.; NEUBERT 1998: 364, figs 41–48, 53; VERDCOURT 2006: 16; ALI & HAUSDORF 2017: 2, fig. 3; IQBAL et al. 2023: 54, fig. 2.



Fig. 4. *Pupoides coenopictus* (Hutton, 1834). NMBE 0585602, Bajdah, 1,089 m, height = 4.5 mm



Type material. Syntypes *Buliminus fabianus*, SMF4740/8 ex coll. O. Boettger ex Gredler ex L. Pfeiffer; 6 syntypes *Bulimus mahariscus*, MHNG; 2 syntypes *Bulimus euphraticus*, MHNG; holotype *Bulimus marebiensis*, MHNG; holotype *Bulimus kursiensis*, MHNG; syntype *Bulimus ragnus*, MNHNP.

Material examined. Description (based only on the collected specimen (NMBE 0585602) in this study): Shell small (height = 4.5 mm) with 5 eroded whorls, brown. The teleoconch bears numerous growth lines on all whorls. The second specimen consisting of a broken base of *P. coenopictus* clearly shows the oval apertural form and the characteristic blunt angularis in the uppermost parietal position.

Remarks. *Pupoides coenopictus* is the only species of the genus known in the Kingdom of Saudi Arabia. It was first reported in KSA about 22 miles south of Hail (Hail Province) (MORDAN 1980), which corresponds roughly to a beeline distance of 510 km from Bajdah (Table 1). It is also known from the Eastern Province (NEUBERT 1998). The species has been described under several names. For a detailed account

of the synonymies, see PILSBRY (1921), SEDDON (1992) and NEUBERT (1998).

The singular shell and a broken base containing the aperture of a second shell were found on moist sandy substrate in a shaded wadi under a bush of *Retama raetam* (Forssk.) Webb et Berthel (Fabaceae) and plants of black nightshade (*Solanum nigrum* L., Solanaceae). The wadi was located in a deep chasm (Figs 15–16) penetrating narrow walls of late Cambrian and Ordovician sandstone formations (ALOUFI & EID 2019).

Distribution. *P. coenopictus* inhabits arid regions spanning a broad geographical range from the Cape Verde Islands through northern and eastern Africa, the Middle East, Afghanistan, Tajikistan, Pakistan, India and Sri Lanka (PILSBRY 1921, SEDDON 1992, NEUBERT et al. 2015, ALI & HAUSDORF 2017, IQBAL et al. 2023). On the Arabian Peninsula, it is considered common in Yemen and Oman (NEUBERT 1998). The present report in Bajdah constitutes the first record in Tabuk Province and the third known occurrence for KSA.



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Figs 5–8. *Arabivitrina jansseni* in its granitic habitat: 5–7 – live juvenile snails amidst vegetation at Taif, Al-Hawaya village, 2,470 m; 8 – adult shell



Family Thiariidae

Melanoides tuberculata (O. F. Müller, 1774)

Figs 9–12

Nerita tuberculata O. F. MÜLLER 1774: 191.

Melanoides tuberculata – NEUBERT 1998: 446, table 2;

ALOUFI & AMR 2015: 244–245, fig. 2A.

Material examined. Description (based on the two collected specimens from Khaybar): the two shells are rather small for this species (12.5–13.0 mm). They bear 8–10 whorls and show two morphological forms as well as degrees of shell degradation. Both forms fall within the wide spectrum of variability known for this species in the Middle East (YOUSIF et al. 2009, AMR et al. 2014).

The darker specimen shows axial ribs on the upper whorls of the spire and a thickened, elliptically formed aperture with a smoothly rounded base. The surface sculpture of the first 2–6 whorls is reticulate. The protoconch is broken. Teleoconch sculpture consists of numerous parallel rows of spiral ridges and grooves, which fade out from the parietal tip of the

aperture (frontal view) towards the base of the shell. Prominent, maroon-coloured patches are present on the last three whorls as well as visible through the inner apertural wall.

The second specimen is cream coloured, bears some axial ribs on the upper 4 whorls of the spire and has an elliptical aperture with a thin, sharp lip and a pointed tip at its base. The protoconch is fully formed. Whorls 3–6 show a reticulate structural pattern. Teleoconch sculpture consists of numerous parallel rows of spiral ridges and grooves on each whorl which are interspersed with dark brown colour patches. The regularly spaced spiral ridges continue to the base of the shell. The pattern of brown coloured patches is barely visible through the inner apertural wall.

The two occurrences of *M. tuberculata* were both in irrigation canals in Madinah Province (see Table 1). The first siting was in an eco-gardening farm in Al-Ula and the second in an oasis in Khaybar. Though no specimens were collected in Al-Ula, photographs of a large population of *M. tuberculata* were made there. Two specimens were collected at the Khaybar oasis.



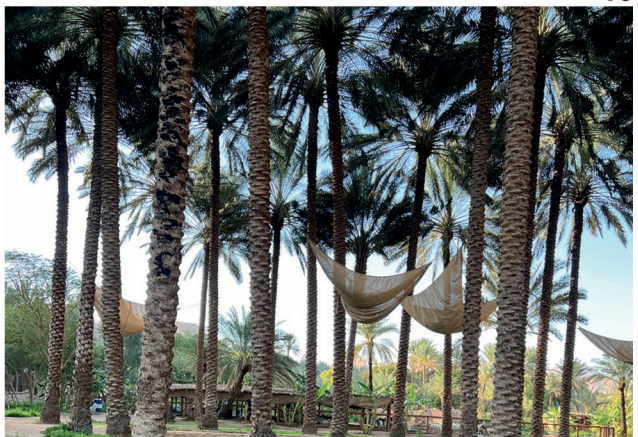
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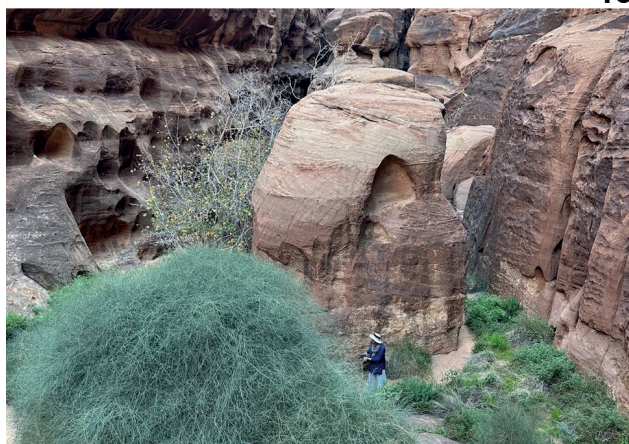
Figs 9–12. *Melanoides tuberculata* (O. F. Müller 1774) in two oasis habitats: 9 – Khaybar oasis and date plantation; 10 – live population in irrigation canal of date plantation, Al-Ula, 692 m; 11 – shells NMBE 0585603, Khaybar, 730 m; 12 – date plantation at Eco-gardening Farm, Al-Ula



13



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Figs 13–16. Snail habitats and vegetation growth during March 2024: 13 – granite terrain 2,424 m, Taif, Al-Hawaya village area; 14 – undercover, Taif, Al-Hawaya village, 2,470 m; 15 – chasm between sandstone formations with AJ at Bajdah, Tabuk Province, 1,202 m; 16 – late Cambrian and Ordovician sandstone formations, Bajdah, Tabuk Province, 1,178 m

Melanoides tuberculata is a widely known invasive species inhabiting tropical and subtropical freshwater bodies. It lives at the bottom of standing or moderately moving warm water habitats and is known throughout its range as a major intermediate host of digenean trematodes. The species is considered common in the Palestinian Territories (West Bank) especially the Dead Sea basin and Jericho district, bordering the Jordan River Valley (HANDAL et al. 2023). Its presence in the oases of Al-Ula and Khaybar was most probably facilitated via transport by birds (ROLL 2008, SCHUSTER et al. 2014). As a partheno-

genic species, a single individual is sufficient enough to produce several thousands of offspring (NEUBERT 1998).

Distribution. Worldwide throughout much of Africa, SE Asia and Australia as well as in the southern USA, Caribbean and South America.

In KSA, it is known from Tabuk Province (ALOUFI & AMR 2015). NEUBERT et al. (2015) considered *M. tuberculata* a common species throughout the Arabian Peninsula, warranting the status of Least Concern (LC) in the IUCN Red List of Categories and Criteria (IUCN 2024).

DISCUSSION

The malacofauna of the Kingdom of Saudi Arabia remains critically underexplored (NEUBERT 1998). Considering that the snails in this study were found during a few excursions and hikes and those in NEUBERT (1998) during a week in the field, the known malacodiversity constitutes only a small fraction of the potentially rich biodiversity in the habitat conducive regions of KSA.

Compared to the data reported by NEUBERT (1998) for freshwater molluscs in KSA, this small investigation reveals that four different species of freshwater molluscs have so far been found in the Khaybar (= Khaibar) oasis at different times. For example, BROWN & WRIGHT (1980) reported the species *Pseudobithynia badiella* (Küster, 1853) from there, while NEUBERT (1998) reported finds of

Biomphalaria arabica (Melville et Ponsonby, 1896) and *Physella acuta* (Draparnaud, 1805) housed in the SMF collection, dating from 1990 from the Khaybar oasis. Since these previous reports, none of these species were spotted alive nor were any of their shells found at Khaybar in March 2024. Although it is probable that they may still be there and that AJ just did not find any at the time, their absence to this degree is nonetheless worth mentioning. Moreover, the presence of vast, thriving populations of *M. tuberculata* at Khaybar oasis in March 2024 suggests a few things. It not only provides the first evidence of the species there but that it likely represents a relatively recent colonisation event. We remark that numerous, decrepit empty shells (devoid of soft tissue) of only the small to medium size classes were found along the banks of the irrigation canals while live individuals crawling about in the canals showed similar, small to medium sized individuals. Though this population could genetically present a smaller shell size, it is possible that the empty shells amassed along some of the banks indicate rather, a major mortality event affecting an earlier generation of the small to medium size classes such that no snails survived to reach their maximum adult size or, that they perhaps became too numerous and were dredged out of the canals before reaching full size. No large individu-

als were found alive nor any shells that could compare with specimens reaching up to nearly 50 mm in length as has been reported for both Jordan (AMR et al. 2014) and Tabuk Province (ALOUFI & AMR 2015).

Khaybar oasis is a cultural landscape that has been occupied and farmed for thousands of years (CHARLOUX et al. 2024). It is historically a major centre for date plantations. The apparent lack of the few freshwater species reported at Khaybar oasis four and three decades ago (and of any other potential freshwater molluscs excepting *M. tuberculata* at Al-Ula) is most probably due to reduced habitat suitability caused by agricultural fertilizers such that water chemistry has changed, resulting in the algal blooms and the respective algal mass decomposition observed there by AJ in March 2024.

As for the live vitrinids found in Makkah Province, ecological conditions were favourable, and spring-time vegetation was abundant. Moreover, it is known that water vapor condenses in granitic outcrops and increases the humidity in the soil between cracks in granite rocks. These moist conditions enable plant growth which would otherwise not stand a chance in the abutting arid soil (SHAKDOFA et al. 2024). The live populations of *Arabivitrina jansseni* were found amidst ample plant cover growing around granite rocks above 2,290 m altitude. For an arid land not

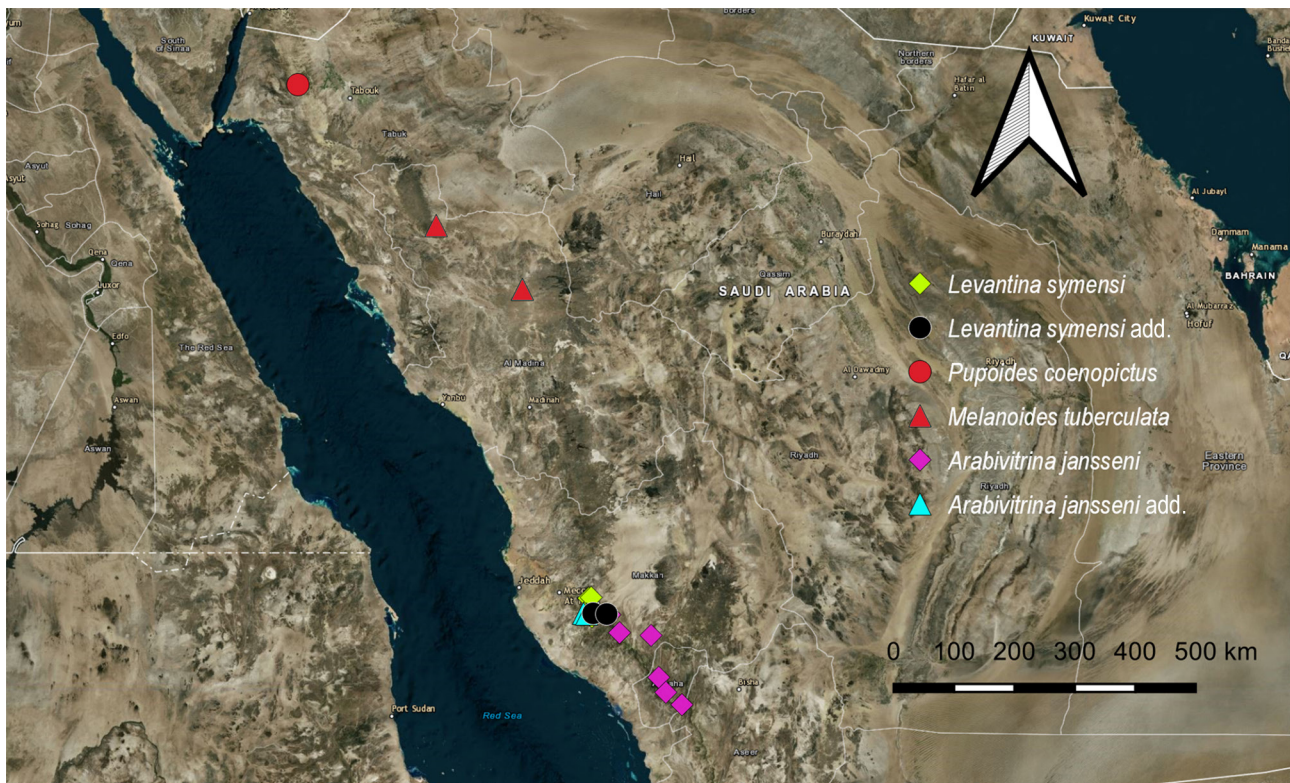


Fig. 17. Map of the western part of the Kingdom of Saudi Arabia (KSA) with coloured shapes designating both new (add.) occurrence records from this study and known records from the literature: green diamond – known records of *Levantina symensi*; black circle – new records of *Levantina symensi*; red circle – first record of *Pupoides coenopictus* in Tabuk Province; red triangle – first records of *Melanoides tuberculata* in Madinah Province; pink diamond – known records of *Arabivitrina jansseni*; turquoise triangle – new records of *Arabivitrina jansseni*



well known for its malacofauna, the presence of three viable populations of *Arabivitrina* within just 180 m in elevation (see Table 1) underscores the uniquely favourable ecological conditions conducive to longer term vitrinid habitation in the granitic environment of northern Taif, Makkah Province.

The natural property at Al-Hawaya harbouring the majority of snails encountered in this study (above 2,290 m), comprised sclerophyllous woodland such as *Juniperus* and *Acacia* trees, *Lavendula dentata* and vegetation floristically resembling spring season Afromontane groups (Figs 13–14). Edaphically, the region is granitic, which constitutes about 55% of the western margin of the Saudi Arabian Hejaz plateau, encompassing the 170 km² of the Taif area (NASSEEF & GASS 1977). The Taif highlands region is characterised by rugged topography containing a variety of habitats, particular soil textures, water resources, microclimate and elevation conducive to habitation by these species.

The herein reported records of the terrestrial species *Pupoides coenopictus*, *Arabivitrina jansseni*, *Levantina symensi* and of the freshwater species, *Melanoides tuberculata*, provide new geographical and ecological data for the Kingdom of Saudi Arabia (Fig. 17). It is our intention that these records not only enhance

the larger malacofaunal dataset presented in recent inventories for the Middle East (NEUBERT 1998, HELLER 2009, BÖSSNECK 2011, NEUBERT et al. 2015, ALI & HAUSDORF 2017) but that they encourage new exploration in underexplored areas and the further study of molluscs in Saudi Arabia. We emphasise the significance of developing effective management strategies aimed at comprehensively documenting species diversity in uncharted regions in KSA (ALATAWI 2022).

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