

First Record of the Scorpion *Vachoniolus globimanus* (Scorpiones: Buthidae) from Jordan

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Abstract

Four species of the genus *Vachoniolus* have been described from Iran, Oman, Saudi Arabia and the United Arab Emirates. The scorpion *Vachoniolus globimanus* Levy, Amitai and Shulov, 1973 is recorded from Jordan for the first time. Specimens of this species have been collected from Wadi Rum, southern Jordan. Morphological analysis, morphometric values, and taxonomic features were used to identify the collected specimens. This record extends the known distribution range of the genus *Vachoniolus* from central, western and southern Arabian Peninsula and Iran to the northwest in southern Jordan. The aim of the present study is to identify and describe the newly collected scorpion species from Wadi Rum desert in Jordan with additional ecological notes on their habitat.

Keywords: *Vachoniolus globimanus*, WadiRum, scorpions, Jordan.

1. Introduction

Despite recent extensive fieldwork and description of five new species from Jordan in the past two years (Lourenço *et al.*, 2021a & b; Al-Saraireh *et al.*, 2021; Abu Afifeh *et al.*, 2022; Al-Saraireh *et al.*, 2023), the fauna of the scorpion in Jordan is still to be explored, particularly in southern and eastern deserts with different and varied habitats including sand and rock-covered deserts.

In Jordan, family Buthidae includes nine genera (*Androctonus* Ehrenberg, 1828, *Birulatus* Vachon, 1974, *Buthacus* Birula, 1908, *Buthus* Leach, 1815, *Compsobuthus* Vachon, 1949, *Hottentotta* Birula, 1908, *Leiurus* Ehrenberg, 1828, *Orthochirus* Karsch, 1891, and *Trypanothacus* Lowe, Kovařík, Stockmann and Šťáhlavský, 2019 (Amr *et al.*, 1988; Amr and Al-Oran 1994; Lourenço *et al.*, 2002 and 2010).

The southern and eastern deserts such as Wadi Rum and parts of Wadi Araba are suitable habitats for sand dwelling scorpions. These scorpions are stenotopic and adapted to live in sandy desert environments (Fet *et al.*, 1998; Prendini, 2001). Several scorpion genera are considered psammophilous (e.g. *Apistobuthus*, *Buthacus*, *Buthiscus*, *Trypanothacus* and *Vachoniolus*) and known to occur in the deserts of North Africa and Middle East (Levy *et al.*, 1973; Lowe *et al.*, 2019).

The genus *Vachoniolus* was originally created by Levy *et al.* (1973) based on a single male specimen found in the collection of British Museum, collected from Oman in 1950. It was closely related to genus *Buthacus* by having reduced carapacial and mesosomal carination in addition to the presence of bristle combs, but the new genus is

mainly characterized by grossly swollen pedipalp chela, and the absence of tibial spurs. *Vachoniolus globimanus* Levy, Amitai and Shulov, 1973, was described as the type species for this genus. Until now, four species of the genus *Vachoniolus* have been described from the Middle East; *Vachoniolus iranensis* Navidpour, Kovařík, Sologlad and Fet, 2008 from Iran, *Vachoniolus batinahensis* Lowe, 2010, *Vachoniolus gallagheri* Lowe, 2010 and *Vachoniolus globimanus* from Oman. *Vachoniolus globimanus* has a wide range of distribution and was recorded from Oman, Saudi Arabia and the United Arab Emirates (El-Hennawy, 1992; Lowe, 2010; Alqahtani and Badry, 2021). So far, this genus has not yet been recorded from Jordan.

Vachon (1974) reported that the trichobothrial pattern of *V. globimanus* (male type, swollen chela) was similar in neobothriotaxy to that of *Buthacus minipectinibus* (female type, non-swollen chela), and suggested that these two taxa might belong to the same genus. However, he delayed a formal taxonomic action until a later study. Later, Vachon (1979) transferred *B. minipectinibus* to *Vachoniolus* and reported on sexual dimorphism. Hendrixson (2006) studied additional specimens of *Vachoniolus* from Saudi Arabia and United Arab Emirates and placed *V. minipectenibus* as a synonymy to *V. globimanus*.

Here, to the best of our knowledge, this is the first record of *V. globimanus* in Jordan with accurate and integrated information about its distribution across the desert environment.

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2. Material and methods

2.1. Systematics

Vachoniolus globimanus Levy, Amitai et Shulov, 1973
Vachoniolus globimanus Levy, Amitai and Shulov, 1973: 113–140, figs. 42–48; Vachon 1974: 910, 948, fig. 49; Vachon, 1979: 42–44, figs. 18–25, 28, 31, 34–36; Vachon and Kinzelbach, 1987: 100; El-Hennawy, 1992: 102, 133; Tigar and Osborne, 1997: 552, tab. 2; Tigar and Osborne, 1999: 174, 180, tab.2; Fet and Lowe, 2000: 278; Fet, Soleglad and Lowe, 2005: 13; Hendrixson, 2006: 36, 100–102, figs. 23–24, pl. 18; Kaltsas, Stathi and Mylonas, 2008: 525; Navidpour et al., 2008: 24–26; Lourenço and Duhem, 2009: 47, fig. 29; Lowe, 2010: 17–23, 37, figs. 57–83, 94–96, 104–111, 137–141, 146–148, tab. 1; Alqahtani and Badry, 2021: 8, 12, figs. 3, 7, tab. 1; Aloufi et al., 2022: 16–17, figs. 3. = *Buthacus minipectenibus* Levy, Amitai and Shulov, 1973: 128–130, figs. 27–31. *Vachoniolus minipectinibus* (incorrect subsequent spelling): Vachon, 1974: 948; Vachon, 1979: 49, figs. 12–17, 27, 30, 33, 36. *Vachoniolus minipectenibus*: Kinzelbach, 1985: III; Vachon and Kinzelbach, 1987: 101; El-Hennawy, 1992: 102, 133; Tigar and Osborne, 1997: 552, tab. 2; Acosta and Fet 2005: 5–6; Fet, Soleglad and Lowe, 2005: 13. *Buthacus minipectenibus* (incorrect subsequent spelling): Vachon and Kinzelbach, 1987: 100. *Vachoniolus minipectinatus* (unjustified emendation): Fet and Lowe, 2000: 278; Hendrixson, 2006: 99–100.

2.2. Collection sites and diagnosis:

The specimens were collected at night around 21:00 hr in 15 July 2022. Scorpions were collected by ultraviolet (UV) detection and preserved in the field by standard methods (Williams, 1968; Stahnke, 1972; Sissom, Polis and Watt, 1990). Specimens were transferred to Biology Department, Jordan University. Specimens of *V. globimanus* collected from Saudi Arabia were used as comparative materials.

Illustrations and measurements were made with the aid of stereoscopic microscope with a camera and an ocular micrometer (efix). Measurements follow Stahnke (1970) and are given in mm, with the following exceptions: carinal terminology is after Francke (1977). Trichobothrial notations follow Vachon (1974 and 1975) and morphological terminology mostly follows Vachon (1952) and Hjelle (1990).

Examined material: 2 adults ♂♂, 1 adult ♀, Wadi Rum, 13 km SE Al Ghal (29° 26' 00.1" N, 35° 40' 56.8" E), 890 m asl., 15.VII.2022, leg. B. Abu Afifeh and R. Abu Afifeh.

Comparative material of *V. globimanus* from Saudi Arabia: Adult ♂, Al Qarnaen, Uruq Bani M'arid Protected Area (19° 07' 58.45"N, 45° 08' 27.06"E), 5.V.2019, leg. A. Aloufi. 1 adult ♀, Al Makhrameah, Al Wabari Farm, Tabuk Province (28° 53' 43.08"N, 36° 07' 28.94"E), 23.VII.2017, leg. A. Aloufi.

All materials were deposited in the collections of the University of Jordan, Amman, Jordan.

3. Results

3.1. Taxonomy and systematics

Family Buthidae C. L. Koch, 1837

Genus *Vachoniolus* Levy, Amitai and Shulov, 1973

Vachoniolus globimanus Levy, Amitai and Shulov, 1973, Figs.1-4, Tab. 1

3.2. Characteristics of *V. globimanus*

Medium to large buthid scorpion 45–65 mm; base color yellow to orange-yellow with or without melanic pigmentation on metasoma IV–V and telson; Carapace smooth to shagreened, without distinct carinae; tergites smooth to finely granular, weak median carina on tergites I–VI, 5 carinae on tergite VII; pedipalp chela of males distinctly swollen; aculeus long; external surface of pedipalp patella with eight or nine trichobothria; pedipalp femoral trichobothrium d_5 distal to e_2 , femur and patella shorter than carapace; metasomal segments relatively slender; pectine teeth for females 10–18, for males 16–25; legs with or without tibial spurs (Hendrixson, 2006; Lowe, 2010).

3.3. Description of *Vachoniolus globimanus* collected from Wadi Rum

Large size buthid scorpions, male 64 mm, and female 52 mm in total length.

Coloration: male has uniform pale-yellow body with faint fuscosity on tergites and marked melanic pigmentation on telson and metasoma V. Female's segment V with light grey pigmentation (Fig. 1 A & B, Fig. 2 & 3).

Prosoma: carapace smooth devoid of carinae; surface of carapace shagreened with minute granules anteriorly; anterior margin of carapace slightly convex, median eyes relatively large and located on the anterior one-half of carapace, four pairs of small size lateral eyes.

Mesosoma: Tergites smooth to shagreened, Tergite I smooth, lacking carinae; Tergites II–VI with single median obsolete carina, tergite VII with weak median protuberance and two pairs of weak lateral carinae, Sternites III–VI smooth; sternite VII with obsolete to smooth two pairs of median and lateral carinae. Pectinal tooth counts 17–21 in males, 14–14 in the female; males pectines long, extending beyond middle of trochanter of leg IV, female pectines short, not reaching beyond coxa of leg IV, pectines with fulcra.

Metasoma: All segments longer than wide, becoming more narrow and slender posteriorly; L/W ratios: I=1.40–1.42, II=1.73–1.74, III=1.86–1.87, IV=2.24–2.35, V=2.75–2.91, (Table 1), 10 complete carinae on segment 1, 8 complete carinae on segments II and III, 4 carinae on segment IV, segment V with 3 carinae. **Telson:** Vesicle slim, narrower than metasomal segment V, long aculeus, without subaculear tubercule.

Legs: tibial spurs present on legs III–IV; vestigial and reduced on III; moderate on IV, retrolateral and prolateral pedal spurs present on all legs; tibiae I–III with retrosuperior bristle combs; basitarsi I–III with bristle combs.

Pedipalps: Manus of male swollen; slender in female; the ratios between manus width of male to manus width of

female is 2.29; the ratios between manus depth of male to manus depth of female is 2.47. Smooth manus and movable finger; fixed and movable fingers with 6-9 rows of denticles. Trichobothrial pattern: neobothriotaxic (Fig. 4), type A-beta (Vachon, 1974 and 1975), with supernumerary *esb*₃ on external surface of patella (Fig. 4D and J); femoral trichobothrium *d*₅ located distally relative to trichobothrium *e*₂ on the external surface of femur (Fig. 4B and I), *d*₂ of dorsal surface of both femur and patella, chela external *Eb*₃, *Est* and *esb* petite.

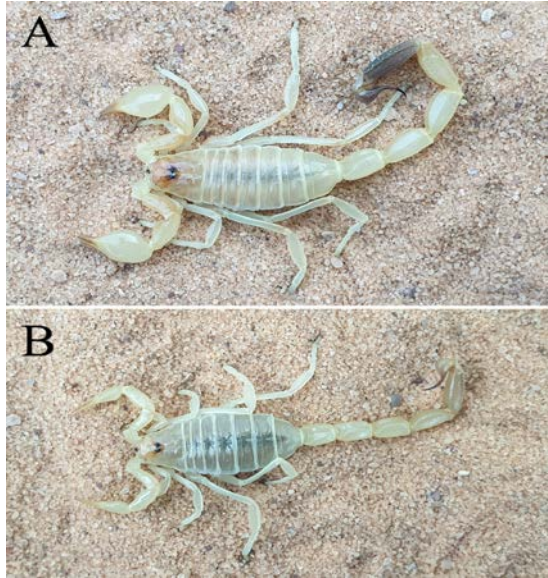


Figure 1: Habitus of *Vachoniolus globimanus* from Wadi Rum. A. Adult male. B. Adult female.

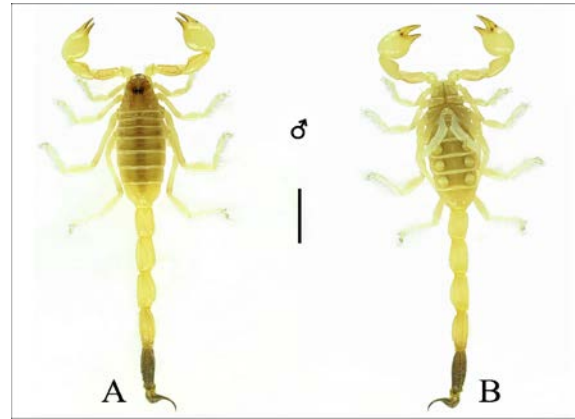


Figure 2: Male *Vachoniolus globimanus* from Wadi Rum. A. Dorsal aspect. B. ventral aspect. Scale bar = 10 mm.

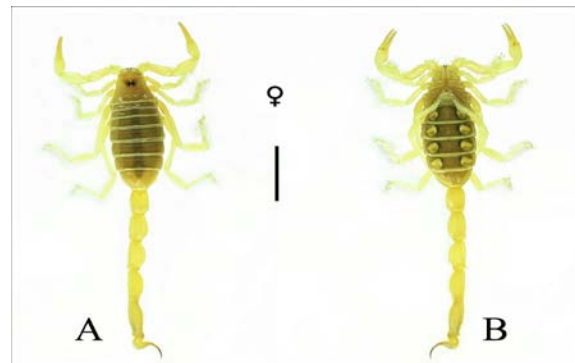


Figure 3: Female *Vachoniolus globimanus* from Wadi Rum. A. Dorsal aspect. B. ventral aspect. Scale bar = 10 mm.

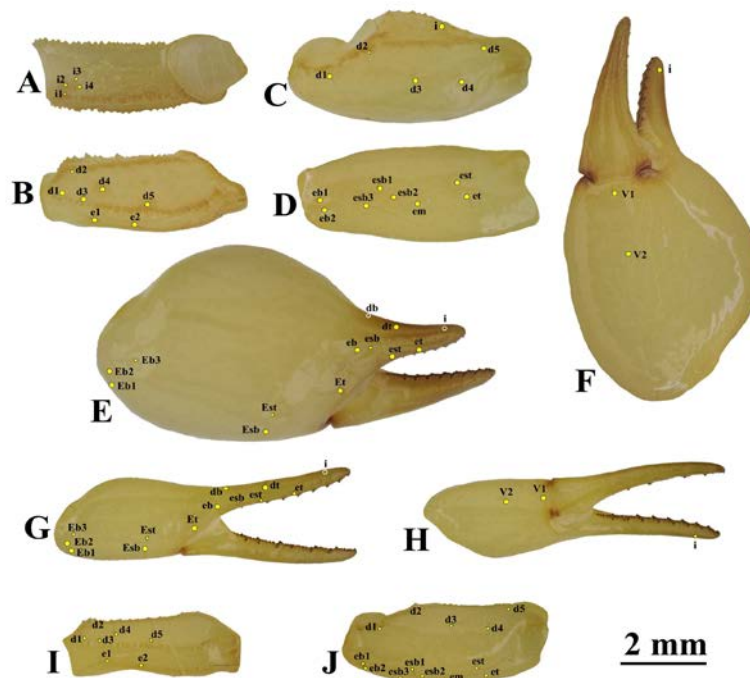


Figure 4: *Vachoniolus globimanus* from Wadi Rum, 13 km SE Al Ghal. (A-F: male). A. Femur of right pedipalp, internal aspect, B. Femur of right pedipalp, dorsal aspect, C. Patella of right pedipalp, dorsal aspect, D. Patella of right pedipalp, external aspect, E. Chela of right pedipalp, external aspect, F. Chela of right pedipalp, ventral aspect. (G-J: female). G. Chela of right pedipalp, external aspect, H. Chela of right pedipalp, ventral aspect, I. Femur of right pedipalp, dorsoexternal aspect, J. Patella of right pedipalp, dorsoexternal aspect. Scale bar = 2 mm.

** Abbreviations for trichobothria: b: basal, d: dorsal, db: dorsal basal, dt: dorsal terminal, e: external, eb: external basal, esb: external suprabasalem: external median, et: external terminal, i: internal, m: median, sb: suprabasal, sd: supradistal, st: subterminal, t: terminal v: ventral. For the hand: E: external, Eb: external basal, Est: external subterminal, V: ventral.

Table 1. Measurements for males and females of *V. globimanus* from Wadi Rum in Jordan and Saudi Arabia.

	Jordan		Saudi Arabia	
	Male	Female	Male	Female
Morphometric values in mm				
Total length (Including telson)	64.23	52.82	50.70	63.92
Carapace: Length / Anterior width / Posterior width	6.24 / 3.60 / 7.32	5.64 / 3.24 / 6.60	5.28 / 3.18 / 5.76	6.90 / 3.96 / 7.80
Mesosoma length	17.53	15.13	10.32	14.90
Metasomal segment I: Length / Width	5.28 / 3.72	4.20 / 3.00	4.38 / 3.12	5.40 / 3.84
Metasomal segment I: L/W ratio	1.42	1.40	1.40	1.41
Metasomal segment II: Length / Width	6.24 / 3.60	4.80 / 2.76	5.16 / 3.00	6.00 / 3.54
Metasomal segment II: L/W ratio	1.73	1.74	1.72	1.69
Metasomal segment III: Length / Width	6.48 / 3.48	5.04 / 2.70	5.52 / 2.94	6.24 / 3.48
Metasomal segment III: L/W ratio	1.86	1.87	1.88	1.79
Metasomal segment IV: Length / Width	7.32 / 3.12	5.64 / 2.52	6.12 / 2.64	7.20 / 3.24
Metasomal segment IV: L/W ratio	2.35	2.24	2.32	2.22
Metasomal segment V: Length / Width / Depth	8.04 / 2.76 / 2.52	6.60 / 2.40 / 2.28	6.96 / 2.52 / 2.18	8.16 / 3.12 / 2.88
Metasomal segment V: L/W ratio	2.91	2.75	2.76	2.62
Telson:				
Length / Width / Depth	6.00 / 1.80 / 1.86	5.16 / 1.68 / 1.56	5.76 / 1.68 / 1.68	6.96 / 2.04 / 2.04
Pedipalp femur: Length / Width	4.80 / 1.92	4.08 / 1.56	4.32 / 1.50	4.92 / 1.92
Pedipalp patella: Length / Width	5.52 / 2.64	4.80 / 1.92	5.04 / 2.16	6.00 / 2.40
Pedipalp chela:				
Length / Width / Depth	8.28 / 3.84 / 5.04	6.84 / 1.68 / 2.04	7.92 / 3.36 / 3.72	8.40 / 1.95 / 2.28
Movable finger: Length	3.96	4.32	3.60	5.04

3.4. Habitats

Al Ghal is located within the vast Wadi Rum escarpment (Fig. 5). It is surrounded by precipitous, sandstone and granite mountains, isolated from each other by flat corridors covered with mobile sand-dunes and sand sheets. Small patches of trees (e.g. *Acacia radiana*) and bushes such as *Haloxylon persicum* and *Retama raetam* are the typical plants of this sandy habitat, with a rainfall less than 200 mm annually (Abu Baker *et al.*, 2004). The sand of Wadi Rum massifs originated from the wind erosion of the Paleozoic sandstone rocks, and the sedimentation continued during the Ordovician and Silurian periods (Abed, 2002).



Figure 5: Habitat of Al Ghal area Wadi Rum, southern Jordan.

Specimens were collected by UV detection after 9-11 pm. Scorpions were found near the edge between sand dunes and rocky terrain with scattered vegetation. They were not observed in sand dunes devoid of vegetation. *Buthacus* sp. was found about 500 m from the site in more cohesive flat sandy soil, *Leiurus jordanensis* Lourenço, Modrý and Amr, 2002 and *Orthochirus* sp. were also found near rocky areas surrounded by sand dunes. Within the area, the Urchin Beetle, *Prionothea coronate* (Olivier, 1795), was very common.

4. Discussion

The original description of *Vachoniolus globimanus* matched with the specimens examined in this study (Levy *et al.*, 1973; Vachon, 1974 and 1979; Hendrixson, 2006; Lowe, 2010). L/W ratios for the metasomal segments of *V. globimanus* were as follows: I=1.37-1.60, II=1.64-1.95, III=1.76-2.09, IV=2.20-2.62, V=2.46-3.05 (Lowe, 2010). The collected specimens from Wadi Rum in this study as well as the comparative materials from Saudi Arabia were within this range.

The closest record comes from Al Makhrameah, Tabuk Province, in northwestern Saudi Arabia, some 75 km far from the present locality (Aloufi *et al.*, 2022). This record extends the known distribution range of *V. globimanus* from central, western and southern Arabian Peninsula to the northwest in southern Jordan. All known species of this genus are confined to southeastern and southwestern Arabia (Lowe, 2010) and eastern Iran (Navidpour *et al.*, 2008). It shares similar habitat that consists of soft sand deserts (Fig. 6).

The presence of *V. globimanus* in southern Jordan draws the attention for the possible presence of other psammophilous species known from Saudi Arabia such as *Parabuthus liosoma* (Ehrenberg, 1828) and *Apistobuthus pterygocercus* Finnegan, 1932 in southwestern Jordan, as well as further north along the sand crescents that extend from southern Jordan reaching as far as Al Hazim area near Azraq (Disi *et al.*, 1999).

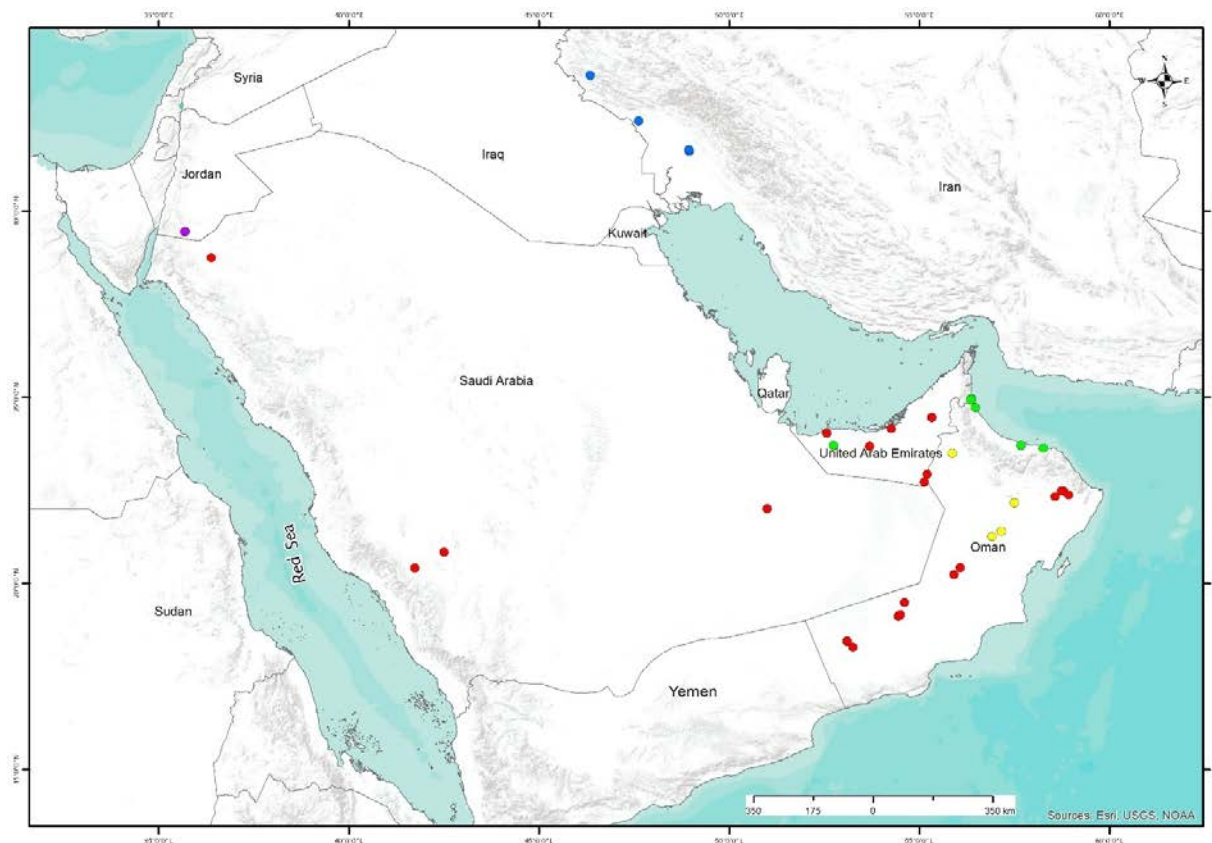


Figure 6: Distribution of species of the genus *Vachoniolus* in the Middle East. *Vachoniolus batinahensis* (Green circle). *Vachoniolus gallagheri* (Yellow circle). *Vachoniolus globimanus* (Red circle), Wadi Rum new locality (Purple circle). *Vachoniolus iranensis* (Blue circle). Localities are based on Hendrixson (2006), Navidpour *et al.* (2008), Lowe (2010), Alqahtani and Badry (2021), Navidpour (2021), and Aloufi *et al.* (2022).

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