

Amphibians and reptiles of the Badia region of Jordan

Amphibien und Reptilien des Badia-Gebietes in Jordanien

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KURZFASSUNG

Aus der Badia (Syrische Wüste) Ostjordanien, wird das Vorkommen von 40 Amphibien- bzw. Reptilienarten beschrieben, die 13 Familien repräsentieren (Bufonidae, Ranidae, Gekkonidae, Chamaeleonidae, Lacertidae, Agamidae, Scincidae, Varanidae, Leptotyphlopidae, Boidae, Colubridae, Elapidae and Viperidae). Die Funddaten des gesammelten Materials und eine überblickhafte ökologische Beschreibung des Untersuchungsgebietes werden vorgelegt. Unterschiede in den psammophilen Reptilienfaunen der Gebiete von Al-Hazim und Wadi Rum werden beschrieben.

ABSTRACT

40 species of amphibians and reptiles are reported to occur in the Badia region (Syrian Desert) of eastern Jordan. These species represent 13 families (Bufonidae, Ranidae, Gekkonidae, Chamaeleonidae, Lacertidae, Agamidae, Scincidae, Varanidae, Leptotyphlopidae, Boidae, Colubridae, Elapidae, and Viperidae). Locality records of the specimens collected and a rough ecological description of the study area are provided. Differences in the composition of the psammophilous reptile faunas of the areas of Al-Hazim and Wadi Rum are described.

KEY WORDS

Amphibia, Reptilia; Syrian Desert (Badia) of Jordan, ecology, distribution

INTRODUCTION

Several studies were conducted on the reptiles of Jordan, however, the Badia region (which is part of the Syrian Desert) in the east of the country was the least studied area: SCHMIDT (1930, 1939) reported on materials collected by HENRY FIELD from Iraq and Trans-Jordan in the course of the Marshal FIELD North Arabian Desert Expedition of 1927 and 1928. Later, PARKER (1935) reported on specimens collected by Colonel R. MEINERTZHAGEN on his trip to Syria and adjacent countries in 1933 and described *Laudakia stellio picea* from the black lava desert of Jordan. In 1967, DAAN analyzed some of these agamid specimens collected from the black lava desert and Qasr el Burgus (=Burqu) and WERNER (1992) mentioned specimens collected by

ZINNER in 1966. In 1949/1950, the Austrian-Iranian Expedition started its long journey by car from Mafraq, Jordan into Iraq. Few specimens were collected from this area. The specimens were deposited in the Vienna Natural History Museum and the results were published by WETTSTEIN (1951).

The present study was undertaken to investigate the barely known herpetofauna of the Jordanian Badia and to compare its species composition with that of similar habitats in the Wadi Rum area of southern Jordan. The study was also done in view of continuous anthropogenous changes in the ecology of the Eastern Desert and their probable negative effects on its reptile species diversity.

MATERIALS AND METHODS

In the Jordanian Badia region, amphibians and reptiles were collected from several locations (fig. 1, table 1) representing all major ecological types of habitats. All specimens collected are deposited at the

Jordan University Museum (JUM: reptiles collection, JUMA: amphibian collection). For the spelling of names of the various localities, the official standard nemes gazetteer of Jorgan (ANONYMOUS 1990) was used.

Table 1: Localities and their coordinates.

Tab. 1: Fundorte und ihre Koordinaten.

Locality / Fundort	Latitude / Breite	Longitude / Länge
1 Al Shumaysanat	31° 45' N	37° 41' E
2 Al Wisad	31° 53' N	37° 57' E
3 Al-Bustan Reserve	32° 51' N	38° 49' E
4 Al-Dhuleil	32° 09' N	36° 06' E
5 Al-Hazim	31° 35' N	37° 15' E
6 Ash Shawmari	30° 37' N	36° 28' E
7 Azraq	31° 52' N	36° 50' E
8 Azraq ad Duruz	31° 53' N	36° 50' E
9 Buqayawiyah	32° 03' N	37° 07' E
10 Dayr al Kahf	32° 17' N	36° 50' E
11 Jabal al-Uwaynid	31° 49' N	36° 44' E
12 Jawa	31° 51' N	35° 56' E
13 Mafraq	32° 21' N	36° 12' E
14 Marabb Suwayid	32° 18' N	37° 27' E
15 Qasr Amrah	31° 48' N	36° 35' E
16 Qasr Burqu	32° 37' N	37° 58' E
17 Qasr el Hallabat	32° 04' N	36° 22' E
18 Safawi	32° 10' N	37° 07' E
19 Shubeika	32° 25' N	37° 14' E
20 Surra Reserve	32° 24' N	36° 09' E
21 Umm al-Qittayn	32° 19' N	36° 38' E
22 Wadi al-Qattafi	31° 55' N	37° 34' E
23 Wadi Anaza	32° 23' N	37° 04' E
24 Wadi el-Butm	31° 47' N	36° 39' E
25 Wadi el-Ghusayn	32° 28' N	37° 45' E

Study area

The Eastern Desert of Jordan (called Badia where it can be cultivated when irrigated by ground water) is part of the Syrian Desert and situated on the north-western edge of the Arabian Desert. From its geology, the Badia is divided into the basalt plateau in the north and the limestone, chalk, and flint desert in the south. The

plateau is a flat open country with slightly incised wadis draining inland.

The topography of the Badia is dominated by low relief hills which produce elevation differences of 20 to 30 m. The lowest altitude (400 m a.s.l.) is found adjacent to the border to Saudi Arabia, the highest altitudes (1200 m a.s.l.) are found in the west. Eighty percent of the area is represented by a desert plain covered with Tertiary and Quaternary basalts. These basalts form the "desert pavement" which is composed of stones of various sizes. In many of the basalt areas, large boulders are dominant, while small angular chert fragments become more common towards the south-east of the Badia. The basalt pavement gives rise to a highly specific environment. The second main geomorphological form occurring in the Badia area is represented by sedimentary deposits of fine grained material which has been deposited by fluvial action. Locally, these particular areas are known as Qa'a (ANONYMOUS without date).

The Badia region is classified as a steppe and falls almost exclusively in the arid climate zone. It is not a true desert in that it receives about 200 mm of annual precipitation. In some places such as Azraq and Burqu, there are large permanent water bodies and surrounding wetlands. Several soil types ranging from saline to sand soils are found in the area. Climate and topography of the Badia have limiting effect on the productivity, density, and composition of the vegetation. Moisture is the main element that determines both the spatial and temporal distribution and the abundance of plant species (ANONYMOUS without date).

TAXONOMIC ACCOUNT

Bufo viridis LAURENTI, 1768

Material collected: JUMA0060, Azraq, 19.3.1979. JUMA0321 and JUMA0323, Azraq, 3.8.1983, JUMA0361-0363, Azraq, 16.5.1989. JUMA0375, Burqu, 19.1.1995. JUMA0515, Buqayawiyah, 14.6.1998.

In Burqu, tadpoles of various stages as well as adults were quite common. Specimens were collected after heavy December rainfall. The pool of Burqu consists of one large water body, about 1200 m long

and 40 to 50 m wide, with a depth that may reach 3 m in rainy seasons. This pool is situated at the lowest level of a "Qa" and receives water from the surrounding hills and wadis. This water body which sustains water all year is located in the heart of the Badia region, about 120 km from the nearest permanent water in Jordan which is found in the Azraq area. The temporary rain-fed pond of Buqayawiyah keeps the water for over six months per year. In the Badia, the expansion of human activities

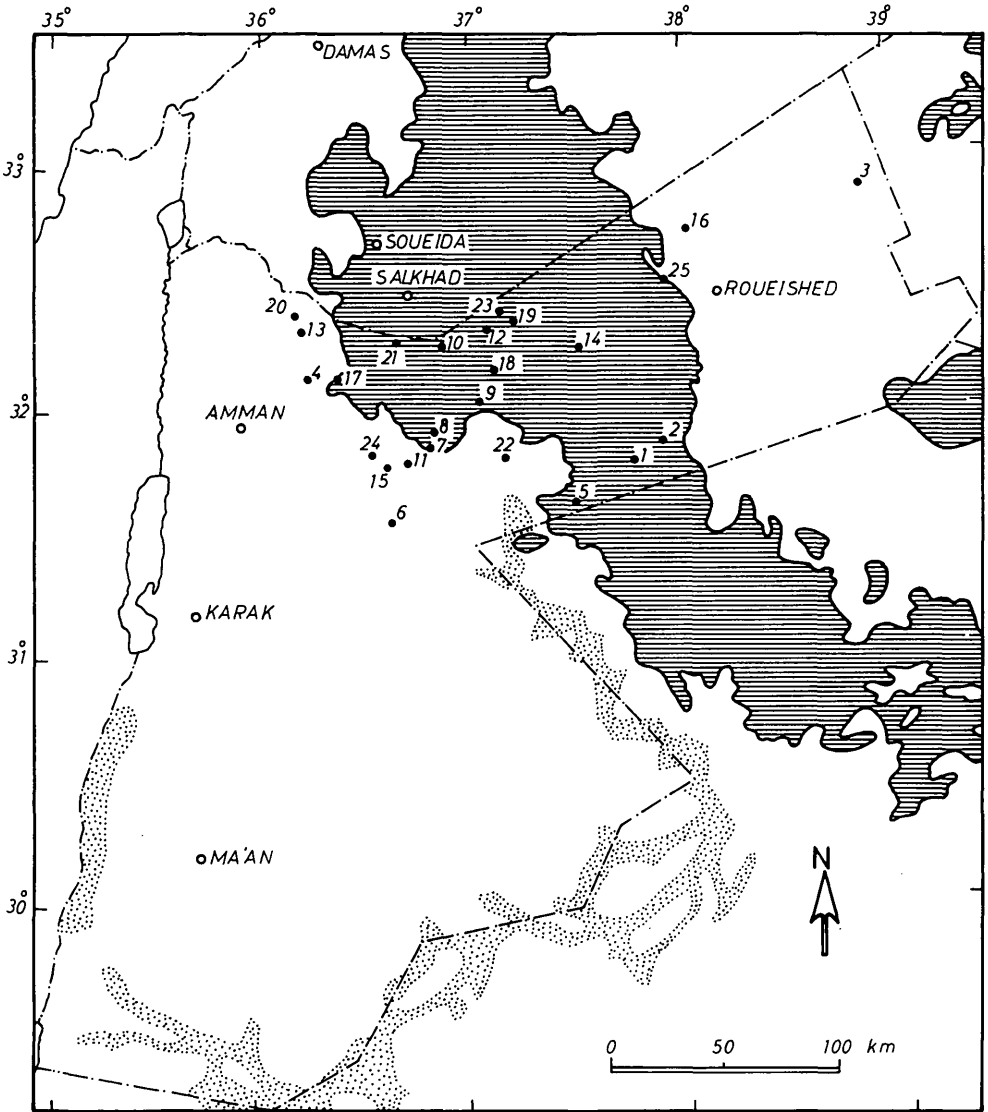


Fig. 1: Map of Jordan showing the Badia area (hatched), the study sites (for numbering of localities see table 1) and the distribution of sand dunes (dotted) between Wadi Rum in the south and Al-Hazim (5).

Abb. 1: Karte von Jordanien mit dem Gebiet der Badia (schraffiert), den Untersuchungsstellen (Numerierung siehe Tab. 1) und der Verteilung der Sanddünen (punktiert) zwischen Wadi Rum im Süden und Al-Hazim (5).

activities and agricultural projects results in the establishing of new water bodies, providing additional breeding opportunities. Some maps show additional water bodies in this area but they are seasonal and do not persist longer than a few months. It remains unknown whether they support amphibian populations.

Rana cf. levantina
SCHNEIDER & al., 1992

Material collected: JUMA0322 and 0424, Azraq, 3.8.1983.

Ranid frogs are abundant in the remnant water pools of Azraq. SCHNEIDER & al. (1992) described *R. levantina* from Israel, based on bioacoustic analyses. However, the conspecificity of the Azraq population with *R. levantina* needs to be verified.

Bunopus tuberculatus
BLANFORD, 1874

Material collected: JUM2318, Al-Hazim, June 1996.

This terrestrial gecko species which is widely distributed in southern Jordan and Wadi Araba (AMR & al. 1994), is usually associated with sandy habitats and was found under scattered rocks or in rodent burrows.

Cyrtopodion scaber
(HEYDEN, 1827)

Material collected: JUM2253, Safawi, 15.10.1996. JUM2483, Safawi, 18.7.1997. JUM2540, 10 km from Safawi to Mafraq, without date.

Cyrtopodion scaber was collected at old and abandoned buildings in the basalt plain, as well as from the Safawi Research and Development Program headquarters. WERNER (1991) reported this species to occur in the Syrian Desert. In Safawi, this species is closely associated with human settlements and could have been introduced by human activities, as was reported by BAHÁ EL DIN (1994) from Egypt.

Hemidactylus turcicus turcicus
(LINNAEUS, 1758)

Material collected: JUM2006, W Ash Shawmari, 3.10.1991. JUM2256, Azraq, 24.3.1990. JUM2257, Sa-

fawi, 17.10.1996. JUM2258, Buqayawiyah, 17.10.1996. JUM2440-2442, Azraq, 27.3.1997. JUM2500, Azraq, 26.8.1997. JUM2509 and 2516, Azraq, 23.2.1998.

In Jordan, *H. turcicus* is widely distributed and found in various habitats (DISI & AMR 1998). In Azraq Nature Reserve, the Turkish Gecko was found in deep horizontal burrows in association with termites of the family Hodotermitidae.

Ptyodactylus puiseuxi
BOUTAN, 1893

Material collected: JUM1932 and 1943, Azraq, June 1990. JUM2383, Burqu, 8.5.1992. JUM2388, 5 km N Azraq, 25.8.1992. JUM2200, Burqu, April 1995. JUM2275, Buqayawiyah, 2.10.1996. JUM2307, Al-Wisad, 5.11.1996. JUM2427, 2457 and 2466, Safawi, 3.6.1997. JUM2479, Wadi Al-Ghosain, 17.7.1997. JUM2480, Safawi, 18.7.1997. JUM2504-2505, N Azraq, 24.9.1997. JUM2507, N Azraq, 1.10.1997. JUM2511, N Azraq, 2.10.1997. JUM2510, N Azraq, 15.10.1997. JUM2541-2543, Al-Wisad-Buqayawiyah, June 1998.

Ptyodactylus puiseuxi is a dominant gecko of the black lava desert. This mostly diurnal species is distributed throughout northern Jordan and extends eastwards into the Badia. Animals from the Badia region are considerably smaller in size, when compared with those from western Jordan. *Ptyodactylus puiseuxi* constitutes part of the diet of the little owl *Athene noctua* (AL-MELHIM & al. 1997).

Stenodactylus doriae
(BLANFORD, 1874)

Material collected: JUM2461, Al-Hazim, 5.6.1997. JUM2492 and 2494, Al-Hazim, 31.7.1997. JUM2503, Al-Hazim, 3.9.1997.

Stenodactylus doriae inhabits the soft wind blown sand dunes as found in some parts of Wadi Araba, Wadi Rum, and Al-Hazim. This gecko is entirely nocturnal, the peak activity being observed just after sunset. From Saudi Arabia a similar habitat was described for *S. doriae* (ARNOLD 1980).

Stenodactylus grandiceps
HAAS, 1952

Material collected: JUM2007, Al-W Ash Shawmari, 3.10.1991. JUM2425, Buqayawiyah, 2.10.1996. JUM2433, Al-Hazim, June 1998. JUM2499-24500, Azraq, 26.8.1997.

This species is widely distributed in the arid regions of Jordan. However, due to its secretive life there are only few records. *Stenodactylus grandiceps* was collected in different habitats, e.g., in highly vegetated areas or on hard substrate deprived of vegetation.

Chamaeleo chamaeleon recticrista
BOETTGER, 1880

Material collected: JUM1591, Ash Shawmari Wildlife Reserve, 15.10.1983. JUM2309, Ash Shawmari Wildlife Reserve, 10.10.1996.

Chamaeleo chamaeleo has been rarely found in the study area. So far, only two specimens from Azraq and one from Ash Shawmari were collected. Additionally, one juvenile was observed in Azraq on stems of *Typha* sp. in August 1997. It is questionable, whether the animals of Shawmari and Azraq are representatives of a relict population, an introduced population or man-introduced individuals only.

Laudakia stellio picea
(PARKER, 1935)

Material collected: JUM1936, Azraq, June 1990. JUM2189-2190, Burqu, April 1995. JUM2231-2233, and 2242-2244, Burqu, 9.10.1996. JUM2321, Buqayawiyah, 3.10.1996. JUM2529-2530, 20 km W Safawi, 16.6.1998. JUM2531-2532, 15 km along the highway to Dayr al Kahf, 3.10.1996. JUM2537, 10 km from Safawi to Mafraq, 16.6.1998.

Laudakia stellio picea is a diurnal species endemic to the black lava desert and characterized by the small body size compared to the other subspecies occurring in Jordan: *L. stellio stellio* (LINNAEUS, 1758) and *L. stellio brachydactyla* (HAAS, 1951). Mean snout-vent length of ten adult specimens collected in this area was 84.5 mm (range: 75 - 95 mm, SD: 10.82), mean tail length was 112.2 mm (range: 118 - 125 mm, SD: 13.95). Similar observations were reported by PARKER (1935), DAAN (1967), WERNER (1992), and MORAVEC & MODRÝ (1994).

However, during our study, we found areas where morphological *L. stellio picea* and *L. stellio stellio* were sympatric, even syntopic (on the same stone). Noteworthy to mention, the dark form *picea* was more common towards the east and mostly associated with the dry black lava desert, while

the lighter and brighter form *stellio* was abundant at higher altitudes of the Dayr al Kahf area. At present, we treat the two forms as subspecies. Our near future intention is to identify areas of sympatry and measure the morphological differences between the two forms.

Pseudotrapelus sinaitus
(HEYDEN, 1827)

Material collected: JUM0526, N. Azraq, June 1980. JUM1935 and 1940, Azraq, June 1990. JUM 2195, Qasr Burqu, April 1995. JUM2226, Al Wisad, 5.11.1996. JUM2385, Jabal al-Uwaynid, 9.5.1992. JUM2456, Safawi, 3.6.1997. JUM2469, Safawi-Azraq road, 7.6.1997. JUM2470-2472, Safawi, 7.6.1997. JUM2484-2488, N. Azraq, 24.7.1997. JUM2512, N. Azraq, 2.10.1997. JUM2519, N. Azraq, 23.2.1997. JUM2576, 15 km from Safawi to Mafraq, 2.6.1998.

In the study area, *Pseudotrapelus sinaitus* is a dominant diurnal species, inhabiting mainly places covered with rocks, rocky outcrops, and gravel but also hard surfaces with scattered rocks. WERNER (1971) reported on some differences between the populations of the lava desert and those of the eastern shore of the Dead Sea and Wadi Araba. In our morphometric studies we did not find statistical differences which would justify subspecific splitting of these populations.

Trapelus pallidus haasi
(Y. WERNER, 1971)

Material collected: JUM0399, Azraq, 21.8.1979. JUM0431, between Azraq and Ash Shawmari, 9.7.1978. JUM2000-2003, Al-Hazim, 3.10.1991. JUM2008-2013, W. Ash Shawmari Wildlife Reserve, 3.10.1991. JUM2196, Burqu, April 1995. JUM2265-2271, Buqayawiyah, 7.10.1996. JUM2245, Burqu, 9.10.1996. JUM2290, Al-Wisad, 6.11.1996. JUM2375, Al-Hazim, May 1989. JUM2508, N. Azraq, 1.10.1997.

This diurnal agamid prefers open areas with scattered vegetation, especially depressions filled with hard fine sand and gravelly substrate.

Trapelus persicus fieldi
(HAAS & Y. WERNER, 1969)

Material collected: JUM2450-2451, 2453, Al-Hazim, June 1997. JUM2477, Azraq, 14.7.1996.

Trapelus persicus fieldi inhabits both hard and sand dune substrates covered with low shrubs. There it hides in bushes or bur-

rows when chased. These lizards are associated with *Nitraria retusa* shrubs in the Al-Hazim area and with *Atriplex* sp. in the Al-Azraq Wildlife Reserve and bask at the top of the shrubs. Although *T. persicus fieldi* was collected at Qasr Burqu (SCHMIDT 1929) no further specimens were found despite of intensive field studies in the Burqu area.

Uromastix aegyptia microlepis
(BLANFORD, 1874)

Material collected: JUM0630, Azraq, June, 1983. JUM1882, Safawi, May 1983. JUM2221, Safawi, 1996. JUM2247, Marabb Suwayid, 3.10.1996. JUM 2526, 25 km from Safawi to Mafraq, June 1998.

This diurnal agamid inhabits hard substrates, either hard sand or gravel. Young "daabs" were found in the food of the little owl *Athene noctua*. Specimens from the black lava desert display darker coloration.

Acanthodactylus boskianus
(DAUDIN, 1802)

Material collected: JUM1312 and 1317, N Azraq, June 1983. JUM1321, Ash Shawmari, without date. JUM1949, Azraq, June 1990. JUM2236, Shubeika, 3.12.1996. JUM2284, Marabb Suwayid, 3.10.1996. JUM2291, Al-Wisad, 5.11.1996. JUM2384, 10 km from Al Wisad to Safawi, 9.5.1992. JUM2386, 31 km NW Al-Wisad, 9.5.1992. JUM2458 and 2460, Wadi el-Butm, 4.6.1997. JUM2473, Al-Hazim, 7.6.1997. JUM2478, Wadi el-Ghusayn, 17.7.1997. JUM2527, Al-Malkia, 1.6.1998. JUM2536, 15 km from Safawi to Mafraq, 13.6.1996.

This widely distributed species was collected from various habitats like open areas with hard substrate and scattered vegetation but also from wadi beds with fine sand and small rocks.

Acanthodactylus grandis
BOULENGER, 1909

Material collected: JUM0774-0775, 15 km from Al-Dhuleil to Azraq, without date. JUM1994, Al-Hazim, 3.10.1991. JUM2260, Al Shumaysanat, 14.10.1996. JUM2281, Al-Wisad, 5.11.1996. JUM2304, Al-Hazim, 29.10.1996. JUM2493 and 2495, Al-Hazim, 31.7.1997.

This inhabitant of the desert is mostly found on hard substrates as was already reported by HAAS (1943, 1951) who collected this species from stony areas of the Syrian Desert.

Acanthodactylus opheodurus
ARNOLD, 1980

Material collected: JUM0770, Al-Hazim, June 1983. JUM1305 and 1310, N Azraq to Safawi, June 1983. JUM1352, 1354 and 1357, Al-Hazim, June 1983. JUM1941, Azraq, June 1990. JUM2260, 12 km W Safawi, 14.10.1996. JUM2305, Al Wisad, 5.11.1996. JUM2306, Al-Hazim, 29.10.1996. JUM2476, Al-Bustan Reserve, 14.7.1997.

Acanthodactylus opheodurus is found on coarse-grained sand among vegetation e.g., in the flood plains of sparsely vegetated wadis. If disturbed, this lizard takes refuge in bushes or burrows. According to WERNER (1986). *A. opheodurus* is an euryecious psammophilous species but was not found sympatric with *A. boskianus*.

Acanthodactylus robustus
F. WERNER, 1929

Material collected: JUM2281, Al Wisad, 2.11.1996.

This species endemic to the Syrian Desert exclusively inhabits hard substrate covered with sparsely scattered vegetation.

Acanthodactylus schmidti
HAAS, 1957

Material collected: JUM0795, Al-Hazim, without date. JUM2237, 2248-2249, Al-Hazim, 29.10.1996. JUM2463, Al-Hazim, 5.6.1997. JUM2465, Al-Hazim, 6.6.1997.

Acanthodactylus schmidti is well adapted to inhabit soft wind blown sand dunes stabilized by root systems of desert plants. Burrows of this lizard were observed mainly among the root system of *Nitraria retusa*. ALDAKHIL & DE SILVA (1988) reported on a similar association with the root systems of *Hammada elegans* and gave further details on the borrow systems of *A. schmidti* in Saudi Arabia.

Mesalina guttulata
(LICHTENSTEIN, 1823)

Material collected: JUM1422, 1425, 1427, 5 km N Azraq to Safawi, 5.8.1983. JUM2192-2194, Burqu, April 1995. JUM2255, 2262-263, Marabb Suwayid, 2.10.1996. JUM2277, Shubeika, 3.12.1996. JUM2295, Burqu, 25.11.1996. JUM2302, Marabb Suwayid, 23.3.1995. JUM2378, 22 km SW Safawi, 6.5.1992. JUM2381, 37 km NE Safawi, 7.5.1992. JUM2454, Safawi, 3.6.1997. JUM2468, Safawi, 6.6.1997. JUM2481, Burqu, 17.8.1997. JUM2513, Jawa, 30.10.1997. JUM2517, Azraq Reserve, 23.2.1998.

This lacertid is one of the dominant species in the Syrian Desert. It was collected from various habitats characterized by different physical and geomorphological features. The specimens of the black desert are significantly darker and show distinct white ocelli.

Mesalina olivieri
(AUDOUIN, 1829)

Material collected: Al-Hazim, JUM0778-0779, Qasr Amra-Azraq road, without date. JUM0783, 20 km from Al-Dhuleil to Azraq, without date. JUM0785-0788, Al-Hazim, June 1981.

Mesalina olivieri inhabits the Syrian Desert and Wadi 'Araba where it has been encountered on fairly hard substrates. WERNER (1987) reported that this species was collected in Saharo-Arabia and Wadi 'Araba where it occupies non-sandy soils as well as sandy river beds.

Mesalina brevirostris
BLANFORD, 1874

Material collected: JUM2004-2005, W Ash Shawmari Wildlife Reserve, 3.10.1991. JUM2251, Burqu, 24.11.1996. JUM2302, Marabb Suwayid, 23.3.1996.

Mesalina brevirostris was collected from hammada lands (= open habitats with scattered vegetation) as well as from densely vegetated areas in Ash Shawmari.

Ophisops elegans blanfordi
SCHMIDT, 1939

Material collected: JUM2259, Wadi Qatafi, 4.11.1996. JUM2280, Marabb Suwayid, 3.10.1996. JUM2285, 12 Km W Safawi, 14.10.1996. JUM2379, 22 km SW Safawi, 6.5.1992. JUM2387, Jabal al-Uwaynid, 10.5.1992.

This lizard was found in the more vegetated hammada. In Jordan, *O. elegans* was previously known mainly from habitat types of the Mediterranean ecozone. The subspecific status of the Jordanian populations is unclear, that of the individuals of the Syrian Desert is peculiar.

According to WERNER (1971), *O. elegans* specimens collected from Jordan were representatives of two forms: *Ophisops elegans ehrenbergi* WIEGMANN, 1835 inhabits more mesic areas and the Mediterranean biotope while *O. elegans blanfordi* is dominant in arid areas. The subspecies

ehrenbergi is characterized by the shortness or absence of the vertebral line that extends to the occipital region while *blanfordi* is characterized by the presence of a well developed vertebral line and a single postnasal.

However, after examination of 36 specimens of *O. elegans* from various localities within the mesic region, we found that 22 showed a short vertebral line and two postnasals.

At present we intend to follow HAAS (1951) who suggested that little systematic value should be attributed to the differences between the various forms of *O. elegans*. Since there is no distinct geographic barrier between the known forms, we think that the slight morphological differences may be mere variations within one population.

Chalcides ocellatus ocellatus
(FORSSKÅL, 1775)

Material collected: JUM0426-0427, Ash Shawmari, 1979. JUM1320, Ash Shawmari, June 1983.

Chalcides ocellatus ocellatus was encountered in different areas characterized by damp ground. ARNOLD (1980, 1984) indicated that - in Arabia - this species is secretive but abundant in plantations and cultivated areas where the ground is damp, especially near the sea. Furthermore, it is said to inhabit buildings and gardens where it was observed under leaves.

Eumeces schneiderii
(DAUDIN, 1802)

Material collected: JUM0386, Ash Shawmari, 22.3.1979. JUM1661, Surra Reserve, May 1983.

One more specimen was found under a stone in Safawi (but not collected). The subspecific status of the Arabian populations is subject to discussions (see SCHÄTTI & GASPERETTI 1994).

Mabuya vittata
(OLIVIER, 1804)

Material collected: none.

This skink was seen on several occasions in the densely vegetated and humid habitats in the Azraq oasis and Ash Shawmari Wildlife Reserve. Previously recorded from Azraq Druze by WERNER (1972).

Scincus scincus meccensis
WIEGMANN, 1837

Material collected: JUM2317, Al-Hazim, 5.9.1997.

So far, this psammophilous species was recorded only from sandy dunes in the Hazim area. Remnant parts of three sub-adult specimens (partially destroyed by birds) were found in May 1997. Additionally, one adult male was collected in September 1997. This specimen is significantly larger (total length: 180 mm; snout-vent length: 112 mm) than all animals previously collected from Jordan.

Varanus griseus griseus
(DAUDIN, 1803)

Material collected: JU2315, Buqayawiyah, 1997.

Varanus griseus is widely distributed throughout the study area. Two specimens were collected from Burqu and Buqayawiyah, additionally, numerous foot prints of the monitor lizard were seen on the sandy hills in Al-Hazim. *Varanus griseus* is diurnal and attains its highest activity in the afternoon (12:00-17:00). The locals call it "warral" and consider the animal to be dangerous; they also utilize it in popular medicine. Among the Bedouins, the "warral" is known as a predator of snakes.

Leptotyphlops macrorhynchus
(JAN, 1861)

Material collected: JUM2317, Safawi, June 1997.

The specimen found at the Safawi Research and Development Programme headquarters extends the known Jordanian range of this snake considerably to the east. This leptotyphloid was previously known only from Petra (BARBOUR 1914; DISI & al. 1988).

Eryx jaculus
(LINNAEUS, 1758)

Material collected: JUM0839, between Safawi and Dayr al-Kahf, 6.6.1981.

Two specimens were found in loose soil under rocks. Other specimens were seen in Safawi and along the road from Safawi to Azraq (basalt plain).

TOKAR & OBST (1993) considered the populations east of Egypt to be *E. j. turcicus* (OLIVIER, 1801), although they mentioned some uncertainties which remained to be resolved.

Coluber ventromaculatus
GRAY, 1834

Material collected: JUM0546, Ash Shawmari, 1980. JUM0931, Jawa, 1.7.1982. JUM2261, Shubeika, 15.10.1996.

All specimens were collected on ham-mada basalt. Two spotted specimens were seen in Qasr Burqu on the road to Azraq.

DISI (1993) mentioned that this species seems to prefer more humid places (agricultural areas near water canals or water pipes) which corresponds with its presence in Burqu. On the other hand, on the road to Azraq, *C. ventromaculatus* was collected in desert habitat.

Coluber ventromaculatus is hardly to be distinguished from *C. rogersi* (J. ANDERSON, 1893) based on scale counts and coloration alone. From their external features, Egyptian specimens considered as typical *C. rogersi* are actually nearly identical to those reported as *C. ventromaculatus* from Jordan. The systematic status of these two nominal taxa deserves investigation.

Eirenis coronella
(SCHLEGEL, 1837)

Material collected: JUM0934, Jawa, 1.7.1982.

Eirenis coronella was collected on the basalt plain among small stones. The snake inhabits semidesert habitats where it hides under stones which lie on bare open ground.

Malpolon moilensis
(REUSS, 1834)

Material collected: JUM0553, Ash Shawmari, without date. JUM0675, Dair al Kahf, June 1981. JUM0904, Jawa, May 1982. JUM0973, Umm al-Qittayn, 19.5.1982. JUM1413, Ash Shawmari, June 1983. JUM1702, Qasr el Hallabat, April 1986. JUM1875, Al-Dhalil, 5.5.1987.

This diurnal snake is common in the arid regions of the Badia, southern Jordan, and Wadi Araba where it is mainly restricted to open habitat, as well as sparsely vegetated substrate e.g., vegetated wadis.

Malpolon monspessulanus insignitus
(GEOFFROY ST. HILAIRE, 1809)

Material collected: JUM0211, Ash Shawmari, 2.6.1978. JUM0355, Ash Shawmari, 21.6.1979. JUM0366, Ash Shawmari, 10.5.1979. JUM0423, 20 km between Qasr Amrah and Azraq, 6.6.1997. JUM1910, Ash Shawmari, June 1989. JUM1927, Ash Shawmari, May 1990. JUM2250, Al Wisad, 5.11.1996.

Additional observations made by A. DISI include: a specimen collected by ANN SEARIGHT at the Azraq Aquatic Reserve in 1980, a specimen seen in the reserve, and a third specimen observed on the highway 20 km from Azraq towards Safawi. This species is more common in the Mediterranean ecozone of western Jordan.

Natrix tessellata
(LAURENTI, 1768)

Material collected: JUM0438-0440, Azraq Wetland Reserve, 6.5.1980. JUM0454, Azraq Wetland Reserve, 29.4.1980. JUM0457, Azraq Wetland Reserve, 1980.

This aquatic snake exclusively lives in close vicinity of permanent water as found in the Azraq oasis.

The Dice Snake was observed to feed on *Rana* as well as small fishes. In the early 1970s, when the parasite fauna of the aquatic vertebrates of Azraq was studied (MADI 1976), *N. tessellata* was very common both in the northern and southern Azraq pools. Currently, the population of this snake is declining due to the shrinkage of its habitat caused by extensive water pumping.

Psammophis schokari
(FORSSKÅL, 1775)

Material collected: JUM1956, Ash Shawmari, April 1990. JUM2228, Al-Hazim, 28.10.1996. JUM2234, Safawi, without date. JUM2252, Wadi Anaza, 15.10.1996. JUM2278, Wadi al-Qattafi, 4.11.1996.

This species is widely distributed in the Syrian Desert and must be considered the most abundant snake species there. It was collected among large rocks on the basalt plain as well as in sandy areas. This species occupies all ecozones in Jordan where it usually prefers more vegetated places.

Spalerosophis diadema cliffordii
(SCHLEGEL, 1837)

Material collected: JUM2052, Ash Shawmari, without date. JUM2227, Burqu, 9.10.1996. JUM2528, Azraq, 23.6.1997.

Spalerosophis diadema cliffordii is widely distributed in Jordan where it occurs in desert and semidesert habitats. Rodent burrows frequently shelter this snake. Its local name is "Ragta".

Walterinnesia aegyptia
LATASTE, 1887

Material collected: JUM1499, Azraq, 12.10.1983. JUM2107, Ash Shawmari, 1982. JUM2223, Burqu, 24.11.1996.

The Burqu specimen was collected in a pool in the afternoon (15:00) after heavy rainfall. The local population of *Bufo viridis* provides the food source of this mostly batrachophagous snake.

Cerastes gasperettii
(LEVITON & S. ANDERSON, 1967)

Material collected: JUM2228, Al-Hazim, 29.10.1996. JUM2464, Al-Hazim, 5.6.1997.

Two specimens of this strictly nocturnal species were collected from sand dunes fixed by *Nitraria retusa* shrubs. A Wagner's Gerbil *Gerbillus dasyurus*, was found in the stomach of one of the vipers.

Pseudocerastes persicus fieldi
K. SCHMIDT, 1930

Material collected: JUM0265, Ash Shawmari, 9.7.1978. JUM0436, Ash Shawmari, 1980. JUM0547, Ash Shawmari, June 1980. JUM0908, Jawa, May 1982. JUM1706, Qasr el Hallabat, September 1986. JUM1993, 10 km SE Al-Hazim, 3.10.1991. JUM2230, Ash Shawmari, 1994.

Pseudocerastes persicus fieldi was seen also in Buqayawiyah. This nocturnal species often utilizes rodent burrows as a shelter during the day. It prefers gravelly substrate, called "Qa". Two different color forms occur in the study area. While specimens from the lava desert are dark brown to blackish, the specimens from the hammada are pale brown or yellowish, like in other parts of Jordan.

DISCUSSION

This study presents the first comprehensive inventory of the herpetofauna of the Syrian Desert in Jordan. Fourty species were observed in the study area which are representatives of two amphibian (Ranidae, Bufonidae) and nine reptile families (Gekkonidae, Chamaeleonidae, Lacertidae, Scincidae, Leptotyphlopidae, Boidae, Colubridae, Viperidae, Elapidae).

This diverse herpetofauna is not only explained by the great variety of habitats ranging from sand dunes, black lava desert to hammada, and wetlands but also by the fact that the Badia represents cross roads of species of different zoogeographical affinities. It acts as a filter for some Mediterranean species that are restricted to the western mountains of Jordan and prevents them to penetrate further to the east. This is true for several Mediterranean species that are common just to the west of the study area such as: *Laudakia stellio stellio*, *Trapelus ruderatus ruderatus* (OLIVIER, 1804), *Acanthodactylus tristrami* (GÜNTHER, 1864), *Lacerta laevis* GRAY, 1838, *Ablepharus* sp., *Typhlops vermicularis* MERREM, 1820, several colubrids, and viperids. Many of these species are absent in the neighboring Iraq, and the north-western corner of Saudi Arabia. On the other hand, other species that are known from the Mediterranean ecozone penetrate deeply into the Badia, such as *Ptyodactylus puiseuxi*, *Ophisops elegans*, and *Eumeces schneideri*.

The territories of other species (e.g., *Uromastix aegyptia*, *Varanus griseus*) extend from southern Jordan and Wadi Araba through the true deserts into north-eastern Jordan, northwards to the Syrian Desert and eastwards into Iraq.

The oasis of Azraq is the only wetland in the heart of the Badia region. This oasis is fed with water by an extensive network of wadis and a complicated system of anthropogenous deep aqueducts. Several otherwise widespread amphibian and reptile species the distribution of which - in the Badia region - is restricted to the Azraq oasis, evidently represent relict species, which survived aridification of the surrounding territory (*Rana* cf. *levantina*, *Chamaeleo chamaeleon*, *Mabuya vittata*, *Malpolon monspessulanus*, *Natrix tessell-*

lata). The nearest populations of the above species are found more than one hundred kilometers west of Azraq, separated by an arid area bare of suitable habitats.

Considering the presence of an endemic fish species *Aphanius sirhani*, as well as some endemic aquatic invertebrates, it is highly suggestive that the Azraq wetland may be a center of endemic forms, amphibians included. In this respect, the systematic status of the population of *Rana* cf. *levantina* requires further research, to confirm or exclude its conspecificity with populations in western Jordan.

Al-Hazim - situated in the southern part of the study area near the Saudi Arabian border - is characterized by the presence of vegetated sand dunes, extending there from Saudi Arabia. These dunes belong to a continuous series of sand dunes along the south-east Jordanian border to Saudi Arabia (reaching from near Al-Hazim in the north-east as far as near Wadi Rum in the west (fig. 1). In the Wadi Rum area, the psammophilous reptile community is represented by six species, strictly associated with the sand dune habitat: *Stenodactylus doriae*, *Scincus scincus meccensis*, *Acanthodactylus schmidti*, *A. ophiodurus*, *Phrynocephalus arabicus* ANDERSON, 1894, *Cerastes gasperettii*. Only five out of these are known from the sand dunes of Al-Hazim, while the Arabian Toad-headed Agama, *Ph. arabicus*, is "replaced" by *Trapelus persicus fieldi*. It seems that this continuous series of sand dunes permitted a northward range expansion of species such as *S. scincus meccensis* and *C. gasperettii* while other species known from Wadi Rum have not been found in Al-Hazim (e. g., *Coluber elegantissimus* (GÜNTHER, 1878).

Similar observations were reported by WERNER (1987) who showed that the substrate - sand dunes, in this case - can be a limiting factor for the distribution of species. WERNER (1987) furthermore stated that stenoecious psammophiles developed competitive advantage for a life in sandy habitats due to special adaptations. Sand dunes must be considered a limiting factor for the distribution of several species which supports the concept of "islands of sand".

The area under our study is about 11,210 km² in size and represents almost 18 % of the territory of Jordan. This region harbours about 36 % of the number of reptile taxa recorded from Jordan (DISI 1996). DISI (1996) and DISI & BÖHME (1996) consider *A. robustus*, *T. persicus fieldi*, *L. stellio picea*, and *S. grandiceps* as endemites of the Syrian Desert. More than half of the species on record are of Arabian origin, since the Syrian Desert is an extension of the Arabian Desert. Moreover, DISI

(1996) believes that the Syrian Desert may represent the focal point of evolution of *Acanthodactylus* species in the area.

DISI (1996) stressed the fact that interpretation of fine patterns of the herpetofaunal distribution in the Middle East has been hampered by inadequate herpetological inventories from some surrounding regions, including the study area. Thus, still more detailed investigations are required for better understanding of the reptile fauna of the eastern Badia region.

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