

Revision of the Levantine “*Lacerta*” *laevis*/ *kulzeri*-Complex: 3. The Rock Lizard of Wadi Ramm, *Phoenicolacerta kulzeri khazaliensis* ssp. n.

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Abstract

A new lacertid, the Wadi Ramm Rock Lizard, *Phoenicolacerta kulzeri khazaliensis* ssp. n. from Wadi Ramm, southern Jordan, is described. Its morphological features are discussed in comparison with other populations of *P. kulzeri*, all known data on its biology are presented.

Kurzfassung

Eine neue lacertide Eidechse, die Wadi Ramm-Felseneidechse, *Phoenicolacerta kulzeri khazaliensis* ssp.n. aus dem Wadi Ramm, Süd-Jordanien, wird beschrieben. Ihre morphologischen Merkmale werden im Vergleich mit anderen Populationen von *P. kulzeri* diskutiert und alle bekannten Daten zu ihrer Biologie werden vorgestellt.

Key words

Reptilia: Sauria: Lacertidae: *Phoenicolacerta kulzeri khazaliensis* ssp. n.; Wadi Ramm, Jordan.

Introduction

Already in 1914, BARBOUR reported the occurrence of the rock dwelling lizards from the region around the antique ruins of Petra in Jordan. He referred them to the south-turkish species *Lacerta danfordi*. Later, the status and relationship to other species of this taxon was considered questionable. It has been referred to *Lacerta laevis*, then back to *L. danfordi*, and finally, it was put to the relationship of the questionable, almost unknown *Lacerta*

kulzeri from Lebanon Mts. (see the overview in BISCHOFF & MÜLLER, 1999). After new data and new comparative material had been collected and studied, BISCHOFF & SCHMIDTLER (1999) made clear that *L. kulzeri* is a distinct species. They put the Petra Rock Lizard to *L. kulzeri*, and BISCHOFF & MÜLLER (1999) described it as its new subspecies, *Lacerta kulzeri petraea*. ARNOLD *et al.* (2007) extracted *Lacerta laevis* and its close relatives from the col-

lective genus *Lacerta* and included them into the newly described *Phoenicolacerta*. The proper name of the Petra Rock Lizard is therefore *Phoenicolacerta kulzeri petraea* (BISCHOFF & MÜLLER, 1999).

Up until now, Petra had been considered the extreme southern range limit of lizards belonging to the "Lacerta" *laevis/kulzeri*-complex, the present genus *Phoenicolacerta*. In 2000, a population of rock lizards apparently belonging to the same taxonomic group had been discovered, inhabiting Djebel Khazali in Wadi Ramm, southern Jordan, some 100 km south of Petra (comp. DISI *et al.*, 2001). They are subject of this report together with their description as new subspecies.

Material and Methods

The studied material is deposited in the following collections: Zoologisches Forschungsmuseum Alexander Koenig, Bonn (ZFMK), Zoologische Staatssammlung, München (ZSM), Hebrew University of Jerusalem (HJ), Jordan University Museum, Amman (JUMR), Naturhistorisches Museum Wien (NMW) and Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt/AM. (SMF).

Four lizards (3 males and 1 juvenile) from Wadi Ramm were examined (see data at „Holotype“ section). Their external morphology was compared to specimens of *Phoenicolacerta kulzeri petraea* and to all known populations of *P. kulzeri* s. l. (compare the list in BISCHOFF & MÜLLER, 1999). The sexually dependent features have been considered only in male specimens. All study specimens provided 17 metric and 24 pholidotic features (explanatory notes see SCHMIDTLER & BISCHOFF, 1999). Pholidotic features occurring bilaterally have been studied separately for the right and left sides of the body. Indexes of individual body proportions and relative sizes of scales have been calculated. The data of Wadi Ramm Rock Lizards are compared to those for the geographically neighbouring *P. kulzeri petraea* in Tab. 1 and 2. Here, we focus on the features, defining Wadi Ramm Rock Lizards solely.

Besides of metric and pholidotic features, colours and patterns of all populations of *P. kulzeri* s.l. are compared here. Finally, the habitat of Wadi Ramm is described.

Results and discussion

The mean and maximal head-and-body lengths (61.2 mm and 62.5 mm, respectively) are much bigger in Wadi Ramm Rock Lizards than in the representatives of Petra

Wall Lizards (54.5 mm and 61.5 mm, respectively). However, the specimens from Mt. Hermon (maximal 65.3 mm) and from Lebanese Djebel Barouk (max. 66.4 mm) are even bigger. The relative head length of 21.9 % indicates that the Wadi Ramm Rock Lizard is the most short-headed representative of *P. kulzeri*. Even the data of the relatively short-headed *P. k. petraea* (24.7 %) are exceeded. The length of tail is only limitedly useful as a feature, thanks to the very frequent regenerates. The tails of specimens from Wadi Ramm tend to be 2.2 times longer than the head-and-body length, therefore, a little (relatively) longer than in *P. kulzeri petraea* (mean 2.1 times). The length of the first supratemporal comprises 32.4 % of the parietal length, a figure typical for this species. In comparison with *P. k. petraea* (41.3 %), the supratemporals are very (relatively) long. The enlarged massetericum is obscure to almost invisible. Its diameter comprises on average 12 % of the parietal length, therefore representing together with both type specimens of *L. kulzeri* (11.1 %) the lowest value within the species. It is interesting, that the Wadi Ramm Rock Lizards show in numerous pholidotic features the highest values within *P. kulzeri*. The mean number of dorsal scales at midbody is 58.3 (max. 62). In other populations, the values vary between 48 and 53.9, only populations of Mt. Hermon and Petra exhibit maximum values that can reach the mean values of Wadi Ramm lizards. There are an average 16.4 (max. 20) supraciliar granules, mean for the remnant populations are 10 to 14. Here, the populations from northern and central Lebanon reach with their maximum the mean values of the Wadi Ramm Lizards. The number of gular scales in one line between symphysis of submaxillars and the collar (average 25.8; max. 27 as compared to 21.6–24.7 in other populations) is also very high. Together with Petra Rock Lizards, the specimens of Wadi Ramm wear the highest number of subdigital lamellae under the fourth and longest toe (averages for Petra = 30.4; max. 32, averages for Wadi Ramm = 30.9; max. 33 as compared to 26.2–29.7 in other populations). Also in the temporal region, the Wadi Ramm Rock Lizards show a very fine pholidosis with high numbers of scales. There are 13.4 (max. 15) temporal scales between postocular and tympanicum in one row, 4.9 (max. 6) temporals between massetericum and tympanicum, 3.5 (max. 5) temporals between massetericum and 5.6 (max. 7) temporals between supratemporal and supralabial. The Petra Rock Lizards wear significantly higher numbers of temporals (compare Tab. 2). The upper postocular is mostly evidently in touch with the parietal, which is predominantly not the case in populations from Petra.

The Wadi Ramm Rock Lizards are light brownish grey (Fig. 1). The entire dorsal part of the body wears a significant dark reticular pattern, sometimes modified to curls at the back. Medially, the neck is partly patternless. The pileus wears irregular dark splashes. A dark band starts just behind the nostril and reaches to the rostral margin of the tympanum. In the region around the upper labials, it is emarginated ventrally with a white stripe. Unlike the specimens from Petra, the dark band does not



Fig. 1. Adult male of *Phoenicolacerta kulzeri khazaliensis* ssp. n. from Wadi Rum.

extend to the flanks. Flanks appear a little darker than the back, thanks to their significant reticulation. The tail colour is the same as the body, but with slightly irregularly dark spots. The outer sides of the legs are clearly light dotted. The entire ventral side is patternless greyish white, with a mother of pearl shine. There are no blue spots there, which is typical for *P. kulzeri*.

Independently from the planned comprehensive revision of *Phoenicolacerta kulzeri*, the evident differences in the features of the Wadi Ramm Rock Lizards if compared to all other representatives of this species justify its description as a new subspecies.

Diagnosis. A middle-sized, short-headed Rock Lizard belonging to *P. kulzeri*-complex. Measuring on average 61.2 mm (head-and-body length), it is significantly larger than its geographically closest conspecific neighbour *P. kulzeri petraea*. The temporal scalation is very fine; the massetericum is (almost) indistinct. The subspecies reaches the highest mean numbers of the dorsal scales (58.3; compared to 48–53.9 in other populations), supraciliar granules (16.4; compared to 10–14), gulars (25.8; compared to 21.6–24.7) and subdigital lamelles (30.9; compared to 26.2–30.4) within *P. kulzeri* s. l. Unlike *P. kulzeri petraea*, the upper postocular touches the parietal mostly very clearly. The reticular pattern on generally light underground and the lack of dark bands on the flanks is an evident diagnostic feature if compared to all other *P. kulzeri* s.l.

Phoenicolacerta kulzeri khazaliensis ssp. n.

Holotype and Terra typica. adult male ZFMK 73470, Jordan: Wadi Ramm, Djebel Khazali, Hashemite Kingdom of Jordan, *leg.* D. MODRY, July 2000.

Description of the Holotype (Terminology used as in SCHMIDTLER & BISCHOFF, 1999). A big, slender specimen. KRL = 62.5 mm, Kl = 13.3 mm, Kb = 6.3 mm, Kh = 3.5 mm, Vb = 22.9 mm, Hb = 37.0 mm, 4. Z = 12.4 mm, S = 141 mm. Body indexes (in %): Kl : KRL = 21.3, Kb : Kl = 47.4, Kh : Kl = 26.3, Vb : KRL = 36.6, Hb : KRL = 59.2, 4. Z : Hb = 33.5, Tail 2.3 × as long as head and body. Pholidosis: 58 not keeled dorsal scales, 26 ventrals in longitudinal rows and 6 in transversal rows (there are additional 1 to 5 scales medially between the first 4 transversal rows), 22 marginals, 5/6 supralabials before subocular, suboculars significantly longitudinally keeled, 7/7 supraciliars, 16/17 supraciliargranules, 5 smaller scales on both sides behind the elongate supratemporal, Massetericum indistinct on both sides, temporals: tympanicum – postocular = 11/13, massetericum – tympanicum = 5/5, massetericum – supratemporals = 4/5, supralabials – supratemporals = 5/5; upper postoculars in evident contact with parietals, 1/1 postnasals, 3/2 frenals, 1/1 praeoculars, 24 gulars, 11 collars, tibial scales little smaller than dorsals (slightly keeled), 21/19 femoral

Table 1. Snout-vent lengths, body and pholidotic proportions of *Phoenicolacerta kulzeri khazaliensis* ssp.n. from Wadi Ramm in comparison to *Phoenicolacerta kulzeri petraea* from Al Iraq, Dana/Shoubak and Petra.

Character	<i>P. k. petraea</i>									<i>P. k. khazaliensis</i>		
	Al Iraq			Dana/Shoubak			Petra			Wadi Rum		
	No.	Min.	Max.	No.	Min.	Max.	No.	Min.	Max.	No.	Min.	Max.
Head-vent length (mm)	1	50.7	50.7	2	43.5	52.4	7	47.2	61.5	3	60.3	62.5
Head length: Head-ventlength (%)	1	22.3	22.3	2	22.3	25.5	7	23.7	26.4	3	21.3	22.2
Head width: headlength (%)	1	46	46	2	45.1	47.9	7	44.9	49.1	3	43	47.4
Head height: headlength (%)	1	26.6	26.6	2	19.8	25.6	7	23.3	28.3	3	22.2	26.3
Front leg: head-vent length (%)	1	35.9	35.9	2	34.5	35.5	7	32.9	39.2	3	35.5	36.6
Hind leg: head-vent length (%)	1	63.1	63.1	2	58.2	58.4	7	54.3	61.2	3	58.6	59.2
4th toe: hind leg length (%)	1	32.8	32.8	2	34.2	37.8	7	31.1	36.8	3	33.5	37.5
Height: width of occipital (%)	1	92.3	92.3	3	70.6	93.3	7	72.2	94.7	3	75	88.2
Length of interparietals: parietals (%)	2	42.9	43.9	6	40.9	55.3	14	33.3	53.9	6	42	46.8
Interparietals, width:length (%)	2	52.6	66.7	4	57.1	66.7	13	48.2	72.2	4	52.4	73.3
1st supratemporal: parietal (%)	4	41.2	50	8	32.3	44.7	26	26.7	53.6	8	26.5	40.4
Massetericum: parietals (%)	4	14.7	22	8	12.9	25.6	26	8.9	34	8	7.7	21.3
Anal, height: width (%)	1	60.6	60.6	3	47.2	69	7	48.8	65.5	3	53.1	67.6

Table 2. Pholidotic features of *Phoenicolacerta kulzeri khazaliensis* ssp.n. from Wadi Ramm in comparison to *Phoenicolacerta kulzeri petraea* from Al Iraq, Dana/Shoubak and Petra.

Character	<i>P. k. petraea</i>									<i>P. k. khazaliensis</i>		
	Al Iraq			Dana/Shoubak			Petra			Wadi Rum		
	No.	Min.	Max.	No.	Min.	Max.	No.	Min.	Max.	No.	Min.	Max.
Dorsals	1	48	48	3	52	56	7	50	59	3	57	62
Ventrals	1	25	25	3	24	26	7	25	28	3	24	26
Marginals	2	19	22	4	20	21	13	11	21	4	20	25
Supraciliars	4	6	8	6	5	7	26	5	7	8	6	7
Supracilar granula	4	13	14	6	13	14	26	11	15	8	14	20
Temporals (tympanicum postocular)	4	9	10	6	7	9	26	7	11	8	11	15
Temporals (massetericum tympanicum)	4	3	4	6	3	5	26	3	6	8	4	6
Temporals (massetericum supratemporals)	4	1	2	6	1	2	26	1	3	8	2	5
Temporals (supralabial supratemporal)	4	3	4	6	3	4	26	3	5	8	5	7
Gulars	2	22	23	4	22	24	13	22	27	4	24	27
Collars	2	11	11	4	8	11	13	8	10	4	9	11
Femoral pores	2	16	18	6	16	20	14	17	22	6	18	21
Subdigital lamella	2	28	30	6	29	31	13	28	32	6	30	33
Scales around the 6th tail vertebra	1	23	23	3	23	23	6	23	28	3	23	24
Scales between the femoral pores	1	4	4	3	2	4	7	3	5	3	3	4
Preanals	1	18	18	3	6	7	7	4	6	3	4	5

pores, 33/32 subdigitallamellae. Tail scales dorsally strongly keeled (ventrally at the basis not keeled), Tail whorls equally long, 24 scales around 6th tail whorl, 3 scales between the femoral pore rows, 5 pre-anals (the third central one is the smallest). Scale indexes (in %): occipital (height : width) = 77.8, interparietal (width : length) = 52.4, length of the interparietal : parietal = 42.0, length of the first supratemporal : parietal = 30.0/28.0, massetericum : parietal = 10.0/10.0, height : width of the anal shield = 67.6.

Colouration in alcohol: light sandy colours to olive-grey above. A dark brown band, irregularly lightly spotted, extends between the nostril and rostral rim of the tympanum. The bands are emarginated medially through

the edges of the pileus crests, ventrally through whitish supralabials and lower temporals. The posterior supralabials are dotted with black. The rostral is yellowish. Pileus is slightly and irregularly dotted with black. The back is decently reticulated with brown, the neck is predominantly patternless. The flanks with dark reticulation, giving them a darker appearance if compared to the back colouration. The dark flank bands are absent. The upper surface of the legs wear a dark reticulation also. Tail with irregular small dark dots. The ventral part of the body is bluish grey and patternless.

Paratypes. 3 specimens: ZFMK 73471–72.

Variation in paratypes. The variability is compiled in the tables 1 and 2, comprising measures, proportions and scalation of *Phoenicolacerta kulzeri khazaliensis* ssp. n. The paratypes and the holotype represent a very homogeneous group. For comparison, data of the geographically neighbouring *P. kulzeri petraea* are presented also. *ZFMK 73471* has a forked tail.

The colouration and pattern shows also a very little variation. A specimen at JUMR is darker bluish grey, when compared to the other specimens; evidently thanks to the conservation. *ZFMK 73471* is darker reticulated at the back than the holotype, indicating a reticular pattern similar to the ones on the flanks. In the JUMR specimen, this feature is even more expressed. The juvenile *ZFMK 73471* shows the same pattern as the adults. Its back is slightly darker dotted to reticulated. The tail was probably bluish to greenish when alive. Due to the absence of females in the type series, no comment on the sexual dimorphism can be made.

Derivatio nominis. The name is derived from the type locality, Djebel Khaz-ali in Wadi Ramm, Jordan.

Range. So far, specimens of the Wadi Ramm Rock Lizard are available only from deep gorge in massif of Djabal Khazali, Wadi Ramm, southern Jordan.

Biotope and Activity. Wadi Ramm is situated within the Sudanian Penetration ecozone of Jordan, an area of extreme desert climate with a mean annual rainfall of around 50 mm. Generally, it is an extensive network of very arid sandy wadis, dominated by the sandstone peaks of Jabal Ramm (1754 m) and Jabal Umm Ishrin (1753 m). In contrast to the generally arid appearance, the presence of faunal and floral Mediterranean elements, presumably of relict origin was documented recently. Several Mediterranean plant species were reported from the contact zone between the sandstone and magmatic rocks, for an extensive review see DANIN (1999).

Among the herpetofauna, a typically Mediterranean species also reported from Wadi Ramm is *Ablepharus rueppellii*, which was collected and observed repeatedly near freshwater springs nearby the Ramm village. *Chamaeleo chamaeleon* and *Hemidactylus turcicus* are further reptilian species with affinities to more humid or, at least, mesic habitats (SINDACO *et al.*, 1995, DISI *et al.*, 2001; ABU BAKER *et al.*, 2004) that were also recorded from the Wadi Ramm area.

A wealth of literature documents the oscillations of climatic conditions in the Near East over the past million years (NEEV & EMERY, 1967, BEGIN *et al.*, 1974, DANIN, 1999). Each period of a more humid climate could have allowed the Mediterranean flora and fauna to penetrate into the desert. Periods wetter than today's were recorded from approx. 780,000 years ago. Probably the best documented is the wet, pluvial period between 70,000 and 20,000 BP (HOROWITZ, 1979, in DANIN, 1999). More recently, between 10,000 and 8,000 BP, an increase of summer rainfall led to a generally more humid climate



Fig. 2. Habitat of *Phoenicolacerta kulzeri khazaliensis* ssp. n.

(TCHERNOV, 1998). Nevertheless, associating the relict occurrence of the Wadi Ramm Rock Lizard and other Mediterranean elements in Wadi Ramm with any of the mentioned humid periods without further data is purely speculative. Hopefully, future molecular phylogenetic analysis may help to estimate the separation of the Wadi Ramm population from the nearest taxa of the *Lacerta kulzeri* complex.

So far, *Phoenicolacerta kulzeri khazaliensis* ssp. n. is only known from Jabal Khazali in Wadi Ramm. It inhabits the deep canyon of this sandstone massif. The estimated length of the accessible part of canyon is around 200 m. In July 2000, adult animals were observed foraging on mostly vertical slopes of the canyon (both isolated and shaded) and basking on little horizontal ledges insulated by midday sunshine. When pursued, the lizards rapidly climbed to higher parts of cliffs and hid away in crevices or in bushes. A single juvenile was collected on the sandy bottom of the canyon, while the rest of the specimens were collected from the vertical sandstone cliffs. The entire canyon represents a unique wet habitat in the midst of xeric Wadi Ramm. Even in July, the sandy soil on the bottom was humid and there were dense growths of plants (mostly *Podonosma orientalis*) on its slopes and bottom and dense ferns *Adiantum capillus-veneris* on the lowest and shaded parts of slopes (Fig. 2). Moreover, some specimens of a false tree *Ficus pseudo-sycomorus* were recorded on the bottom.

Conservation. The Wadi Ramm Rock Lizard is currently known from only one single, very restricted population. It is possible, that careful exploration of hardly accessible cliffs and deep canyons in the Ramm mountains could result in the discovery of further populations. Most of the Wadi Ramm area is currently a Wildlife Reserve. Unfortunately, this had no direct positive impact on the population of this newly discovered Ramm Lizard, since the habitat of the population in Jabal Khazali is daily visited by unorganised groups of tourists. Some level of control of access to the deeper parts of the canyon, possibly with an informational board, is advisable as a first conservation measure limiting the human impact on the population.

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