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NEW DATA ON THE DISTRIBUTION, MORPHOLOGY AND HABITAT CHOICE OF THE *Lacerta laevis-kulzeri* COMPLEX

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Presently, within the lizard populations included in the *Lacerta laevis-kulzeri* complex, two main groups appear to be well distinguished in terms of morphology, distribution and ecology:

Lacerta laevis Gray, 1838 (sensu lato) which is generally distributed in the Mediterranean region to the west of the Rift valley between Central Israel/Palestine and southern Turkey. The species prefers humid habitats in oak forests, gardens and valleys. Despite considerable morphological variation, only one subspecies (*troodica* from Cyprus) has been acknowledged to date. During our research in the northern mountains to the east of the rift valley (Syria/Turkey), a quite distinct rock lizard was detected living in hills with sparse vegetation; our classification of it under *L. laevis* s.l. is highly provisional.

The second group comprises the often misunderstood rock-lizard *Lacerta kulzeri* Müller & Wettstein, 1932, described from Bcharré/Lebanon. It is mainly distributed in the continental mountains and hill lands to the east of the Rift valley, from the Anti-Lebanon to Petra/Jordan in the south. Morphologically different and isolated populations occur here and at the eastern side of the Lebanon Mts. and the volcanic Djebel Druz/South Syria.

Near Bloudan/Anti-Lebanon and at Djebel Barouk/Lebanon Mts. both groups were found sympatrically.

Key words: Sauria, Lacertidae, *Lacerta laevis-kulzeri* complex; distribution, morphology, ecology; Near East.

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Trenutno se unutar populacija guštera uključenih u *Lacerta laevis-kulzeri* kompleks mogu, na temelju morfologije, rasprostranjenosti i ekologije, dobro razlučiti dvije glavne skupine:

Lacerta laevis Gray, 1838 (sensu lato) koja je rasprostranjena uglavnom u Sredozemlju zapadno od doline Rift valley između Centralnog Izraela/Palestine i južne Turske. Vrsta preferira vlažna staništa u hrastovim šumama, vrtovima i dolinama. Uprkos značajnoj morfološkoj varijabilnosti, do sada je priznata samo jedna podvrsta (*troodica* s Cipra). Tijekom naših istraživanja u sjevernim

planinama istočno od doline Rift valley (Sirija/Turska), pronađena je na brežuljcima s rijetkom vegetacijom posebna gušterica; mi smo je vrlo provizorno smjestili u *L. laevis* s.l.

Druga skupina obuhvaća često pogrešno protumačenu *Lacerta kulzeri* Müller & Wettstein, 1932, opisanu iz Bcharré/Libanon. Ona je rasprostranjena uglavnom u kontinentalnim planinama i brežuljcima istočno od doline Rift valley, od Anti-Libanona do Petre/Jordan na jugu. Tamo i na istočnoj strani gorja Libanon i vulkanskog Djebel Druza/južna Sirija, javljaju se morfološki različite i izolirane populacije.

Blizu Bloudana/Anti-Libanon i na Djebel Barouku/gorje Libanon nađene su simpatrički obje vrste.

Ključne riječi: Sauria, Lacertidae, *Lacerta laevis-kulzeri* kompleks, rasprostranjenost, morfologija, ekologija; Bliski istok.

INTRODUCTION

Lacerta laevis Gray, 1838 is among the most cited lizards in the Eastern Mediterranean region, the Levant. The known great variability in the coloration of the lower flanks (BISCHOFF & FRANZEN, 1993) and the dorsal pattern has barely been investigated, or the differences in pholidosis and body-proportions. So it is not surprising that only two synonyms (*Podarcis judaica* Camerano, 1877 and *Lacerta laevis nigra* Angel, 1936 – widely overlooked hitherto) are available. At present, only the Cyprus populations are regarded as a valid subspecies (*L. laevis troodica* Werner, 1936).

BARBOUR (1914) was the first to notice that the lizards from Mt. Hermon and from Petra in Jordan are different from *L. laevis*; he assigned them to the southern Turkish *L. danfordi*, as did HOOFIEN (1968, 1969). BARBOUR's decision, however, was rejected by BOULENGER (1916) who again lumped them with *L. laevis*. In 1932 MÜLLER & WETTSTEIN described *L. kulzeri* from the Cedars above Bcharré in northern Lebanon, but one year later they considered the taxon a subspecies of *L. danfordi* (Müller & Wettstein 1933).

EISELT & SCHMIDTLER (1987) stated that the *L. danfordi*-complex reaches its southernmost limit in the central Amanus Mountains (Nur Dağlari) in southern Turkey. They also examined the two remaining type specimens of *L. kulzeri* and advocated their close relationship with *L. laevis*; they provisionally named the form of the high mountains of northern Lebanon »*L. laevis kulzeri*«. Henceforth the lizards of higher elevations on Mt. Hermon and from Petra were qualified as *L. laevis kulzeri* (see WERNER, 1988; HOOFIEN *et al*., 1990; SIVAN & WERNER, 1992; BISCHOFF & FRANZEN, 1993; SINDACO *et al*., 1995 »*L. laevis kueltzeri*«). DISI (1991) even quoted only *L. laevis kulzeri* for Jordan, though characteristic *L. laevis* live in the northwestern parts of the country.

The validity of the taxon *kulzeri* remained uncertain. Except for the three type-specimens (the specimen deposited in the Munich collections was destroyed in World War II) no material was available for investigation, and the political situation in Lebanon prevented research for some decades. Therefore, a final assessment of the short series from Mt. Hermon and Petra was also rendered difficult.

This unsatisfactory taxonomic situation was the reason for our being persistently on the look-out for lizards similar to *L. laevis* during numerous excursions in Turkey, Lebanon and Syria. The first results have been published: BISCHOFF & SCHMIDTLER

(1994, 1996), IN DEN BOSCH & BISCHOFF (1996), BISCHOFF *et al*., (1998), IN DEN BOSCH *et al*., (1998). *L. kulzeri* could be found again in Lebanon in many localities. It is the aim of this article to give some information about the present state of our investigations on the variability, distribution and ecology of the *Lacerta laevis-kulzeri* complex in the Near East. Further work on specific and infraspecific taxonomy is presently in preparation.

MATERIAL

We studied 76 *Lacerta laevis* sensu lato and 62 *L. kulzeri* s.l., among them the holotype of *L. laevis* Gray, 1838, the syntypes of *Podarcis judacia* Camerano, 1877, the neotype (designation by EISELT & SCHMIDTLER, 1987) and paratype of *L. kulzeri* Müller & Wettstein, 1932. Series from the following localities were included in our studies (see Fig. 1): Kahramanmaraş (TR), Harbiye (TR), Bcharré (RL), Baalbek (RL), Damascus (SYR), Cyprus, east of the Syrian rift valley (Al Barah / SYR and W. of Gaziantep / TR) here: »Eastern rock-*laevis*« , Central Lebanon, northern Lebanon (RL), Djebel Barouk (RL), Anti-Lebanon (SYR), Mt. Hermon (IL), Djebel Druz (SYR), and Petra (JOR).

The material collected during our excursions is presently housed in the Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn (ZFMK) and in the private collection of J. F. Schmidtler, Munich (CS). Other specimens discussed here are deposited in the following collections: British Museum (Natural History), London (BMNH); California Academy of Sciences, San Francisco (CAS); Hebrew University of Jerusalem (HUJ); Museo Regionale di Scienze Naturali, Torino (MZUT); Naturhistorisches Museum, Wien (NMW); Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main (SMF); University of Jordan, Amman (UA); Zoologische Staatssammlung München (ZSM).

METHODS

Characters studied: The arithmetic mean per series of the following morphometric and meristic features (each left /right side, if present) are used in this paper (descriptions in EISELT & SCHMIDTLER, 1987 and BISCHOFF & SCHMIDTLER, 1994): Snout vent-length (♂ / ♀), index first supratemporal / parietal (♂), index masseteric / parietal (♂), number of gulars (♂), dorsals (♂), ventrals (♂), scales in 6th tail-whorl (♂), femoral pores (♂), subdigital lamellae (♂), preanals (♂).

Moreover, the colouration of the lateral and the lower sides and the dorsal pattern were described. A statistically valuable exhibition of these features, especially of the dorsal pattern, is still awaiting completion..

Statistical procedures: The mean values of 9 morphometric and meristic features (except snout vent-length) are basic to the statistical procedures performed in this paper – descriptive statistics and cluster analysis. The phenetic distances between the series are represented numerically by the Manhattan-distances. Their values were used for calculation of a phenogram. The closer two series appear in the

Fig. 1. Distribution of the *Lacerta laevis-kulzeri* complex in the Near East. Above 1000 m (dotted areas), Syrian Rift valley (triangles), continuous distribution area of *L. laevis* s.l. (shaded zone). Populations investigated in this paper: *Lacerta laevis* s.l. (circles) and *L. kulzeri* s.l. (squares). 1 = Cyprus, 2 = Harbiye, 3 = Bcharré, 4 = Baalbek, 5 = Damascus, 6 = Kahramanmaraş, 7 = East of Syrian Rift valley, 8 = Central Lebanon, 9 = Anti-Lebanon, 10 = Djebel Druz, 11 = Petra, 12 = Mt. Hermon, 13 = Djebel Barouk, 14 = northern Lebanon.

branching sequence, the larger are their phenetic similarities. For cluster aggregation in the phenogram representation, the UPGMA was used (ROHLF, 1962; SNEATH & SOKAL, 1973).

RESULTS

Morphometric data

Snout vent-length: Though statistically valuable statements concerning the snout vent-lengths are difficult because of permanent ontogenetic growth, a surprising variation in sexual size dimorphism is obvious: In most *L. laevis* s.str. and *L. laevis troodica* the males attain the largest sizes in general; the females remain smaller. In the »Eastern rock-*laevis*« (No. 7) and in *L. kulzeri* s.l. the females are larger than the males (see Tab. 1).

Tab. 1. Maximal / mean values of the snout vent-lengths in the 14 populations of the *Lacerta laevis-kulzeri* complex (see Fig. 1).

species / series	♂				♀			
	n	**min**	**x**	**max**	**n**	**min**	**x**	**max**
L. l. laevis / Kahramanmaraş	6	56.0	64.5	73.0	6	57.0	62.7	67.0
L. l. laevis / Harbiye	5	69.4	70.8	72.5	5	57.6	67.8	71.6
L. l. laevis / Bcharré	5	61.0	67.8	72.9	5	51.6	56.3	64.6
L. l. laevis / Baalbek	5	61.7	68.5	76.5	3	62.5	67.1	70.9
L. l. laevis / Damascus	5	56.6	73.1	84.9	3	70.5	73.9	76.2
L. laevis troodica / Cyprus	5	62.2	65.4	70.0	5	57.8	60.3	62.7
L. cf. *laevis* / E. Syr. Rift valley	7	54.2	58.7	61.5	3	54.4	59.7	63.0
L. kulzeri / central Lebanon	5	49.8	54.0	59.2	5	48.7	53.3	60.8
L. cf. *kulzeri* / n Lebanon	1	–	51.2	–	3	49.7	53.4	55.5
L. cf. *kulzeri* / Djebel Barouk	6	58.8	62.1	66.4	4	54.7	62.9	66.0
L. cf. *kulzeri* / Antilebanon	6	49.0	56.1	60.9	5	55.0	58.2	62.4
L. cf. *kulzeri* / Mt. Hermon	1	–	63.5	–	5	57.6	63.8	70.5
L. cf. *kulzeri* / Djebel Druz	5	55.9	58.0	61.8	5	48.8	58.6	65.2
L. cf. *kulzeri* / Petra	6	47.2	55.5	61.5	3	59.5	61.7	64.4

Pholidosis: The diagnostic importance of the size of the masseteric within the *L. laevis-kulzeri* complex has been mentioned several times (MÜLLER & WETTSTEIN, 1932; HOOFIEN, 1968; HOOFIEN *et al.*, 1990; BISCHOFF & SCHMIDTLER, 1994; BISCHOFF *et al.*, 1998). This fact is confirmed by our studies (Tab. 2): Two groups exist from the point of view of the mean values of the masseteric / parietal index: large, i.e. 31 – 40 (all series of *L. laevis* s.l.; except the »Eastern rock-*laevis*«: 25 !), and small, i.e. 15 – 27 (in all *L. kulzeri* s.l.). In 5 further features a similar grouping is more or less evident (Tab. 3): Supratemporal / parietal index, dorsals, scales in 6th tail-whorl, subdigital lamellae, preanals. *L. laevis troodica* is mostly similar to the continental *L. laevis* s.str., even if exceeding the ranges of the mean values of the samples of the latter. The position of the »Eastern rock-*laevis*«, however, seems to be ambiguous;

Tab. 2. Index masseteric-diameter / parietal-length (♂ + ♀) in %. Minimal / mean / maximal values; standard deviation (×).

species / series	n	min	x	max	(n–1)
L. l. laevis / Kahramanmaraş	24	23.17	40.26	50.70	7.06
L. l. laevis / Harbiye	20	22.45	39.71	54.00	8.13
L. l. laevis / Bcharré	20	22.22	31.16	41.79	6.22
L. l. laevis / Baalbek	16	20.83	32.01	40.00	6.47
L. l. laevis / Damascus	16	18.75	36.93	44.00	6.85
L. laevis troodica / Cyprus	20	26.67	34.71	46.38	5.37
L. cf. *laevis* / E. Syr. Rift valley	20	9.43	24.97	36.36	7.25
L. kulzeri / central Lebanon	20	7.90	15.06	26.67	5.24
L. cf. *kulzeri* / n Lebanon	8	13.46	17.02	21.95	2.87
L. cf. *kulzeri* / Djebel Barouk	20	11.11	18.69	25.00	3.92
L. cf. *kulzeri* / Antilebanon	20	11.11	17.14	25.58	4.00
L. cf. *kulzeri* / Mt. Hermon	12	14.29	19.80	36.00	5.98
L. cf. *kulzeri* / Djebel Druz	20	17.02	26.86	31.71	4.49

the mean values of some features are nearer to those of *L. laevis* s.l., in other nearer to the values of *L. kulzeri* s.l.; in some they exceed both (Tab. 3). This situation probably accounts for the problematic aspects of the UPGMA-phenogram (see above).

Colouration and pattern

L. laevis s.l. and *L. kulzeri* s.l. are well discriminated by features of colouration (body and tail): Adult *L. laevis* s.l. always display blue points on the outer ventrals. Throat and belly are mostly blue, green, yellow or red, especially in adult males (less pronounced in females, missing in juveniles). This colouration – with some peculiarities also present in the »Eastern rock-*laevis*« – is subject to great geographical variability (BISCHOFF & FRANZEN, 1993), which will be described elsewhere. In *L. kulzeri* s.l., none of these colours have been recorded. On the other hand, young specimens of *L. kulzeri* s.l. display bluish or greenish (turquoise) tails, never present in *L. laevis* s.l.

The pattern of the dorsum in *L. kulzeri* s.l. seems to be more variable than in *L. laevis* s.l. This fact especially refers to a clear geographical variation. *L. kulzeri* (central Lebanon) is more or less dorsally reticulated (see figs. in IN DEN BOSCH & BISCHOFF, 1996; IN DEN BOSCH *et al.*, 1998). Specimens from Anti-Lebanon, and surprisingly also from northern Lebanon, are distinguished by their broad and distinct dark bands along the flanks continuing onto the tail (BISCHOFF & SCHMIDTLER, 1994). The background colouration of Djebel Barouk- and Hermon- specimens is darker than that in the Anti-Lebanon-specimens; their flanks are also banded, but

Tab. 3. Basic data (only mean values) for the Manhattan-distances in Tab. 4: I = Index 1st supratemporal / parietal (%), II = Index masseteric / parietal (%), III = gulars, IV = dorsals, V = ventrals, VI = scales in 6th tail-whorl, VII = femoral pores, VIII = subdigital lamellae, IX = preanals.

	Cyprus	Harbiye	Bcharré	Baalbek	Damascus	Kahraman-maraş	E. Syr. Rift valley	central Lebanon	Antilebanon	Dj. Druz	Petra	Mt. Hermon	Dj. Barouk	n Lebanon
I	36	43	44	42	43	44	33	34	36	38	41	34	37	36
II	35	40	31	32	37	40	25	15	17	27	15	20	19	17
III	24.8	21.5	22.0	20.9	20.7	20.2	23.0	24.7	23.9	22.3	24.1	22.7	21.6	23.2
IV	65.0	57.8	56.2	59.2	54.0	52.8	62.4	51.8	50.8	53.4	54.8	50.0	50.2	52.0
V	24.8	23.8	24.8	23.6	24.6	23.9	25.0	25.8	25.6	25.8	26.5	24.1	25.7	24.1
VI	27.8	27.4	28.0	25.8	26.4	26.2	24.0	23.8	23.8	22.7	25.3	24.2	24.7	24.0
VII	21.3	20.7	20.5	21.4	19.9	19.4	22.4	17.7	18.1	19.8	19.7	21.2	20.6	18.0
VIII	35.1	31.1	30.8	33.9	31.7	29.0	33.0	28.9	30.2	27.8	30.9	26.5	28.4	28.5
IX	6.4	7.8	7.2	8.0	6.8	7.5	6.9	5.4	4.6	5.4	5.0	5.3	5.0	5.0

the dorsal sides are more or less reticulated (HOOFIEN *et al*., 1990). Specimens from the volcanic Djebel Druz have a striking dark reticulation (BISCHOFF *et al*., 1998). Finally, the lizards from Petra are very light, with a more or less twisted dorsal pattern and indistinctly banded flanks (MÜLLER & BISCHOFF, 1994).

The geographical variation of the dorsal pattern in continental *L. laevis* s.l. appears to be less pronounced than in *L. kulzeri* s.l. The pattern of *L. laevis troodica* resembles Anti-Lebanon-specimens in some respect (SCHÄTTI & SIGG, 1989). In general, the dorsal pattern of *L. laevis* s.l. is characterized by two faint lateral bands and a broad middorsal row of more or less indistinct points and spots (BISCHOFF & FRANZEN, 1994).

Cluster analysis

Despite a partly small sample size, the two main branches within the phenogram appear to be well supported. We provisionally name the populations aggregated in these two branches »*Lacerta laevis* s.l.« and »*Lacerta kulzeri* s.l.«. The clustering of the Cyprus *L. l. troodica* with the population here named »Eastern rock-*laevis*« (No. 7 in the map; see also Material section) reveals some problems if only Manhattan-distances are considered:

a. The distance between *troodica* and the »Eastern rock-*laevis*« is relatively low (2.79).

b. The distances between *troodica* and the continental *laevis*-samples (2.76 – 4.60) are clearly higher than between the continental *laevis*-samples (1.17 – 2.80).

c. On the other hand, the distances between *troodica* and the *L. kulzeri* s.l.-samples are extremely high (4.44 – 5.68).

d. The distances between the »Eastern rock-*laevis*« and the other *L. laevis* s.l.-samples (2.79 – 5.48; mean: 3.97) are very unequal and slightly higher than between the »Eastern rock-*laevis*« and the *L. kulzeri* s.l.-samples (3.12 – 3.70; mean: 3.62 !).

The classification of the »Eastern rock-*laevis*« under the name *L. laevis* s.l. must therefore be considered as highly provisional[1].

Distribution and habitat

The *L. laevis-kulzeri* complex is endemic to the Eastern part of the Mediterranean region, the so called »Levant«. *L. laevis* s.l. is continuously distributed from the central part of the Turkish Taurus Mountains in the north (Lamas valley W of Mersin and Dereşimli/Kayseri, see BISCHOFF & FRANZEN, 1993 and SCHMIDTLER, 1997) along the coastal plains and western mountains and hills (the natural regions No. I A/B in the Mediterranean region sensu ABDULSALAM & POHLMANN, 1985) down to Jerusalem in central Israel (Fig. 1). Its main distribution is restricted to the west of the

[1]Meanwhile this form was described »*Lacerta cyanisparsa*« Schmidtler & Bischoff (1999).

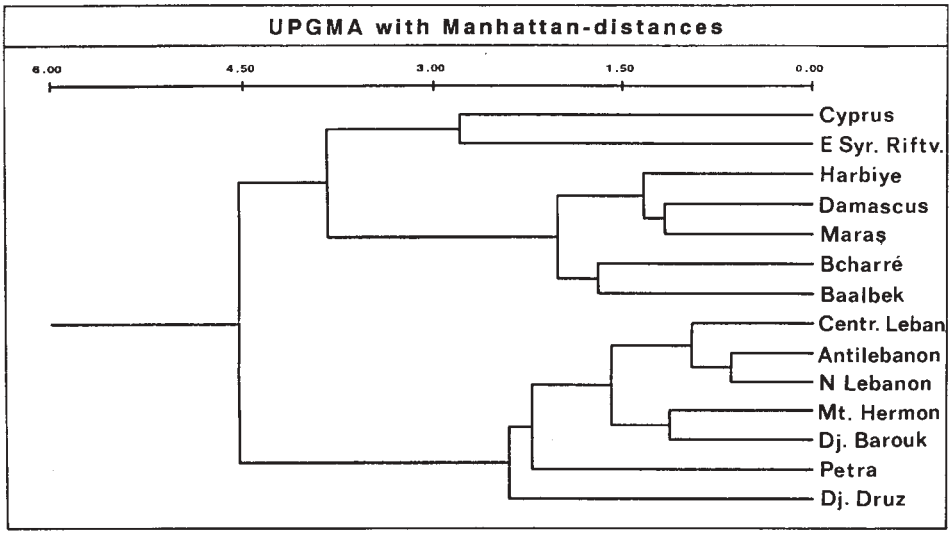

Fig. 2. Manhattan-distances (Tab. 4) and UPGMA-phenogram.

Syrian rift valley, except the »Eastern rock-*laevis*« (No. 7 in Fig. 1) and some other isolated localities in Syria and Jordan.

On the other hand, the populations of *L. kulzeri* s.l. have isolated distributions predominantly in the southern part of the »Mountains and hill lands to the east of the rift valley« (Natural region no. III sensu ABDULSALAM & POHLMANN, 1985) from the Anti-Lebanon Mountains in the north to Petra in the south (Fig. 1). It attains Lebanon Mountains – mainly on the eastern slopes – to the west and the volcanic Djebel Druz (No. VIII E »Djebel al'Arab« sensu ABDULSALAM & POHLMANN, 1985). The lower limit of the vertical distribution is 1100 m.

According to its main distribution, *L. laevis* s.l. (except the »Eastern rock-*laevis*«, see below) lives in zones with high precipitations between 600 and 2000 mm annually. In the drier zones east of the rift valley, this group is restricted to regions with a high edaphic humidity (e.g. the Barada-oasis around Damascus or the ruins within the gardens of Baalbek). So, *L. laevis* s.l. prefers shady habitats in gardens or oak-forests, or valleys with *Platanus orientalis*. Here, it may be found in meadows, or climbing on trees and rocks up to altitudes of 1900 m – in the surroundings of Bcharré in northern Lebanon. *Mabuya vittata* often lives syntopically with *L. laevis* s.l., especially in meadows.

Contrary to this, the »Eastern rock-*laevis*« east to the rift valley, and *L. kulzeri* s.l., are typical rock lizards. They generally live in climatically drier zones with annual rainfalls between 300 and 600 mm. In these areas they are found on large, strongly insolated, bare rocks, often without vegetation or water around. *Laudakia stellio*, *Lacerta cappadocica* (only »Eastern rock-*laevis*«) and *Ptyodactylus puiseuxi* may be found syntopically with *L. kulzeri* s.l. or the »Eastern rock-*laevis*«. In the two localities where *L. kulzeri* s.l. and *L. laevis* s.l. occur sympatrically (Bloudan / Anti-Lebanon

Tab. 4. Manhattan-distances (calculated by NTSYS) between the 14 series of the *L. laevis-kulzeri* complex accounted in Fig. 1. The basic data see Tab. 3.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	0.00													
2	3.32	0.00												
3	3.30	1.64	0.00											
4	2.76	1.83	1.70	0.00										
5	3.43	1.31	1.58	1.99	0.00									
6	4.60	1.37	2.23	2.80	1.17	0.00								
7	2.79	4.47	3.64	3.06	4.38	5.48	0.00							
8	5.68	6.27	4.98	5.74	5.27	5.41	3.84	0.00						
9	5.31	5.72	4.43	5.20	4.72	5.13	3.74	0.94	0.00					
10	4.44	4.06	2.77	3.53	3.06	3.42	3.12	2.70	2.49	0.00				
11	5.26	4.60	3.33	4.08	3.78	4.68	4.02	1.91	1.81	2.79	0.00			
12	5.36	5.46	4.37	4.82	4.74	4.89	3.23	1.88	1.82	2.31	3.10	0.00		
13	5.31	4.99	3.81	4.47	4.14	4.40	3.70	1.83	1.29	1.87	2.21	1.13	0.00	
14	5.38	4.48	4.34	4.96	4.59	4.62	3.70	0.97	0.64	2.24	2.06	1.47	1.27	0.00

BISCHOFF & SCHMIDTLER, 1994 and Djebel Barouk / Lebanon IN DEN BOSCH *et al.*, 1998), a niche segregation, as described above, is evident.

DISCUSSION

Though our studies are not finished, the specific rank of some populations within *L. laevis* s.l. and *L. kulzeri* s.l. is proved by sympatry (see above, and IN DEN BOSCH *et al.*, 1998). The populations grouped in the two main clusters of the UPGMA-phenogram may be attributed to at least two different species. The possible bipartition of the *Lacerta laevis-kulzeri* complex is supported by morphometric data, pattern, colouration, distribution and ecology as described above.

As stated above, the insular *troodica* is probably more different from continental samples than previously believed (OSENEGG, 1989; SCHÄTTI & SIGG, 1989; BÖHME & WIEDL, 1994; BUDAK & GÖÇMEN, 1995 see also IN DEN BOSCH, 1998). Nevertheless the examination of more material from Cyprus is needed. Within the remaining samples of the continental *L. laevis*, great Manhattan-distances are visible. However, at present, no geographical pattern is recognizable in the variation of the single characters. This is strikingly obvious for the gular colouration: regions with blue throats may be interrupted by zones with yellow, red or green throats. More material, especially from southern Syria, Jordan and Israel, is currently being investigated by us. A restriction of the type locality of *L. laevis* is necessary.

On the other hand, the structures of geographical variability seem clearer in *L. kulzeri* s.l., especially if the dorsal pattern is statistically included. Our first results

correspond to the insular distribution of that group. With respect to morphometric data and the dorsal pattern, at present five units may have taxonomic rank: Central Lebanon (= *L. kulzeri* s.str.), northernmost Lebanon + Anti-Lebanon, Djebel Barouk (possibly including Mt. Hermon), Djebel Druz, and Petra.

As stated in the chapters »cluster analysis« and »morphometric data«, the attribution of the »Eastern rock-*laevis*« to *L. laevis* s.l. is highly provisional. The doubtfulness of its systematic relationships is further documented by pattern and colouration (both agreeing with *L. laevis*, except some peculiarities), its distribution and ecology (both nearer to *L. kulzeri* s.l.). The questions arising cannot be answered by numerical systematics alone. Cladistic studies in morphometrics should be added, as well as genetic or ethological studies, which are planned for the near future (MAYER, IN DEN BOSCH in prep.).

See also footnote on page 218.

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