Morphological and serological investigations on *Lacerta laevis* Gray, 1838 (Sauna: Lacertidae) populations from Anatolia

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Abstract: A total of 51 specimens of *Lacerta laevis* (25 ♂, 26 ♀) from the area of Mersin and Hatay (southern Anatolia) were investigated morphologically, and of these 24 specimens (12 ♂, 12 ♀) were analyzed from the viewpoint of their blood-serum proteins. The populations were found to show great intra- and interpopulation variation in their pattern and colour characteristics and in their serological analyses, while their morphometric characteristics were found to be similar. It is thus concluded that, for the present, it is not possible to separate them into different subspecies.

Kurzfassung: Aus dem Gebiet von Mersin und Hatay in Süd-Anatolien wurden insgesamt 51 Exemplare von *Lacerta laevis* (25 ♂, 26 ♀) morphologisch untersucht; dartiber hinaus wurden von 24 Exemplaren (12 ♂, 12 ♀) auch die Blutserum-Proteine analysiert. Es zeigte sich, dass in Bezug auf Färbung, Färbungsmuster und Serumproteine die Variation sowohl innerhalb dieser Populationen als auch zwischen den beiden Populationen sehr groβ ist, dass diese Variation jedoch nicht in morphologischen Merkmalen zum Ausdruck kommt. Es wird daher vorgeschlagen, von einer Benennung einer eigenen Subspezies vorläufig abzusehen.

Key words: Geographic variation, blood serum proteins, morphology, Turkey, Middle East, Mediterranean area.

Introduction

The SW Asian range of *Lacerta laevis* Gray, 1838 includes Syria, Lebanon, Jordan, Palestine and Israel. The first record from Anatolia, Taurus Mountains, was by WERNER (1899). MERTENS *(1952)* included the Hatay samples in *L. laevis* while placing those from Cyprus in *L. 1. troodica.* BUDAK'S (1976) detailed survey of the *L. laevis* populations from Anatolia concluded that they all belong to the nominate race. According to later studies on Cyprus populations, both from the viewpoint of their morphology (BUDAK & GÖÇMEN 1995*)* and of their blood-serum protein characteristics (TOSUNOĞLU et al. 1999), the Cyprus material was found to be different from the Anatolian material, and so these authors proposed to raise the Cyprus populations to species level as *L. troodica.* However, BEYERLEIN & MAYER (1999) were of the opinion that the population from Cyprus should be accepted at the subspecies level.

Several authors (BISCHOFF & FRANZEN 1993, BISCHOFF **&** SCHMIDTLER 1994) have stated that *L. laevis* populations from Mersin are different from those from Hatay in their venter colour. BISCHOFF & SCHMIDTLER (1994) further stated that the venters of male Mersin specimens resemble those from Syria (Amasi Mts.) in being grey-white or yellowish; gular region and throat are bright

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blue. The acceptance of *kulzeri* as a separate species (BISCHOFF & SCHMIDTLER 1994), which was formerly regarded as a subspecies of *L. laevis* (EISELT & SCHMIDTLER 1986, HOOFIEN, et al. 1990) has left *L. laevis* as monotypic.

The aim of the present work was to study in detail the *L. laevis* populations of Mersin and Hatay, and to find out whether they differ taxonomically, at least at a subspecific level. The differences in regard to morphology and serology were previously described by BUDAK (1976), BISCHOFF & FRANZEN (1993), BISCHOFF & SCHMIDTLER (1994, 1999), SCHMIDTLER & BISCHOFF (1999), TOSUNOĞLU et al. (1999).

Material and methods

ZDEU (= Zoology Department-Ege University, Izmir) 53/1997. 1-21 (10 ♂, 11 ♀) Döver Köyü, Harbiye-Hatay, 18.5.1997, leg M. TOSUNOGLU & B. SALİM.
ZDEU 59/1997. 1-6 (4 ♂, 2 ♀) Belen, lskendemn-Hatay, 19.5.1997, leg M. TOSUNOĞLU & B. SALİM.
ZDEU 60/1997. 1-30 (15 ♂,15 ♀) Mezitli-Mersin, 20.5.1997, leg. M. TOSUNOĞLU & B. SALİM.

A total of 51(25 ♂, 26 ♀) specimens from two different localities in the Hatay and Mersin areas were investigated morphologically, while the serological investigation included the additional intermediate Iskenderun material. The specimens were brought live to the laboratory, and colour slides were taken. Morphometric measurements were made with a dial caliper of 0.05 mm sensitivity. Measurements and related ratios obtained from the two populations were also compared utilizing their CD (Coefficient of Difference; MAYR 1969) values.

Blood samples were obtained from the postorbital sinuses and the etherized lizards were properly fixed and kept in 70% ethanol. Blood-serum proteins were separated by polyacrylamide disc-electrophoresis. The qualitative evaluation of the separations were done on densitometric tracing curves, obtained from a Gelman ACD-15 Model 39430 densitometer scanning at 500 nm, kept in 70% ethanol. The electropherograms were also visually compared.

Results

Pattern and colour. During the breeding season, top of the head is dark olive-green in specimens from Mersin and Hatay. Ground colour of the dorsum is olive-green or light brown. Overlaying top of the head and legs, darker small spots are sparsely present. Males and females of both of the populations show almost the same pattern on their dorsum and generally two types are evident:

1. Dorsum is homogenous in ground colour or with a few indistinct small spots. In 17 of the Hatay specimens (81%), 27 of the Mersin specimens (90%) and 5 of the geographically intermediate Iskenderun (Belen) specimens (83%) this pattern is evident.
2. A pattern forming very fine spots or small maculations randomly covers the dorsum from the nape of the neck to the base of the tail. These partly come together at the tail base and continue backwards as an intermittent dark line. This type of pattern was seen in only 4 (19%) of the Hatay specimens, in 3 Mersin (10%) and 1 Iskenderun (17%) specimens.

The populations displayed significant variation in their ventral colour. The gular regions, throats and whole venters of the Hatay males were dark brick-red, while in females the same areas were greyish-green or dirty white. In Mersin males the venters were yellowish-green, the submaxillar plates blue or greenish-blue, while in females the venters were mainly light greyish-white.

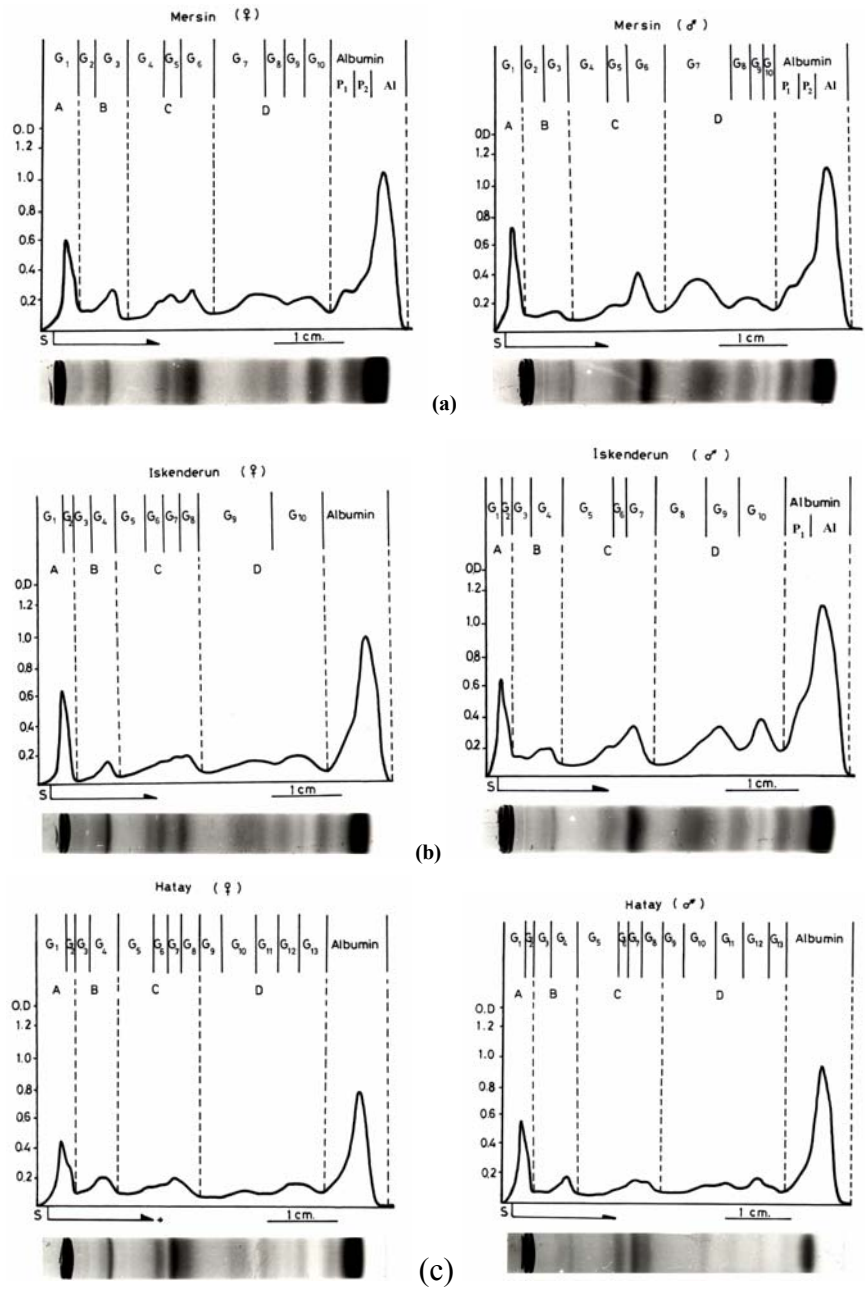

Fig. 1. Representative electropherograms and their densitometric tracing curves of males and females of *Lacerta laevis* from Mersin (a), Iskenderun (b) and Hatay (c), respectively. Al: Albumin; P: Post-albumin; G_1, G_2, etc.: Globulins; O.D.: Optical Density; A to D: Arbitrarily chosen globulin zones to facilitate the comparison of the same areas of the different electrophoretic tracing curves.

Tab. 1. Some pholidotical characteristics and body ratio indices of *L. laevis* specimens collected from two different localities (N: sample size, SD and SE: Standard deviation and Standard error of the mean, CD: Coefficient of Difference values, the measurements are in millimetres), MS: number of scales encircling massetericum, SG: number of supraciliary granules, T: temporals, MG: median gulars, C: collars, D: dorsals, V: ventrals, F: femorals, TL: 4th toe lamellae, HW/HL: head width/head length, PW/HL: pileus width/head length, H/SVL: head length/snout vent length, MD/HL: massetericum diameter/head length.

	Harbiye-Hatay					Mezitli-Mersin					
	N	**range**	**mean**	**SD**	**SE**	**N**	**range**	**mean**	**SD**	**SE**	**CD**
MS	21	8-15	11.86	1.98	0.433	30	8-14	10.93	1.29	0.235	0.28
SG	21	7-14	10.38	1.53	0.334	30	6-14	10.47	1.52	0.288	0.02
T	21	33-62	45.33	8.18	1.784	30	30-59	46.13	7.75	1.416	0.05
MG	21	18-23	21.02	1.51	0.330	30	18-24	20.50	1.54	0.282	0.17
C	21	9-13	10.76	1.29	0.388	30	9-12	10.93	1.03	0.188	0.07
D	20	51-63	57.25	2.79	0.624	30	51-61	54.47	2.35	0.429	0.54
V	10 ♂	23-25	24.40	0.70	0.221	15 ♂	23-26	24.67	0.82	0.211	0.17
	11 ♀	24-28	26.64	1.29	0.388	15 ♀	25-28	26.80	1.01	0.262	0.06
F	21	17-24	20.43	1.89	0.412	30	18-23	20.07	1.37	0.235	0.11
TL	21	28-35	31.24	1.97	0.430	30	29-34	31.07	1.29	0.235	0.05
HW/HL	21	54.20-68.18	62.02	3.80	0.830	30	54.45-67.46	61.93	2.80	0.511	0.01
PW/HL	21	44.46-52.17	49.05	1.79	0.391	30	43.29-50.13	48.00	1.57	0.286	0.31
H/SVL	10 ♂	26.44-27.90	26.93	1.00	0.316	15 ♂	25.29-27.73	26.69	0.73	0.189	0.13
	11 ♀	22.11-24.04	23.24	0.50	0.151	15 ♀	21.61-24.28	22.83	0.75	0.193	0.32
MD/HL	21	8.70-22.61	13.48	3.55	0.775	30	6.46-14.84	11.33	1.79	0.326	0.40

In males of the geographically intermediate Iskenderun population, the gular region, throat and anterolateral parts of the venter were light brick-red, the rest of the venter greyish-white or, as in the Mersin males, the throat region and the anterolateral parts of the venter were greenish-yellow or bluish, the rest of the venter dirty white, similar to those of the females.

These typical colours change outside the breeding season in all populations. The changes were noted in the field for all of the different groups. The reddish tinge of the Hatay males was seen only in gular and throat regions, the rest of the venter becomes greyish-green. In Mersin males, the dominant yellowish-green is replaced by greyish-white, but a blue or greenish-blue tinge is still more or less distinct on submaxillar plates.

Pholidosis and Morphometry. Pholidotic and morphometric data of Hatay and Mersin populations are summarized in Tab. 1. The two populations were found to be quite similar in respect of the compared characteristics. The related CD values were always found less than 1.28, the significant difference level.

Serological Evaluation. The electrophoretic patterns of the examined blood-serum proteins from Mersin, Iskenderun (Belen) and Hatay specimens were found to show a high degree of intra- and interpopulation variation.

In three males from the Mersin population there were two post-albumin fractions before the albumin band, but in one specimen (25%) there was only one post-albumin fraction; in all of the females two post-albumins were seen. It was possible to differentiate ten fractions or fraction groups within the globulin zones of the whole sample (Fig. la).

In two of the four males from the intermediate Iskenderun population, a single post-albumin fraction was seen before the albumin band, but in the remaining two no post-albumin was discerned. A barely discernible post-albumin fraction was seen in the two female specimens. Again, ten fractions or fraction groups were present within the globulin zones of the whole sample (Fig. lb).

While a single post-albumin fraction was evident in two of the four Hatay males, the remaining two had none (Fig. 1c). Similarly, two females possessed single post-albumin fractions but three had none. It was possible to differentiate thirteen fractions or fraction groups within the globulin zones of the whole sample (Fig. lc).

Conclusion

Our data indicate that the *L. laevis* populations from Mersin and Hatay show significant intra- and interpopulation variation as regards blood-serum proteins, and pattern and colour characteristics. They were, however, found to be quite similar regarding their morphometric and pholidosis characteristics. The intrapopulation serological variation stemmed mainly from differences between the sexes, while the main cause of the interpopulation serological variation was concerned with the globulin zones and was of a quantitative nature, i.e. the causes of this variation may be hunger, various stresses, illnesses or some other environmental factors, and so they cannot be a basis for separating the populations into different taxa. So, for the present, we conclude that it is not possible to differentiate the two populations of *L. laevis* at a subspecific level, and so it is still a monotypical species.

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