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A new subspecies of Atif's Lycian Salamander *Lyciasalamandra atifi* (BAŞOĞLU, 1967), from Alanya (Antalya, Turkey)

(Caudata: Salamandridae)

Eine neue Unterart von Atifs Lykischem Salamander, *Lyciasalamandra atifi* (BAŞOĞLU, 1967) von Alanya (Antalya, Türkei)

(Caudata: Salamandridae)

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KURZFASSUNG

Eine neue Unterart von *Lyciasalamandra atifi* (BAŞOĞLU, 1967) wird aus dem südwestmediterranen Anatolien (Alanya, Provinz Antalya, Türkei) beschrieben. Das neue Taxon unterscheidet sich von der nominotypischen Unterart durch eine geringere mittlere Kopf-Rumpf-Länge, eine relative längere Schnauzenregion, graue Rückenfarbe und ein geschlechtsspezifisch unterschiedliches Zeichnungsmuster. Männchen unterscheiden sich von Weibchen durch den Besitz zweier Längsbänder aus weißen Sprenkeln, die jeweils einen schwarzen Punkt tragen. Die Weibchen haben relative größere Köpfe und Ohrdrüsen sowie längere Hinterbeine als Männchen.

ABSTRACT

A new subspecies of Atif's Lycian Salamander, *Lyciasalamandra atifi* (BAŞOĞLU, 1967) is described from the south-west Mediterranean region of Anatolia (Alanya, Antalya Province, Turkey). The new taxon differs from the nominotypic subspecies by having shorter mean total body length, comparatively longer rostrum, grey coloration on dorsum, and a sex-specific pattern. Males differ from females in having two longitudinal bands constituted by white flecks with black points. Females have comparatively bigger heads, parotid glands and longer hind limbs than males.

KEY WORDS

Amphibia: Caudata: Salamandridae, *Lyciasalamandra atifi bayrami* ssp. n., new subspecies, systematics, taxonomy, serology, south-west Anatolia, Taurus Massif, Alanya, Turkey

INTRODUCTION

Nine forms of the salamandrid genus *Lyciasalamandra* were known from the Mediterranean coast of Turkey and some of its islands (STEINDACHNER 1891; PIEPER 1963; BAŞOĞLU 1967; BAŞOĞLU & ATATÜR 1974, 1975; BAŞOĞLU & BARAN 1976; BARAN & ATATÜR 1980; FRANZEN & KLEWEN 1987; MUTZ & STEINFARTZ 1995; ÖZ et al. 2004) until GÖÇMEN et al. (2011) described *L. irfani* from Göynük Canyon (Antalya province) and GÖÇMEN & AKMAN (2012) *L. arikani* and *L. yehudahi* from the Mountains Erentepe (Kumluca Antalya) and Tahtalı (Kemer, Antalya), raising the number of taxa to twelve.

Lyciasalamandra atifi (BAŞOĞLU, 1967) was described as *Mertesiella luschani atifi* from Türbelinaz village, Alanya, Antalya Province, Turkey. Later, BAŞOĞLU & BARAN (1976) extended its known distribution range by the locality record Dikmen village, 14 km southeast of Akseki, Alanya and VEITH et al. (2001) recorded it from Selge and the Cebireis Mountains. Until 2011, *L. atifi* was known along approximately 110 km of the Taurus Mountain range, from Türbelinaz village to the vicinity of the ancient city of Selge (Altınkaya, Serik) (BAŞOĞLU & BARAN 1976; ÖZ et al. 2004; FRANZEN et al. 2008). AKMAN et al. (2011) found 15 *L. atifi* specimens at five new localities (Dim Cave, Gözüküçüklü village, Uzunöz village, Kuşyuvası and Kaplanhanı Plateu) east of Dereköy, Alanya, the previously easternmost known locality, thereby extending the known distribution range of

the species 35 km to the east. These authors pointed out that their new specimens were smaller than other Atif's Lycian Salamander specimens and were of greyish color with small blackish flecks on the dorsum instead of dark brown ones. The juveniles were yellowish on the posterior half of the parotids and along the caudal midline. These differentiations were thought by the authors to be based on their young developmental stage. In total, Akman et al. (2011) evaluated one male, one female and 13 juveniles in their study and, because of the small number of adult individuals, interpreted these differences as variations. After two more trips in the vicinity of the new localities (Cebel-i Reis, Alanya, Antalya province), more adult specimens were collected which attracted their attention. The new specimens originated from four new record localities along the east side of the Dim River. Most recently, the known distribution range of the species was extended 42 km to the east by Göçmen et al. (2013). They found four new localities (Güzelbağ/Alanya, Karaçukur, Çığlık, Gürçam/Gazipaşa), pointed to particular color pattern and morphological features in the new found populations of *L. atifi* and suggested that a more detailed analysis of the color-pattern differences should be done in future studies.

The aims of this paper are to determine the morphological characteristics of the new eastern specimens of *L. atifi* and to compare the populations on the east and west sides of the Dim River in terms of coloration and blood-serum proteins, to clarify the systematic status of these new populations.

MATERIALS AND METHODS

The East Mediterranean region in the province of Antalya was explored five times from April 2011 to April 2012 in search of *L. atifi* (Table 1). Color slides of the live specimens were taken on site. Blood samples were taken in the laboratory within three days of collection after anaesthetizing with ether, by ventral abdominal vein puncture with heparinized hematocrit capillaries. Polyacrylamide gel electrophoresis (PAGE) was used to study the blood serum proteins and densitometry analyses were utilized to estimate their quantities. Finally, all salamanders were fixed by 96 % ethanol injection into their body and deposited in 96 % ethanol in view of their use in future DNA studies (Göçmen et al. 2007; Yildiz 2011). Some specimens were collected from the terra typica of *L. atifi* (Türbelinaz village and Gençler village - Akseki district; last lines in Table 1, Table 3) to compare with the specimens from east of the Dim River. Examined specimens are deposited at ZMADYU (Zooloji Museum of Adıyaman University, Turkey) (Table 1).

The localities where the specimens were collected and the known distribution of *L. atifi* are shown on the map (Fig. 1). The geographical coordinates of the collected specimens were computed with the GPS model Magellan XL (Table 1).

The separation of blood-serum proteins followed the polyacrylamide "disc" electrophoresis method of Davis (1964), slightly modified by Özeti & Atatür (1979). Blood samples were centrifuged for five minutes at 600 g and stored until analysis in equal quantities (4 µl) for each separation run at -20 °C. Blood serum samples were separated using polyacrylamide gel electrophoresis (PAGE). Electrophoretic separations were carried out at room temperature (20-25 °C) with a Canalco Model 1200 electrophoresis apparatus. Separation gels were at first stained with 0.5 % Amido Black protein stain, and then de-stained passively with repeated 7 % acetic acid baths. Gels were qualitatively evaluated directly from the electropherograms. Densitometric curves of the separations were obtained using a Gelman ACD-15 Model 39430 densitometer at a wavelength of 500 nm. The gels were subsequently photographed.

Measurements of body proportions and ratios followed previously published methods on salamanders (Başoğlu & Atatür 1974; Öz & Arikan 1990; Mutz & Steinfartz 1995; Öz et al. 2004; Çiçek et al. 2010; Akman et al. 2011; Göçmen et al. 2011; Göçmen & Akman 2012). They were as follows: Total Body Length – from tip of

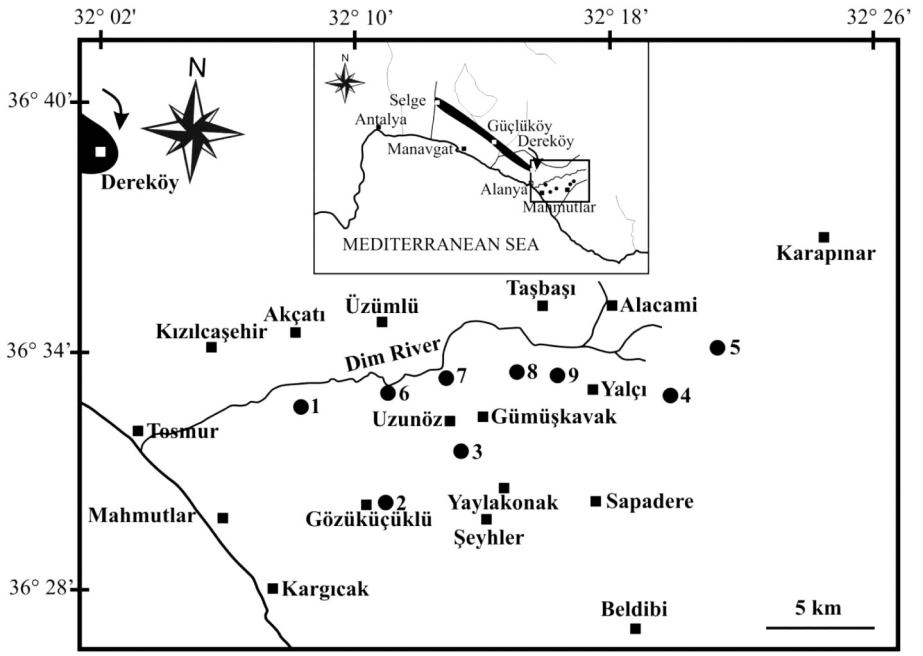

Fig. 1: Map of the new localities (solid circles) where the specimens of *Lyciasalamandra atifi bayrami* n. ssp. were collected. Numbers correspond to those in Table 1.
The arrow in the upper left corner indicates the most eastern locality of *L. atifi* previously known.

Abb 1: Karte der neuen Fundorte (volle Kreise), an denen *Lyciasalamandra atifi bayrami* n. ssp. gesammelt wurde. Die Nummern entsprechen jenen in Tabelle 1 (Spalte zwei).
Der Pfeil in der linken oberen Ecke bezeichnet den östlichsten zuvor bekannten Fundort von *L. atifi.*

Table 1: The materials of *Lyciasalamandra atifi bayrami* n. ssp. under study (ZMADYU: Zoology Museum of Adıyaman University, Adıyaman, Turkey) including information on localities and air temperature upon capture. Numbers in brackets (column two) refer to localities in Fig. 1. M - Male, F - Female, Juv - Juvenile.

Tab.1: Das Untersuchungsmaterial von *Lyciasalamandra atifi bayrami* n. ssp. (ZMADYU: Zoologisches Museum der Adıyaman Universität, Adıyaman, Türkei) mit Angaben zu den Fundorten und zur Lufttemperatur beim Fang. Ziffern in eckigen Klammern (Spalte zwei) entsprechen Fundorten in Abb. 1.

Museum code (ZMADYU) Inventar-nummer	Locality Fundort	Altitude (m. a. s. l.) Seehöhe (m ü. M.)	Coordinates (DMS) Koordinaten (GMS)	Date of collection (Specimens collected) Sammeldatum (gesammelte Exemplare)	Temp. (°C)
2011/216: 1-5	Dim Cave [1]	232	36°32'N, 32°07'E	Dec. 6, 2011 (2 M, 2 F, 1 Juv)	17
2011/217: 1-7	Dim Cave [1]	232	36°32'N, 32°07'E	Dec. 13, 2011 (6 F, 1 Juv)	18
2011/127: 1-9	Gözüküçüklü village [2]	785	36°30'N, 32°11'E	Apr. 6, 2011 (1 F, 8 Juv)	17
2011/128: 1-2	Uzunöz village [3]	1100	36°31'N, 32°13'E	Apr. 6, 2011 (2 Juv)	16
2011/129: 1-3	Kuşyuvasımevki [4]	1243	36°33'N, 32°19'E	Apr. 6, 2011 (3 Juv)	15
2011/169: 1	Kaplanhanı Plateau [5]	1400	36°34'N, 32°21'E	Apr. 6, 2011 (1 M)	15
2012/10: 1-2	Dim River [6]	93	36°32'N, 32°08'E	Mar. 9, 2012 (1 M, 1 F)	14
2012/11: 1	Dim River [7]	93	36°33'N, 32°12'E	Mar. 9, 2012 (1 F)	14
2012/12: 1-2	Dim River [8]	450	36°33'N, 32°15'E	Mar. 9, 2012 (1 M, 1 F)	13
2012/13: 1-2	Yalçı village [9]	518	36°33'N, 32°16'E	Mar. 9, 2012 (1 M, 1 F)	13
2011/83: 1-6	Gençler village	620	36°48'N, 31°45'E	Feb. 25, 2011 (2 M, 3 F, 1 Juv)	14
2012/49: 1-8	Türbelinaz	780	36°34'N, 32°01'E	Apr. 12, 2012 (2 M, 2 F, 4 Juv)	17

Fig. 2: Male of *Lyciasalamandra atifi bayrami* n. ssp. from Dim Cave, Alanya, Antalya (ZMADYU 216/2011).
Abb. 2: Männchen von *Lyciasalamandra atifi bayrami* n. ssp. aus der Höhle von Dim, Alanya, Antalya, Turkey (ZMADYU 216/2011).

Fig. 3: Female and juveniles of *Lyciasalamandra atifi bayrami* n. ssp. from Dim Cave, Alanya, Antalya (ZMADYU 216/2011).
Abb. 3: Weibchen und Jungtiere von *Lyciasalamandra atifi bayrami* n. ssp. aus der Höhle von Dim, Alanya, Antalya, Turkey (ZMADYU 216/2011).

snout to tip of tail (TBL), Rostrum-Cloaca Length – length from tip of snout to the posterior end of the cloacal opening (RC), Length of Trunk – from gular fold to the anterior edge of cloacal opening (LT), Tail Length – from anterior edge of cloacal opening to tip of tail (TL), Nostril-Eye Distance (NED), Distance between Nostrils (DBN), Eye Diameter (ED), Head Length – distance from tip of snout to gular fold (HL), Head Width (HW), Parotid Length (PL), Parotid Width (PW), Fore Limb Length (FLL), Hind Limb Length (HLL), Distance between Fore- and Hind Limbs (DFHL), ratios of HW/HL, TL/TBL, PW/PL, NED/HL. Metric characters were measured using Mitutuyo digital calipers of 0.02 mm sensitivity, except RC, TL and TBL, which were measured with a ruler (mm). Specimens of known and new populations were compared for sexual dimorphism; adults and juveniles were treated separately to avoid the effects of allometry.

Descriptive statistics of the metric values of the populations and inter-population comparisons were conducted with SPSS 15.0 for Windows. To compare the metric characters, Student's t-test was used. In addition, index values involving PERCRA (= length (L) of parameter in percent of rostrum-cloaca length [L / RC × 100] according to WERNER 1971) were subject to t-tests. The level for statistical significance was set at $\alpha \leq 0.05$.

RESULTS

Lyciasalamndra atifi bayrami n. ssp.

Holotype and type locality.– ZMADYU 2011/216-2, male, collected by Kadir Boğaç KUNT on December 6, 2011,in the Dim Cave, Alanya, Antalya, Turkey, 232 m a.s.l.

Paratypes.– ZMADYU 2011/216: 2-5, 2011/217: 1-7, 1 male, 8 females, 2 juveniles collected by M. Z. YILDIZ, B. AKMAN and N. İĞCI on December 13, 2011, in the Dim Cave, Alanya, Antalya, Turkey, 232 m a.s.l. (Table 1).

Diagnosis.– Due to its big size and colorpattern traits the new taxon belongs to *Lyciasalamndra atifi*. It differs from the nominotypic subspecies in having a shorter mean total length, comparatively longer rostrum, dark grey dorsum, and a different pattern of the sexes. Males differ from females in having two paravertebral bands constituted by white flecks, with a central black dot each (Fig. 2). Females lack paravertebral bands (Fig. 3) but have some few indistinct small whitish spots scattered across the dorsum. There is no difference in the colorpattern of the sexes in the nominotypic subspecies.

Etymology.– The subspecific epithet *bayrami* is derived from the name of the authors' supervisor Prof. Dr. Bayram GÖÇMEN who made valuable contributions to the field of herpetology in Turkey.

Description of the holotype.– Total body length 148 mm [192.21 PERCRA], tail length 71 mm [92.21PERCRA], eyes big, eye diameter 5.26 mm [6.83 PERCRA]. Head flat, head length and head with 17.70 and 12.25 mm, respectively [22.99 and 15.91 PERCRA]. Parotids distinct, parotid length 8.29 mm [10.77 PERCRA] and parotid width 2.22 mm [2.88 PERCRA]. Hind limb longer than forelimb, HLL 27.64 [35.90 PERCRA], forelimb length 25.10 mm [32.60 PERCRA]. Nostril to eye distance 2.95 mm [3.83 PERCRA], distance between nostrils 5.77 mm [7.49 PERCRA]. Ratios HW/HL, TL/TBL, PW/ PL and NED/HL are 0.69, 0.48, 0.27 and 0.17, respectively.

Ground color of dorsal side dark grey (alive). Some whitish flecks on posterior part of head. Small black dots on parotids, posterior part of parotids yellowish white. Behind the parotids, numerous whitish flecks, each with a tiny central black dot, constituting two paravertebral bands extending to the tail base. A few scattered whitish flecks between these bands. Black dots form a row along the dorsal midline of the tail as far as to the tip. Dorsal distal parts of extremities light grey, proximal parts pinkish. Tip of tail and caudal protuberance pale. Lateral parts of body white,

Table 2: Descriptive statistics of measurements (mm) and ratios taken from *Lyciasalamandra atifi bayrami* n. ssp. For abbreviations in column one see Materials and Methods. 1 - raw data values; 2 - PERCRA values (sensu Werner 1971); SD - Standard Deviation; SE – Standard Error of the Mean; *p* - significance of the difference between male and female values.

Tab. 2: Deskriptive Statistiken der Werte (mm) und Verhältnisse aus Messungen an männlichen, weiblichen, juvenile und adulten (Männchen + Weibchen) *Lyciasalamandra atifi bayrami* n. ssp. TBL – Gesamtlänge; RC – Kopf-Rumpf-Länge; LT – Rumpflänge von der Kehlfalte zur Kloakenöffnung; TL – Schwanzlänge; NED – Entfernung Nasenloch – Auge; DBN – Nasenlochabstand; ED – Augendurchmesser; HL – Kopflänge bis zur Kehlfalte, HW – Kopfbreite; PL – Parotidenlänge; PW – Parotidenbreite; FLL – Vorderbeinlänge; HLL – Hinterbeinlänge; DFHL – Abstand zwischen Vorder- und Hinterbeinansatz. 1 – Daten der Meßwerte ; 2 – PERCRA-Werte (sensu Werner 1971); Mean – Mittelwert; SD – Standardabweichung; SE – Standardfehler des Mittelwertes; *p* - Signifikanz des Unterschiedes zwischen den Werten von Männchen und Weibchen.

		Males / Männchen						Females / Weibchen						Juveniles / Jungtiere						Adults / Männchen+Weibchen					
		N	Mean	Min	Max	SD	SE	*p*	N	Mean	Min	Max	SD	SE	N	Mean	Min	Max	SD	SE	N	Mean	Min	Max	SD	SE
TBL	1	5	147.4	143.0	150.0	2.61	1.17	0.016	13	132.1	102.0	171.0	19.48	5.40	16	97.8	71.0	119.0	16.83	4.21	18	136.3	102.0	171.0	17.87	4.21
	2	5	181.8	163.0	192.2	11.32	5.06	0.728	13	183.8	161.9	190.7	7.57	2.10	16	178.6	156.3	187.7	7.49	1.87	18	183.2	161.9	192.2	8.45	1.99
RC	1	5	81.4	76.0	92.0	6.39	2.86	**0.039**	13	71.9	55.0	92.0	10.59	2.94	16	54.8	39.0	65.0	9.13	2.28	18	74.6	55.0	92.0	10.39	2.45
LT	1	5	54.8	50.5	62.4	4.64	2.07	0.084	13	49.1	36.2	64.5	7.94	2.20	16	36.0	21.8	43.2	7.03	1.76	18	50.7	36.2	64.5	7.51	1.77
	2	5	67.2	66.4	67.9	0.53	0.24	0.200	13	68.1	64.2	73.5	2.26	0.63	16	65.4	52.0	70.9	4.34	1.09	18	67.9	64.2	73.5	1.96	0.46
TL	1	5	66.0	58.0	71.0	4.85	2.17	0.117	13	60.2	47.0	79.0	9.97	2.76	16	43.0	31.0	54.0	8.40	2.10	18	61.8	47.0	79.0	9.10	2.15
	2	5	81.8	63.0	92.2	11.32	5.06	0.728	13	83.8	61.9	90.7	7.57	2.10	16	78.6	56.3	87.7	7.49	1.87	18	83.2	61.9	92.2	8.45	1.99
NED	1	5	4.6	3.0	9.6	2.81	1.26	0.395	13	3.4	2.8	4.4	0.45	0.13	16	2.5	2.0	3.6	0.45	0.11	18	3.8	2.8	9.6	1.52	0.36
	2	5	5.7	3.8	11.7	3.39	1.52	0.596	13	4.8	3.9	5.6	0.45	0.12	16	4.7	3.5	5.6	0.59	0.15	18	5.0	3.8	11.7	1.74	0.41
DBN	1	5	5.9	5.1	7.1	0.73	0.33	0.065	13	5.1	3.9	6.5	0.74	0.20	16	4.0	3.0	4.7	0.53	0.13	18	5.3	3.9	7.1	0.81	0.19
	2	5	7.3	6.7	7.7	0.39	0.17	0.401	13	7.1	6.5	7.5	0.34	0.10	16	7.4	6.3	9.1	0.63	0.16	18	7.1	6.5	7.7	0.35	0.08
ED	1	5	5.2	4.9	5.9	0.38	0.17	**0.023**	13	4.6	3.8	6.0	0.60	0.17	16	3.9	3.2	4.4	0.36	0.09	18	4.8	3.8	6.0	0.61	0.14
	2	5	6.4	6.1	6.8	0.27	0.12	0.988	13	6.4	5.6	7.5	0.52	0.14	16	7.2	6.4	9.0	0.76	0.19	18	6.4	5.6	7.5	0.45	0.11
HL	1	5	18.6	16.1	21.1	1.92	0.86	0.383	13	17.6	14.3	21.4	2.30	0.64	16	14.6	11.0	17.0	1.91	0.48	18	17.9	14.3	21.4	2.20	0.52
	2	5	22.8	21.1	23.9	1.01	0.45	**0.013**	13	24.5	22.7	26.0	1.08	0.30	16	26.9	24.8	30.2	1.55	0.39	18	24.0	21.1	26.0	1.30	0.31
HW	1	5	12.4	11.7	13.9	0.87	0.39	0.155	13	11.6	9.5	13.9	1.36	0.38	16	9.8	7.4	11.5	1.42	0.36	18	11.8	9.5	13.9	1.28	0.30
	2	5	15.3	14.5	15.9	0.55	0.25	**0.026**	13	16.2	14.3	17.4	1.03	0.28	16	17.9	17.1	19.5	0.71	0.18	18	16.0	14.3	17.4	1.00	0.24
PL	1	5	9.1	8.1	10.5	0.96	0.43	0.548	13	8.7	6.0	11.7	1.67	0.46	16	7.3	4.9	8.8	1.31	0.33	18	8.8	6.0	11.7	1.49	0.35
	2	5	11.1	10.6	11.5	0.38	0.17	**0.011**	13	12.0	10.6	13.9	0.92	0.26	16	13.3	11.9	14.8	0.77	0.19	18	11.7	10.6	13.9	0.90	0.21
PW	1	5	2.7	2.0	3.2	0.56	0.25	0.562	13	2.9	2.0	3.9	0.64	0.18	16	2.2	1.4	3.1	0.45	0.11	18	2.9	2.0	3.9	0.60	0.14
	2	5	3.3	2.7	3.9	0.53	0.24	**0.041**	13	4.0	2.8	4.8	0.58	0.16	16	4.0	3.1	5.2	0.51	0.13	18	3.8	2.7	4.8	0.64	0.15
FLL	1	5	24.7	23.0	26.4	1.28	0.57	0.061	13	22.9	19.5	27.7	2.44	0.68	16	18.6	14.9	21.9	2.10	0.53	18	23.4	19.5	27.7	2.30	0.54
	2	5	30.5	27.4	34.7	3.09	1.38	0.345	13	32.1	27.6	35.4	2.50	0.69	16	34.4	29.4	42.7	3.40	0.85	18	31.7	27.4	35.4	2.68	0.63
HLL	1	5	28.7	27.1	31.7	1.80	0.81	0.185	13	27.0	22.5	32.5	3.09	0.86	16	21.6	15.3	25.2	2.93	0.73	18	27.5	22.5	32.5	2.84	0.67
	2	5	35.3	34.5	35.9	0.69	0.31	**0.001**	13	37.8	35.3	41.6	1.96	0.54	16	39.7	32.8	46.0	2.99	0.75	18	37.1	34.5	41.6	2.04	0.48
DFHL	1	5	45.2	39.9	51.8	4.52	2.02	0.110	13	40.4	31.4	55.9	6.89	1.91	16	29.8	20.1	35.6	5.38	1.34	18	41.7	31.4	55.9	6.58	1.55
	2	5	55.5	52.5	57.5	1.94	0.87	0.622	13	56.1	52.2	60.8	2.49	0.69	16	54.3	48.7	59.7	2.86	0.71	18	55.9	52.2	60.8	2.31	0.54
KKDTY	1	3	3.34	3.13	3.57	0.22	0.13	--	-	-	-	-	-	-	-	-	-	-	-	3	3.34	3.13	3.57	0.22	0.13	
	2	3	3.95	3.60	4.35	0.38	0.22	--	-	-	-	-	-	-	-	-	-	-	-	3	3.95	3.60	4.35	0.38	0.22	
HW/HL	1	5	0.67	0.60	0.73	0.05	0.02	0.659	13	0.66	0.61	0.73	0.04	0.01	16	0.67	0.62	0.71	0.03	0.01	18	0.66	0.60	0.73	0.04	0.01
TL/TBL	1	5	0.45	0.39	0.48	0.04	0.02	0.711	13	0.45	0.38	0.48	0.02	0.01	16	0.44	0.36	0.47	0.03	0.01	18	0.45	0.38	0.48	0.03	0.01
PW/PL	1	5	0.30	0.25	0.34	0.04	0.02	0.118	13	0.34	0.21	0.42	0.05	0.01	16	0.30	0.25	0.38	0.04	0.01	18	0.33	0.21	0.42	0.05	0.01
NED/HL	1	5	0.25	0.17	0.49	0.14	0.06	0.457	13	0.20	0.17	0.22	0.02	0.00	16	0.17	0.13	0.21	0.02	0.00	18	0.21	0.17	0.49	0.07	0.02

Table 3: Descriptive statistics of measurements (mm) and ratios taken from male, female, juvenile and adult (combined male and female) *Lyciasalamandra atifi atifi* (BAŞOĞLU, 1967). For abbreviations in column one and column headers see Materials and Methods and caption to Table 2.

Tab. 3: Deskriptive Statistiken der Werte (mm) und Verhältnisse aus Messungen an männlichen, weiblichen, juvenile und adulten (Männchen + Weibchen) *Lyciasalamandra atifi atifi* (BAŞOĞLU, 1967). Abkürzungserklärungen siehe Tab. 2.

	Males / Männchen							Females / Weibchen						Juveniles / Jungtiere					Adults / Männchen+Weibchen					
		N	Mean	Min	Max	SD	SE	*p*	N	Mean	Min	Max	SD	SE	N	Mean	Min	Max	SD	SE	N	Mean	Min	Max	SD	SE
TBL	1	4	162.8	157.0	171.0	6.02	3.01	0.044	5	146.4	132.0	165.0	12.70	5.68	5	102.0	86.0	127.0	15.28	6.83	9	153.7	132.0	171.0	12.98	4.33
	2	4	191.5	188.2	194.0	2.42	1.21	0.037	5	184.4	178.8	191.9	5.23	2.34	5	181.6	172.0	189.6	6.35	2.84	9	187.5	178.8	194.0	5.46	1.82
RC	1	4	85.0	82.0	89.0	2.94	1.47	0.135	5	79.4	71.0	86.0	6.43	2.87	5	56.0	50.0	67.0	6.52	2.92	9	81.9	71.0	89.0	5.71	1.90
LT	1	4	56.8	54.5	58.3	1.73	0.86	0.130	5	53.2	46.9	57.6	4.13	1.85	5	38.2	34.0	46.7	4.98	2.23	9	54.8	46.9	58.3	3.65	1.22
	2	4	66.8	65.5	68.9	1.47	0.74	0.886	5	67.0	64.4	69.0	1.89	0.85	5	68.2	66.9	69.8	1.12	0.50	9	66.9	64.4	69.0	1.62	0.54
TL	1	4	77.8	75.0	82.0	3.40	1.70	0.024	5	67.0	61.0	79.0	7.04	3.15	5	46.0	36.0	60.0	8.80	3.94	9	71.8	61.0	82.0	7.82	2.61
	2	4	91.5	88.2	94.0	2.42	1.21	0.037	5	84.4	78.8	91.9	5.23	2.34	5	81.6	72.0	89.6	6.35	2.84	9	87.5	78.8	94.0	5.46	1.82
NED	1	4	3.8	3.5	3.9	0.22	0.11	0.149	5	3.3	2.5	4.1	0.60	0.27	5	2.6	2.5	2.8	0.12	0.05	9	3.5	2.5	4.1	0.52	0.17
	2	4	4.4	3.9	4.8	0.40	0.20	0.294	5	4.1	3.5	4.9	0.50	0.22	5	4.8	4.1	5.0	0.38	0.17	9	4.3	3.5	4.9	0.46	0.15
DBN	1	4	5.7	5.0	6.2	0.62	0.31	0.420	5	5.4	4.5	5.8	0.51	0.23	5	3.9	2.6	4.7	0.78	0.35	9	5.5	4.5	6.2	0.55	0.18
	2	4	6.7	6.0	7.4	0.75	0.38	0.898	5	6.8	6.2	7.7	0.58	0.26	5	7.0	5.3	8.4	1.32	0.59	9	6.7	6.0	7.7	0.61	0.20
ED	1	4	5.2	4.8	5.5	0.33	0.17	0.057	5	4.6	4.0	5.3	0.46	0.21	5	3.7	3.5	4.0	0.23	0.10	9	4.9	4.0	5.5	0.50	0.17
	2	4	6.2	5.8	6.5	0.37	0.18	0.410	5	5.8	5.4	7.0	0.66	0.30	5	6.6	6.0	7.1	0.51	0.23	9	6.0	5.4	7.0	0.55	0.18
HL	1	4	20.7	17.9	22.7	2.08	1.04	0.350	5	19.5	17.9	21.5	1.48	0.66	5	14.9	14.0	17.6	1.55	0.69	9	20.0	17.9	22.7	1.78	0.59
	2	4	24.4	21.8	27.0	2.33	1.16	0.911	5	24.5	23.4	25.3	0.76	0.34	5	26.7	25.9	28.0	0.81	0.36	9	24.5	21.8	27.0	1.53	0.51
HW	1	4	13.9	12.5	14.9	1.00	0.50	0.275	5	13.1	11.9	14.2	0.86	0.39	5	10.0	8.8	11.5	1.04	0.47	9	13.5	11.9	14.9	0.95	0.32
	2	4	16.4	15.3	17.7	1.12	0.56	0.737	5	16.6	15.9	17.1	0.46	0.20	5	18.0	17.1	19.1	0.74	0.33	9	16.5	15.3	17.7	0.77	0.26
PL	1	4	9.9	8.7	10.7	0.86	0.43	0.223	5	9.1	8.2	10.2	0.87	0.39	5	7.0	6.2	7.8	0.62	0.28	9	9.5	8.2	10.7	0.91	0.30
	2	4	11.7	10.6	12.5	0.85	0.43	0.746	5	11.5	10.9	12.0	0.39	0.18	5	12.5	11.6	13.2	0.64	0.29	9	11.6	10.6	12.5	0.60	0.20
PW	1	4	2.9	2.6	3.4	0.34	0.17	0.671	5	2.7	2.1	3.7	0.62	0.28	5	2.4	2.0	2.8	0.30	0.13	9	2.8	2.1	3.7	0.49	0.16
	2	4	3.4	3.0	4.0	0.41	0.21	0.931	5	3.4	2.8	4.3	0.57	0.25	5	4.3	3.8	4.7	0.34	0.15	9	3.4	2.8	4.3	0.48	0.16
FLL	1	4	24.4	15.5	27.8	5.92	2.96	0.943	5	24.6	23.5	26.9	1.36	0.61	5	18.8	17.1	22.2	2.00	0.89	9	24.5	15.5	27.8	3.75	1.25
	2	4	28.9	17.5	32.8	7.60	3.80	0.604	5	31.1	29.0	33.2	1.51	0.68	5	33.5	32.7	34.5	0.73	0.33	9	30.1	17.5	33.2	4.91	1.64
HLL	1	4	30.7	28.3	32.4	1.80	0.90	0.436	5	29.4	25.4	32.8	2.75	1.23	5	21.2	18.4	25.8	2.75	1.23	9	30.0	25.4	32.8	2.33	0.78
	2	4	36.1	34.5	37.4	1.17	0.59	0.261	5	37.0	35.8	38.3	1.13	0.51	5	37.8	36.7	38.4	0.68	0.30	9	36.6	34.5	38.3	1.19	0.40
DFHL	1	4	47.6	43.6	49.1	2.63	1.32	0.130	5	44.0	38.0	47.2	3.57	1.60	5	32.0	28.7	39.5	4.27	1.91	9	45.6	38.0	49.1	3.53	1.18
	2	4	55.9	53.2	58.5	2.32	1.16	0.787	5	55.5	52.3	58.9	2.76	1.24	5	57.1	55.3	59.0	1.32	0.59	9	55.7	52.3	58.9	2.43	0.81
KKDTY	1	4	2.56	1.95	3.48	0.71	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2.56	1.95	3.48	0.71	0.35
	2	4	3.00	2.32	3.91	0.76	0.38	-	-	-	-	-	-	-	-	-	-	-	-	-	4	3.00	2.32	3.91	0.76	0.38
HW/HL	1	4	0.67	0.66	0.70	0.02	0.01	0.788	5	0.68	0.66	0.70	0.02	0.01	5	0.67	0.63	0.71	0.03	0.02	9	0.67	0.66	0.70	0.02	0.01
TL/TBL	1	4	0.48	0.47	0.48	0.01	0.00	0.038	5	0.46	0.44	0.48	0.02	0.01	5	0.45	0.42	0.47	0.02	0.01	9	0.47	0.44	0.48	0.02	0.01
PW/PL	1	4	0.29	0.26	0.32	0.02	0.01	0.789	5	0.30	0.24	0.36	0.05	0.02	5	0.34	0.31	0.35	0.02	0.01	9	0.29	0.24	0.36	0.04	0.01
NED/HL	1	4	0.18	0.17	0.22	0.02	0.01	0.327	5	0.17	0.14	0.19	0.02	0.01	5	0.18	0.16	0.19	0.01	0.01	9	0.17	0.14	0.22	0.02	0.01

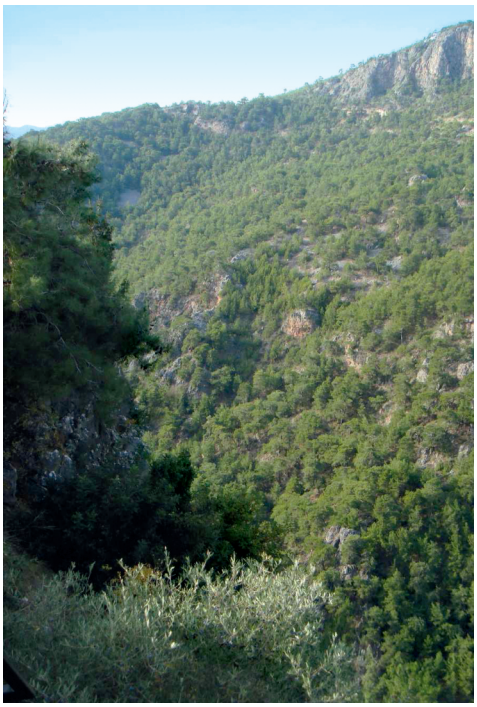

Fig. 4: General aspect of the habitat of *Lyciasalamandra atifi bayrami* n. ssp. north of the Dim Cave, Alanya, Antalya, Turkey.

Abb. 4: Großräumige Ansicht des Lebensraums von *Lyciasalamandra atifi bayrami* n. ssp. nördlich der Höhle von Dim, Alanya, Antalya, Türkei.

clearly distinguished from dorsum. Ventral side of the body is flesh-colored. There are tiny horny denticles on the dorsum that are visible to the naked eye.

Paratypes and variation.– Eleven more specimens collected from the Dim Cave were designated as paratypes. Coloration given for the holotype largely applies to the male paratype. It has whitish flecks on the anterior and posterior part of the head and the coloration of the extremities is more distinctive. In the females, a few whitish flecks are scattered across the dark grey dorsal ground color but they never form bands or stripes. Almost no whitish flecks on dorsum of one female (ZMADYU 2011/217-2). Posterior part of parotids dark,

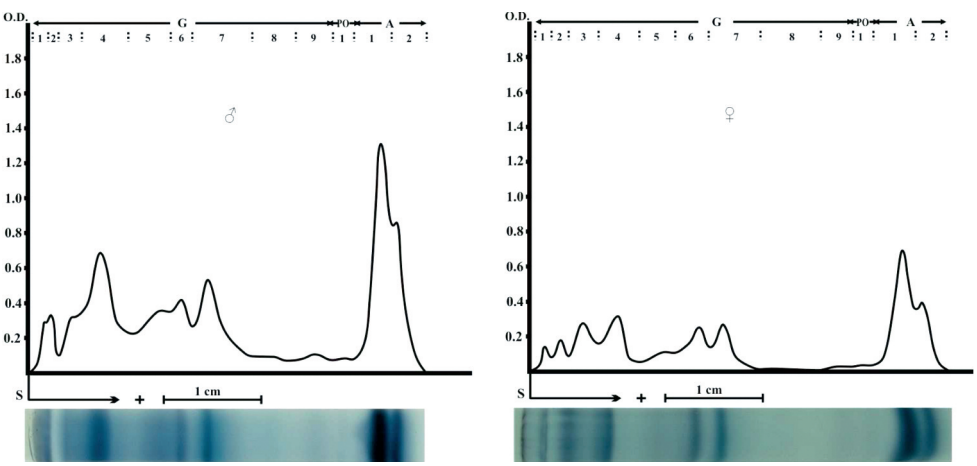

Fig. 5: Electropherograms and densitometric curves representing the separation of blood serum proteins of *Lyciasalamandra atifi bayrami* n. ssp. Left diagram: male (ZMADYU 2011/216-1), right diagram: female (ZMADYU 2011/216-3). OD - Optical density, S - Start, the border between stacking and separating gels, G - Globulins zone, PO - Postalbumin zone, A - Albumin-like proteins zone.

Abb. 5: Elektropherogramme und densitometrische Kurven der aufgetrennten Serumproteine aus dem Blut von *Lyciasalamandra atifi bayrami* n. ssp. Linkes Diagramm: Männchen (ZMADYU 2011/216-1), rechtes Diagramm: Weibchen (ZMADYU 2011/216-3). OD – Optische Dichte, S - Start, Grenze zwischen Sammel- und Trenngel, G – Zone der Globuline, PO – Zone des Postalbumins, A – Zone der Albumine.

not yellowish-white as in males. Head, parotid glands and hind limbs bigger than in males (Table 2).

In both juvenile specimens the dorsum is darker than that of adults with a few scattered whitish flecks. Posterior parts of parotids yellowish-white, lateral parts of trunk white.

Habitat and ecology.– Dim Cave is a karstic cave. When specimens were collected, they were active amongst the crevices of the limestone walls. After rain, about 30 specimens were observed on December 6, 2011, at 17 °C. On the next trip on December 13, 2011, when it had not rained before, about ten specimens were seen, although temperature was not much different (18 °C). This observation showed that high humidity may be most important for their activity. As reported by AKMAN (2011), specimens were also collected under karstic stones in humid pine forests as well as deforested areas (Fig. 4). Specimens were collected at temperatures between 13 °C and 18 °C (Table 1).

One female was gravid when collected and gave birth to two young in the terrarium, proving vivipary in this taxon (Fig. 3).

Electrophoretic pattern.– Three male and three female specimens were used for the blood-serum study. Twelve protein fractions (nine globulin, one postalbumin and two albumin fractions) were observed on gel electrophoresis of the new subspecies in both sexes (Fig. 5).

DISCUSSION

On the basis of colorpattern and morphologic features, this paper describes a new subspecies of *Lyciasalamandra atifi* from the Taurus Massif east of the Dim River, which may represent a dispersal barrier for terrestrial salamanders.

Regarding total length, BAŞOĞLU (1967) provided the raw data of 12 adult Türbelinaz (terra typica of *L. a. atifi*) specimens. Mean total body length (TBL) was 158 mm (range: 134-176 mm). ÖZ et al. (2004) reported a mean TBL of 141.33 mm (N = 11, range: 105-164 mm). They found that *L. atifi* (*Mertensiella luschani atifi* in their terminology) was longer than the other seven taxa recognized as *luschani* subspecies at that time. Studying 17 specimens of *M. luschani atifi* from Türbelinaz Alanya, Dikmen village and Fersin village, Akseki, Antalya province, BARAN & ÜÇÜNCÜ (1994) observed a mean TBL of 161 mm (134-181 mm). The present study found 153 mm (range: 132-171 mm) for Türbelinaz and Akseki specimens (Table 3) and the lowest mean TBL of 136 mm (range: 102-171 mm) in *L. atifi bayrami* n. ssp. (Table 2).

As to males and adults, there were statistically significant differences in various morphometric parameters (TBL, TL, HL, HW, HLL) between *L. atifi atifi* and *L. atifi bayrami* when the raw data was compared. These differences were not present between PERCRA values (Table 4). Raw data and PERCRA, which, by definition, are equal in size for the Rostrum-Cloaca Length (RC, see Materials and Methods section) showed significant differences between adult *L. atifi atifi* and *L. a. bayrami* n. ssp. ($p = 0.026$).

With regard to the relative length of the snout region (NED/HL), ÖZ et al. calculated a mean of 0.167 (0.14-0.21) for *L. atifi*. The authors of the present paper computed 0.17 (0.14-0.22) for Türbelinaz and Akseki specimens but 0.21 (0.17-0.49) for the new subspecies *L. atifi bayrami* revealing the longer rostrum of the latter.

BAŞOĞLU (1967) reported that the dorsal color of Türbelinaz specimens was almost entirely dark brown without any orange or red spots. On the dorsal ground, there were only a few tiny whitish flecks, irregularly scattered on the head. Behind the parotids, they were found only on the sides, of the head, not in the middle (BAŞOĞLU 1967). ÖZ et al. (2004) stated that coloration and pattern of their specimens were similar to those in previous reports (BAŞOĞLU & ATATÜR 1974, 1975; BAŞOĞLU & BARAN 1976; BARAN & ATATÜR 1980; FRANZEN & KLEWEN 1987; BARAN & ÜÇÜNCÜ 1994; BARAN & ATATÜR 1998). Sex-specific pattern differences were never mentioned in earlier descriptions. The new subspecies differs, however, from the

nominotypic subspecies by its coloration and sex-specific differences in pattern. The dorsum of *L. atifi bayrami* is grey, not dark brown. Males differ from females in having two paravertebral stripes constituted by white flecks with a central black dot each.

Applying polyacrylamid gel electrophoresis, GÖÇMEN et al. (2011) found 13 protein fractions (10 globulin, one postalbumin, and two albumin fractions) in the blood plasma of a male *L. atifi* from Akseki. The authors of the present study isolated only 12 protein fractions (nine globulin, one postalbumin, and two albumin fractions) in all specimens of *L. a. bayrami* ssp. n.

Table 4: Comparisons (t-test *p* values) between measurements (mm) and ratios taken from *Lyciasalamandra atifi atifi* (BAŞOĞLU, 1967) versus *L. atifi bayrami* n. ssp. Significant differences ($p \leq 0.05$) in bold. 1 – according to the raw data values; 2 – according to the PERCRA (sensu WERNER 1971) values. For abbreviations in column one see Materials and Methods.

Tab. 4: Vergleich (t-test *p*) der Werte (mm) und Verhältnisse aus Messungen an *Lyciasalamandra atifi atifi* gegenüber *L. atifi bayrami* n. ssp. Signifikante Unterschiede ($p \leq 0.05$) in Fettschrift. 1 – *p*-Werte aus dem Vergleich der Meßwerte; 2 – *p*-Werte aus dem Vergleich der PERCRA-Werte (sensu WERNER 1971). Abkürzungserklärungen für Spalte eins siehe Tab. 2.

		Males Männchen	Females Weibchen	Juveniles Juvenile	Adults Adulte
TBL	1	**0.010**	0.094	0.612	**0.009**
	2	0.129	0.852	0.395	0.124
RC	1	0.306	0.093	0.743	**0.026**
LT	1	0.404	0.178	0.443	0.067
	2	0.626	0.306	**0.031**	0.188
TL	1	**0.004**	0.132	0.525	**0.008**
	2	0.129	0.852	0.395	0.124
NED	1	0.534	0.635	0.462	0.514
	2	0.467	**0.032**	0.804	0.089
DBN	1	0.629	0.384	0.779	0.476
	2	0.247	0.301	0.532	0.104
ED	1	0.963	0.901	0.151	0.566
	2	0.281	0.133	0.066	0.058
HL	1	0.155	0.063	0.701	**0.012**
	2	0.265	0.941	0.777	0.460
HW	1	0.059	**0.015**	0.645	**0.001**
	2	0.150	0.325	0.901	0.150
PL	1	0.201	0.450	0.465	0.140
	2	0.295	0.128	**0.045**	0.543
PW	1	0.646	0.593	0.279	0.756
	2	0.885	0.073	0.210	0.055
FL	1	0.913	0.087	0.906	0.445
	2	0.698	0.295	0.322	0.382
HLL	1	0.145	0.150	0.815	**0.025**
	2	0.283	0.327	**0.035**	0.445
DFHL	1	0.369	0.170	0.362	0.060
	2	0.769	0.687	**0.008**	0.819
KKDTY	1	0.112	-	-	0.112
	2	0.087	-	-	0.087
HW/HL	1	0.978	0.295	0.781	0.407
TL/TBL	1	0.145	0.811	0.385	0.122
PW/PL	1	0.671	0.134	**0.005**	0.059
NED/HL	1	0.369	**0.023**	0.682	0.069

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