

**COMPARISON OF *Lyciasalamandra atifi* (BAŞOĞLU, 1967)
(URODELA: SALAMANDRIDAE) POPULATIONS WITH DESCRIPTION OF THREE NEW SUBSPECIES
FROM ANTALYA PROVINCE**

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Abstract. We compared the isolated populations of *Lyciasalamandra atifi*, (Başoğlu, 1967) a salamander endemic to the historic Lycia region of Turkey, that is found across a range from Antalya/Selge (Altinkaya) to Antalya/Gazipaşa. Along this distance, we determined eight isolated populations (Selge, Fersin, Dikmen, Güzelbağ, Türbelinaz, Gündoğmuş, Cebireis, Gazipaşa) in 2013 and used morphology and serology to compare them. The collected specimens were registered under the ZMADYU (Zoology Museum of Adıyaman University), and a total of 237 (59 ♂♂, 96 ♀♀, 82 juv.) specimens were studied. As a result of our research, three new subspecies are described: *Lyciasalamandra atifi godmanni* n. ssp. from Selge, *Lyciasalamandra atifi veithi* n. ssp. from Dikmen and *Lyciasalamandra atifi kunti* n. ssp. from Güzelbağ. Except Cebireis (*L. a. bayrami*) and Gazipaşa (*L. a. oezi*) populations, the other isolated populations were incorporated in the nominat subspecies due to morphological and serological similarities.

KEY WORDS: *Lyciasalamandra atifi veithi* n. ssp., *Lyciasalamandra atifi godmanni* n. ssp., *Lyciasalamandra atifi kunti* n. ssp., distribution, Antalya, serology.

INTRODUCTION

The Lycian salamander was first identified by Steindachner (1891) as *Molge luschani* from the village of Dodurga in Turkey's Muğla province. It was transferred to the genus *Mertensiella* by Wolterstorff (1925) and eight taxa were subsequently identified as subspecies of *Mertensiella luschani*. The specimens from Dodurga was also accepted as the nominate subspecies of *Mertensiella luschani*. (Veith et al. 2001, Göçmen et al. 2011).

Lyciasalamandra atifi was found in February 1966 for the first time during a zoological excursion on the road between Alanya-Türbelinaz by Atif ŞENGÜN (one male and three juveniles). These specimens were different from the other *Mertensiella luschani* subspecies with regard to size and colouration. As a result, these specimens were described as *Mertensiella luschani atifi* and dedicated to Atif ŞENGÜN, who found them for the first time (Başoğlu 1967). In the light of recent molecular studies, the taxonomical status of these viviparous tailed amphibians was revised and assigned to the genus *Lyciasalamandra* by Veith and Steinfartz (2004) after detailed mitochondrial and allozyme data studies.

Until recently, it was known that there were 9 allopatric species and 16 taxa among Lycian salamanders between Muğla/Marmaris and Antalya/Gazipaşa along a distance of 420 km in southwestern Turkey. These were: [*Lyciasalamandra luschani luschani* (Steindachner, 1891; *L. atifi atifi* (Başoğlu 1967); *L. fazilae* (Başoğlu & Atatür 1974); *L. luschani finikensis* (Başoğlu & Atatür 1975); *L. antalyana antalyana* (Başoğlu & Baran 1976); *L. luschani basoglui* (Baran & Atatür 1980); *L. billae billae* (Franzen & Klewen 1987); *L. flavimembris flavimembris* (Mutz & Steinfartz 1995); *L. irfani* Göçmen et al. 2011; *L. arikani* Göçmen & Akman 2012; *L. yehudahi* Göçmen & Akman 2012; *L. antalyana gocmeni* Akman & Godmann 2014; *L. atifi bayrami* Yıldız & Akman 2015; *L. flavimembris ilgazi* Üzümlü et al. 2015; *L. billae eikeae* Godmann et al. 2016; *L. atifi oezi* Tok et al. 2016]. According to recently published paper by Veith et al. (2016), based on levels of molecular differentiation *L. arikani*, *L. irfani* and *L. yehudahi* were considered as subspecies of *L. billae*. Currently, 6 allopatric species and 16 taxa exist in Turkey.

Except for *L. luschani basoglui* (Baran & Atatür 1980), which exists in Megisti (Kastellorizo) island and *L. helverseni* (Pieper 1963) that lives on some Greek islands (Saria, Kasos & Karpathos), other taxa are endemic to Turkey (Eleftherakos et al. 2007). *Lyciasalamandra atifi* has the largest distribution range among the species of *Lyciasalamandra* (Akman et al. 2011; Göçmen et al. 2013). It was known from Selge to Alanya along a range of 110 km. Recent studies, Akman et al. (2011) and Göçmen et al. (2013) report that the species' range extends until Antalya/Gazipaşa, and up to 1400 m above sea level. Consequently, the range of *L. atifi* has been extended to 185 km.

MATERIALS AND METHODS

To clarify the differences between *Lyciasalamandra atifi* populations, we conducted excursions in February and March in 2013. We stated eight isolated populations (Fersin, Selge, Dikmen, Güzelbağ, Türbelinaz, Gündoğmuş, Cebireis Mountain, Gazipaşa) and used morphology, serology, statistics techniques to compare them. These techniques for each population were methodically described.

The collected specimens were registered under the ZMADYU (Zoology Museum of Adıyaman University) and a total of 237 (59♂♂, 96♀♀, 82 juv.) specimens were studied. These specimens were subjected to morphological and serological studies. To capture the ecological differences between populations and biotopes, we used Canon 1100D and Sony DCS-W510 digital cameras. Sea levels and coordinates of populations measured by using a Macellan XL GPS device.

Some specimens were studied for serology experiments by taking blood samples and the others were etherized, then injected with 96% ethanol solution and stored in glass jars containing 96% ethanol to facilitate future DNA analyses. All collected specimens were deposited in Zoology Museum of Adıyaman University (ZMADYU).

To facilitate population comparisons regarding blood-serum proteins, polyacrylamide gel electrophoresis (PAGE) and densitometric analyses were utilized. Blood samples were obtained in the laboratory within three days of collection after anaesthetizing with ether, by ventral abdominal vein puncture with heparinized hematocrit capillary tubes. The separation of blood-serum proteins followed the polyacrylamide "disc" electrophoresis method of Davis (1964), slightly modified by Arıkan (1983).

Metric characters were measured with a Mitutoyo digital caliper of 0.02 mm sensitivity, except total body length, rostrum-anus length and tail length, which

were measured by a millimetric ruler. Summarized statistics were conducted with SPSS 15.0 for Windows. Furthermore, to control the test results of raw metric characters, they were tested again with a Student's t-test that took indexed values of PERCRA (percents of Rostrum-Anus Length; [each metric character / RA] × 100), which improved the analysis. The evaluation of all statistical analyses was based on the statistical significance level of " $p \leq 0.05$ " (Werner 1971).

We applied ANOVA and discriminant analyses for each population and Student's t-test to evaluate potential sexual dimorphism in each population. For mensural (metric) character comparison we also used subadults (higher value of 65 mm by Rostrum-Anus Length), to avoid effects of allometry. Mensural (metric) characters: Total Body Length –the length of the whole body including the tail (TBL), Rostrum-Anus Length –length from the snout to the posterior end of the cloacal opening (RA), Length of Trunk –length from gular fold to the anterior edge of cloacal opening (LT), Tail Length (TL), Nostril-Eye Distance (NED), Distance Between Nostrils (DBN), Eye Diameter (ED), Head Length –distance from the snout to the gular fold (HL), Head Width (HW), Parotoid Length (PL), Parotoid Width (PW), Fore Limb Length (FLL), Hind Limb Length (HLL), Distance between Fore-and-Hind Limbs (DFHL), Height of dorsal protuberance on base of the tail (HPBT) –only in males.

Ethical permission (Ege University Animal Experiments Ethics Committee, 2013#028) as well as special permission (2013#220762) for the field studies from the Republic of Turkey, Ministry of Forestry and Water Affairs were received.

RESULTS

Selge Population

A total of 32 specimens (11 males, 10 females, 11 juveniles) were studied from Selge-Köprülü Canyon. Specimens were found during daytime, at a temperature of 19.7 °C, on a steep slope beneath the limestone ridges, and at a time of humid and cloudy weather at 482m a.s.l. Habitat photos of Selge population are given in Figure 1.

Colouration and Pattern

Males: The background colour of the adult males of the Selge population is

reddish dark brown, eye lids and the posterior of parotoid glands have yellow spots. On the back there are white spots along the paravertebral sides until the tail base. Background colouration continues in the tail. A white stripe begins under the eye line and lasts until the fore limbs uninterruptedly. This pattern exists in all males.



Figure 1. Habitat of the Selge population from different views.

Females: Background colouration is similar to males. There are yellow spots on the posterior of the eye lids and parotoid glands. Scattered white spots start from the top of the head and continuous until the tail tip. A white stripe begins under the eye line on both right and left sides, lasts until the fore limbs, as in the males. All females have that uninterrupted white stripe pattern.

Juveniles: Posterior of parotoids have yellow colouration. The entire body has white spots, which are randomly scattered on the back and per-

sist until the fingertips and the body is dominated by a reddish dark brown dorsal ground colour. Juveniles have a reddish fleshy tone in the ventral aspect, scattered white spots are also visible. Photos of specimens from Selge population are in Figure 2.



Figure 2. Specimens from Selge. a) Adult male b) Adult female
c) Juvenile d) Dorsal view of a juvenile

Serological Evaluation

Blood serum proteins of a male and female individuals from Selge population, were evaluated by polyacrylamide disc electrophoresis method. Both male and female blood samples were divided into 12 fractions. 10 of them were found in the globulin, 1 albumin and 1 pre-albumin. Figure 3 shows the electrophoretic separation of blood serum proteins.

Body measurements and rates

The Student's t-test indicated significant differences between the sexes and

morphological characters. Summarized statistics and P values from the raw data, ratios and PERCRA index values are given in Table 1. The abbreviations are provided in the Materials and Methods section. According to the Student's t test, we determined statistical significance difference of ($p \leq 0.05$) between males and females in terms of characters from raw data and by the PERCRA index values (Eye Diameter, Head Length, Head Width and Parotoid Length).

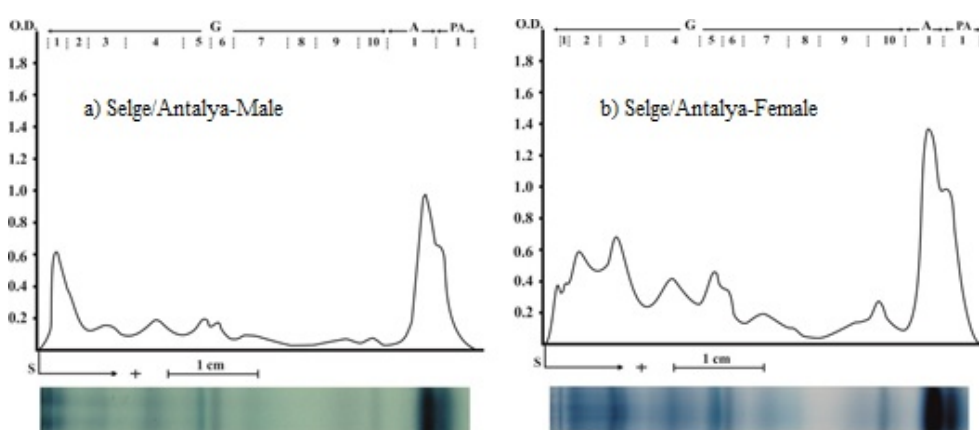


Figure 3. Electrophoretic separation of blood serum protein electropherograms and densitometric curves of the Selge population. (OD: optical density. S: Border between the stacking gel and separating gel. G: Globulin region. PE: Prealbumin. A: Albumin region)

Fersin Population

31 specimens (9 males, 16 females, 6 juveniles) were studied from Fersin/Güçlüköy. We found the specimens under limestone slabs in daytime. The weather was humid and cloudy, the terrain was smooth, with high vegetation. Some specimens were found sheltering inside historical walls. The photos of the habitat of Fersin are in Figure 4.

Colouration and Pattern

Males: The background colour is dark brown and continues to the finger-

Table 1. Body measurements, PERCRA index values and Student's t-test analyses results of the Selge population. 1: Raw data; 2: PERCRA; N: number of specimens; SD: Standard deviation; SE: Standard error of mean; $p \leq 0.05$. The other abbreviations of characters are given in Materials and Methods.

	Male					T-test	Female						
	N	Mean	Min.	Max.	SD		N	Mean	Min.	Max.	SD	SE	
RA	1 11	88.13	68.00	146.00	28.79	0.881	0.124	10	75.10	68.00	83.00	5.10	1.530
TBL	1 11	141.00	126.00	153.00	9.31	2.806	0.867	10	142.40	124.00	158.00	11.03	3.310
	2 11	170.05	100.90	201.22	34.66	10.450	0.058	10	189.54	182.35	201.37	5.45	1.640
LT	1 11	56.77	51.09	62.57	3.48	1.049	0.809	10	54.82	49.22	57.89	2.80	0.840
	2 11	68.50	39.41	77.55	13.96	4.209	0.196	10	73.14	66.54	79.53	3.72	0.810
TL	1 11	63.60	55.00	76.00	26.06	7.858	0.087	10	67.30	56.00	75.00	6.51	1.950
	2 11	77.22	41.12	101.22	34.66	10.450	0.058	10	89.54	82.35	101.37	5.35	1.640
NED	1 11	3.07	2.46	3.62	0.37	0.110	0.763	10	3.12	2.63	3.59	0.32	0.090
	2 11	3.71	2.14	4.79	0.87	0.263	0.078	10	4.15	3.64	4.73	0.38	0.110
DBN	1 11	5.25	4.39	6.21	0.56	0.169	0.732	10	5.25	4.24	5.89	0.59	0.180
	2 11	6.31	3.70	7.52	1.33	0.402	0.113	10	6.93	6.09	7.69	0.53	0.160
ED	1 11	5.06	3.92	6.43	0.77	0.233	0.722	10	5.18	4.44	6.42	0.60	0.180
	2 11	6.00	4.09	7.49	1.08	0.324	0.016	10	6.86	5.29	7.93	0.80	0.240
HL	1 11	17.20	15.44	18.79	0.98	0.295	0.276	10	18.05	16.49	20.55	1.22	0.370
	2 11	20.92	10.85	24.96	4.87	1.468	0.047	10	23.84	22.58	24.78	0.76	0.230
HW	1 11	12.89	11.48	17.75	1.67	0.505	0.692	10	16.81	15.59	17.62	0.61	0.180
	2 11	15.37	8.58	17.30	2.66	0.803	0.049	10	16.81	15.97	17.62	0.61	0.180
PL	1 11	8.96	7.50	12.42	1.32	0.397	0.742	10	12.02	11.02	13.42	0.82	0.250
	2 11	10.65	6.12	12.04	1.81	0.544	0.015	10	12.02	11.02	13.42	0.82	0.250
PW	1 11	3.64	1.83	8.85	1.88	0.567	0.703	10	3.44	2.45	4.19	0.53	0.160
	2 11	4.06	2.66	6.03	1.11	0.334	0.133	10	4.56	3.02	5.56	0.80	0.240
FLL	1 11	23.27	20.36	26.57	1.64	0.496	0.960	10	23.43	19.43	25.40	1.18	0.560
	2 11	28.08	16.43	32.19	5.82	1.754	0.097	10	30.99	27.51	33.73	2.16	0.650
HLL	1 11	25.52	22.42	27.17	1.71	0.514	0.539	10	34.69	31.42	36.55	1.62	0.490
	2 11	30.98	16.21	37.53	7.00	2.112	0.065	10	34.89	31.41	36.55	1.62	0.490
DFHL	1 11	39.39	26.60	45.93	5.51	1.662	0.635	10	40.60	36.32	45.82	3.12	0.940
	2 11	48.29	18.13	58.66	12.88	3.883	0.119	10	53.67	45.74	58.14	3.19	0.960
HPBT	1 11	1.99	1.32	2.58	0.41	0.125							
	2 11	2.45	0.91	3.31	0.78	0.234							
HW/HL	1 11	0.75	0.66	1.11	0.13	0.038	0.319	10	0.71	0.64	0.78	0.04	0.012
TL/TBL	1 11	0.38	0.01	0.50	0.18	0.055	0.094	10	0.48	0.45	0.50	0.01	0.001
PW/PL	1 11	0.39	0.24	0.71	0.13	0.039	0.693	10	0.37	0.27	0.42	0.05	0.014
NED/HL	1 11	0.18	0.15	0.21	0.02	0.006	0.702	10	0.18	0.15	0.20	0.02	0.005

Table 1. (continued)

	Juvenile						Adult						
	N	Mean	Min.	Max.	SD	SE	N	Mean	Min.	Max.	SD	SE	
RA	1	11	52.27	43.00	61.00	6.27	1,800	21	82.22	68.79	146.68	5.67	4.83
TBL	1	11	94.09	77.00	112.00	22.01	6,630	21	142.10	125.00	159.00	10.71	2.16
	2	11	180.59	159.26	225.58	28.23	8,110	21	179.16	100.90	201.74	26.64	5.67
LT	1	11	38.65	30.25	56.16	15.23	4,380	21	55.84	49.22	62.57	4.81	0.64
	2	11	74.83	60.59	130.60	25.97	7,460	21	70.42	39.41	78.83	10.41	2.22
TL	1	11	41.82	31.00	54.00	17.98	5,170	21	59.88	1.32	76.46	5.18	4.52
	2	11	80.59	59.26	125.58	28.23	8,110	21	83.02	41.12	101.74	14.98	3.19
NED	1	11	2.55	2.17	3.36	0.32	0,090	21	3.91	2.14	4.79	0.50	0.16
	2	11	4.89	4.35	5.51	0.36	0,100	21	3.91	2.14	4.79	0.70	0.15
DBN	1	11	3.91	3.28	5.15	0.55	0,160	21	6.61	3.70	7.69	0.83	0.23
	2	11	7.50	6.62	8.44	0.64	0,180	21	6.61	3.70	7.69	1.06	0.22
ED	1	11	4.33	3.48	5.17	0.60	0,170	21	6.41	4.09	7.93	0.65	0.14
	2	11	8.36	6.82	11.86	1.59	0,532	21	6.41	4.09	7.93	1.03	0.22
HL	1	11	13.69	11.31	18.67	1.91	0,550	21	17.60	15.44	20.55	0.53	0.25
	2	11	26.31	22.81	33.40	3.12	0,900	21	22.31	24.96	30.34	3.79	0.81
HW	1	11	10.07	8.54	13.60	1.40	0,400	21	12.82	11.28	17.75	0.82	0.30
	2	11	19.24	17.24	23.55	2.00	0,570	21	16.06	8.58	17.62	2.06	0.44
PL	1	11	6.74	5.00	10.24	1.52	0,440	21	9.02	7.50	12.42	0.65	0.23
	2	11	12.80	9.26	17.07	2.35	0,670	21	11.30	6.12	13.42	1.56	0.33
PW	1	11	2.68	2.42	3.33	0.32	0,090	21	3.54	1.83	8.85	0.34	0.31
	2	11	5.12	4.18	5.71	0.43	0,120	21	4.30	2.66	6.03	0.98	0.21
FLL	1	11	17.51	13.75	27.09	3.50	1,010	21	23.35	19.43	26.57	2.74	0.35
	2	11	33.38	28.39	44.02	5.13	1,470	21	29.47	16.43	33.73	4.61	0.98
HLL	1	11	19.52	14.80	29.82	4.11	1,180	21	25.88	22.18	28.71	2.29	0.42
	2	11	37.12	31.33	48.46	5.62	1,620	21	32.75	16.21	37.53	5.41	1.15
DFHL	1	11	27.55	21.04	44.94	7.24	2,080	21	39.97	26.60	45.93	3.98	0.95
	2	11	52.31	41.28	73.03	10.94	3,140	21	50.85	18.13	58.66	9.75	2.08
HPBT	1							11	1.99	1.32	2.58	0.41	0.12
	2							11	2.45	0.91	3.31	0.78	0.23
HW/HL	1	11	0.74	0.70	0.78	0.03	0,010	21	0.73	0.64	1.11	0.09	0.02
TL/TBL	1	11	0.46	0.37	0.61	0.07	0,020	21	0.42	0.01	0.50	0.01	0.03
PW/PL	1	11	0.41	0.31	0.49	0.05	0,020	21	0.38	0.24	0.71	0.09	0.02
NED/HL	1	11	0.19	0.16	0.20	0.01	0,004	21	0.18	0.15	0.21	0.02	0.00

tips. There are white spots on the head and on the back, along the paravertebral lines until the base of the tail. There are discontinuous white stripes that start under the eye level and continue between the fore and hind limbs.



Figure 4. Habitat of the Fersin population from Fersin/Güçlüköy.

Females: Posterior of the eyelids and parotoid glands have scattered white spots on the head. Limbs, discontinuous white stripes on right and left sides and the ground colouration are the same colouring scheme with males.

Juveniles: Posterior of the parotoids on juvenile specimens have yellow spots in the back part of the head and there are many white spots. Body and tail colouration is the same as in adult specimens. Photos of specimens from the Fersin population are in Figure 5.

Serological Evaluations

Blood serum proteins of a male and female from Fersin were evaluated by polyacrylamide disc electrophoresis method. Blood serum sample of the male specimen divided into 12 fractions. 10 of them were found in the globulin zone, others are albumin and pre-albumin proteins. Female samples divided into 11 fractions. There are 9 globulin, 1 albumin and 1 pre-albumin. Figure 6 shows the electrophoretic separation of blood serum proteins of Fersin population.

Body measurements and rates

The Student's t-test indicated significant differences between the sexes



Figure 5. Specimens from Fersin. a) Adult male b) Adult female
c) Juvenile d) Ventral view of a juvenile.

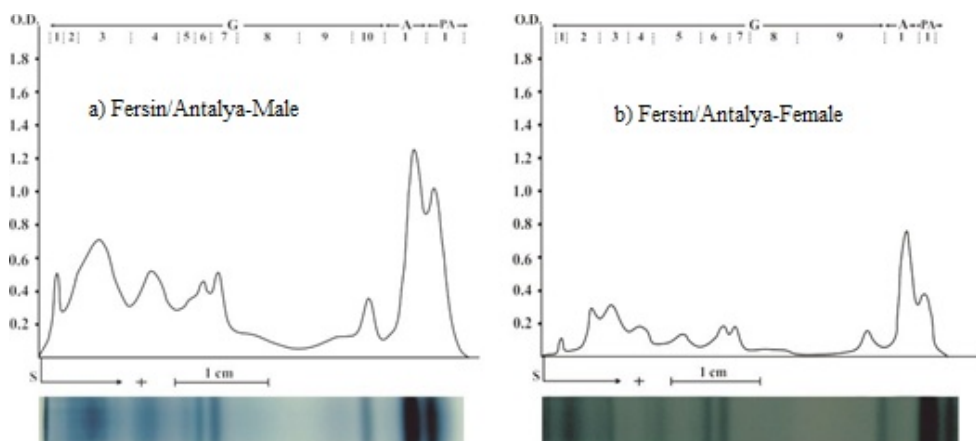


Figure 6. Electrophoretic separation of blood serum protein electropherograms and densitometric curves in the Fersin population. (OD: optical density. S: Border between the stacking gel and separating gel. G: Globulin region. PE: Prealbumin. A: Albumin region)

Table 2.Body measurements, PERCRA index values and Student's t-test results of Fersin population. 1: Raw data; 2: PERCRA; N: number of specimens; SD: Standard deviation; SE: Standard error of mean; $p \leq 0.05$. The other abbreviations of characters are given in Materials and Methods.

	Male					T-test	Female						
	N	Mean	Min.	Max.	SD		N	Mean	Min.	Max.	SD	SE	
RA	1 9	80.89	75.00	84.00	3.02	1.006	0.877	16	81.56	73.00	88.00	5.64	1.370
TBL	1 9	152.56	140.00	165.00	7.68	2.561	0.406	16	151.19	134.00	165.00	10.39	2.520
	2 9	188.61	173.49	196.43	6.51	2.169	0.206	16	185.49	175.90	206.85	7.03	1.704
LT	1 9	61.31	55.27	79.90	7.32	2.441	0.193	16	58.13	49.04	65.81	5.11	1.240
	2 9	75.73	70.38	95.12	7.58	2.525	0.130	16	71.26	66.89	80.44	3.59	0.872
TL	1 9	71.67	61.00	81.00	5.92	1.972	0.251	16	69.63	61.00	78.00	6.16	1.490
	2 9	88.61	73.49	96.43	6.51	2.169	0.206	16	85.49	75.90	106.85	7.03	1.704
NED	1 9	3.57	3.15	4.23	0.34	0.113	0.362	16	3.70	3.20	4.45	0.34	0.082
	2 9	4.42	3.75	5.29	0.51	0.171	0.371	16	4.55	3.68	5.12	0.48	0.116
DBN	1 9	5.20	4.26	6.74	0.84	0.279	0.108	16	5.81	4.61	7.22	0.73	0.177
	2 9	6.42	5.07	8.02	0.92	0.307	0.055	16	7.13	5.30	8.30	0.78	0.189
ED	1 9	5.41	4.86	5.96	0.44	0.148	0.701	16	5.58	4.30	6.64	0.59	0.140
	2 9	6.69	6.08	7.18	0.37	0.123	0.467	16	6.84	5.81	7.81	0.51	0.124
HL	1 9	17.26	16.00	18.32	0.68	0.225	0.038	16	18.86	15.85	23.50	2.02	0.490
	2 9	21.36	20.30	23.49	0.91	0.302	0.005	16	23.12	19.95	28.31	1.85	0.449
HW	1 9	13.17	12.52	14.30	0.63	0.209	0.030	16	13.99	12.29	15.58	1.02	0.247
	2 9	16.28	15.65	17.02	0.55	0.182	0.001	16	17.17	16.30	18.77	0.87	0.211
PL	1 9	8.76	7.74	9.62	0.56	0.186	0.139	16	9.22	8.35	10.58	0.74	0.179
	2 9	10.84	9.33	11.88	0.82	0.272	0.138	16	11.34	9.66	14.11	1.00	0.244
PW	1 9	2.83	2.34	3.50	0.41	0.137	0.102	16	3.16	2.05	3.88	0.56	0.136
	2 9	3.50	2.93	4.38	0.51	0.170	0.090	16	3.86	2.73	5.01	0.72	0.174
FLL	1 9	24.36	22.24	25.78	1.11	0.370	0.879	16	24.58	19.11	28.04	2.27	0.551
	2 9	30.15	27.80	32.19	1.52	0.505	0.976	16	30.17	28.09	35.15	1.71	0.414
HLL	1 9	26.61	24.95	28.14	1.12	0.372	0.578	16	26.56	22.36	29.88	2.41	0.584
	2 9	32.94	30.06	35.25	1.82	0.606	0.636	16	32.61	29.83	38.62	1.97	0.478
DFHL	1 9	42.89	37.70	46.78	2.83	0.942	0.491	16	42.36	35.49	48.34	4.03	0.980
	2 9	53.10	45.42	59.97	4.23	1.410	0.532	16	51.96	46.70	61.49	3.80	0.921
HPBT	1 9	2.13	1.61	3.02	0.49	0.165							
	2 9	2.63	2.02	3.78	0.61	0.205							
HW/HL	1 9	0.76	0.69	0.81	0.04	0.014	0.705	16	0.76	0.59	0.89	0.07	0.017
TL/TBL	1 9	0.47	0.42	0.49	0.02	0.006	0.205	16	0.46	0.43	0.52	0.02	0.005
PW/PL	1 9	0.32	0.28	0.39	0.04	0.014	0.273	16	0.35	0.22	0.42	0.07	0.016
NED/HL	1 9	0.21	0.18	0.24	0.02	0.008	0.623	16	0.20	0.16	0.26	0.03	0.007

Table 2. (continued)

Juvenile													Adult				
	N	Mean	Min.	Max.	SD	SE	N	Mean	Min.	Max.	SD	SE					
RA	1	6	56.67	49.00	65.00	5.28	1.970	25	81.32	73.00	88.00	4.80	0.940				
TBL	1	6	100.67	85.00	115.00	10.93	4.070	25	151.68	134.00	165.00	11.66	2.286				
	2	6	177.54	172.73	192.98	8.60	3.846	25	186.61	173.49	206.85	6.82	1.340				
LT	1	6	38.56	32.88	47.03	4.76	1.780	25	59.28	49.04	79.90	6.40	1.255				
	2	6	67.92	64.89	72.35	2.76	1.030	25	72.87	66.89	95.12	5.70	1.120				
TL	1	6	44.00	36.00	53.00	6.38	2.853	25	70.36	61.00	81.00	6.03	1.180				
	2	6	77.54	72.73	92.98	7.70	2.870	25	86.61	73.49	106.85	6.82	1.340				
NED	1	6	2.72	1.73	3.65	0.68	0.250	25	3.66	3.15	4.45	0.34	0.066				
	2	6	4.79	3.15	5.86	1.02	0.458	25	4.51	3.68	5.29	0.45	0.090				
DBN	1	6	4.10	3.08	5.11	0.65	0.240	25	5.59	4.26	7.22	0.80	0.157				
	2	6	7.20	6.29	7.87	0.62	0.278	25	6.88	5.07	8.30	0.89	0.175				
ED	1	6	4.08	3.50	4.74	0.49	0.218	25	5.52	4.30	6.64	0.54	0.110				
	2	6	7.24	6.36	8.32	0.75	0.334	25	6.79	5.81	7.81	0.46	0.091				
HL	1	6	13.47	12.24	14.74	1.08	0.481	25	18.28	15.85	23.50	1.96	0.384				
	2	6	23.88	21.74	27.04	2.14	0.800	25	22.49	19.95	28.31	1.77	0.347				
HW	1	6	10.87	9.85	12.63	1.11	0.410	25	13.70	12.29	15.58	0.96	0.188				
	2	6	19.18	18.15	20.32	0.92	0.340	25	16.85	15.65	18.77	0.77	0.150				
PL	1	6	7.15	5.40	8.21	1.10	0.491	25	9.05	7.74	10.58	0.70	0.137				
	2	6	12.57	11.02	14.40	1.27	0.569	25	11.16	9.33	14.11	0.97	0.190				
PW	1	6	2.47	1.79	3.32	0.58	0.220	25	3.05	2.05	3.88	0.53	0.104				
	2	6	4.32	3.35	5.11	0.68	0.250	25	3.73	2.73	5.01	0.63	0.120				
FLL	1	6	17.01	14.84	19.12	1.84	0.680	25	24.51	20.94	28.04	1.64	0.340				
	2	6	30.03	27.64	33.54	2.07	0.770	25	30.16	27.80	35.15	1.61	0.316				
HLL	1	6	18.60	15.85	22.15	2.57	0.940	25	26.58	22.36	29.88	2.04	0.399				
	2	6	32.86	27.97	38.86	3.72	1.390	25	32.70	29.83	38.62	1.92	0.380				
DFHL	1	6	27.99	24.26	34.43	4.00	1.490	25	42.55	35.49	48.34	3.86	0.757				
	2	6	49.26	44.44	52.97	3.61	1.190	25	52.40	45.42	61.49	3.90	0.765				
HPBT	1						9	2.13	1.61	3.02	0.49	0.165					
	2						9	2.63	2.02	3.78	0.61	0.205					
HW/HL	1	6	0.79	0.74	0.82	0.03	0.013	25	0.76	0.59	0.89	0.06	0.012				
TL/TBL	1	6	0.44	0.42	0.48	0.03	0.011	25	0.46	0.42	0.52	0.02	0.004				
PW/PL	1	6	0.33	0.27	0.37	0.04	0.018	25	0.34	0.22	0.42	0.06	0.011				
NED/HL	1	6	0.19	0.14	0.23	0.03	0.015	25	0.20	0.16	0.26	0.03	0.005				

and morphological characters. Summarized statistics and p values from the raw data, ratios and PERCRA index values are given in Table 2. According to the Student's t test, we determined statistical significance difference of ($p \leq 0.05$) between males and females in terms of characters from raw data and by the PERCRA index values (Head Length and Head Width).

Dikmen Population

25 specimens (6 males, 11 females, 8 juvenile) were found in Dikmen/Akseki region. In this place, specimens were found in walls left over from ancient settlements. It was hard to reach the specimens inside the walls, so fieldwork continued into the night to acquire enough specimens for statistics. The weather was humid and cloudy, temperature of 17°C. Habitat photos of Dikmen population are given in Figure 7.



Figure 7. Habitat photos from Dikmen and views of the old walls that sheltered the specimens.

Colouration and Pattern

Males: Background colour is dark brown and there are white spots on the eyelids, anterior of the parotoids and in the back in a scattered pattern. Posterior of the parotoids have yellowish spots. Dorsal part of the tail is light brown and white spots at the limbs continue to the fingertips. No white striping on lateral parts.

Females: Yellowish spots are visible posterior of the parotoids. In the dorsal of the body, there are white spots on a dark brown background colour. The dorsal colouration of the tail is light brown. No white striping on lateral parts.

Juveniles: Yellow spots on the posterior of the parotoids are visible in juveniles. In the dorsal, there are scattered white spots on the head and back on a dark brown background colouration. Other colour pattern features are the same as males. Photos of specimens from the Dikmen population are in Figure 8.



Figure 8. Specimens from Dikmen. a) Adult male b) Adult female c) Juvenile d) Dorsal view of adult female, adult male and juvenile.

Serological Evaluations

Blood serum proteins of a male and female from Dikmen population were evaluated by polyacrylamide disc electrophoresis method. Both male and female blood serum samples were divided into 11 fractions. Nine of them

were found in the globulin, 1 albumin and 1 pre-albumin (Figure 9).

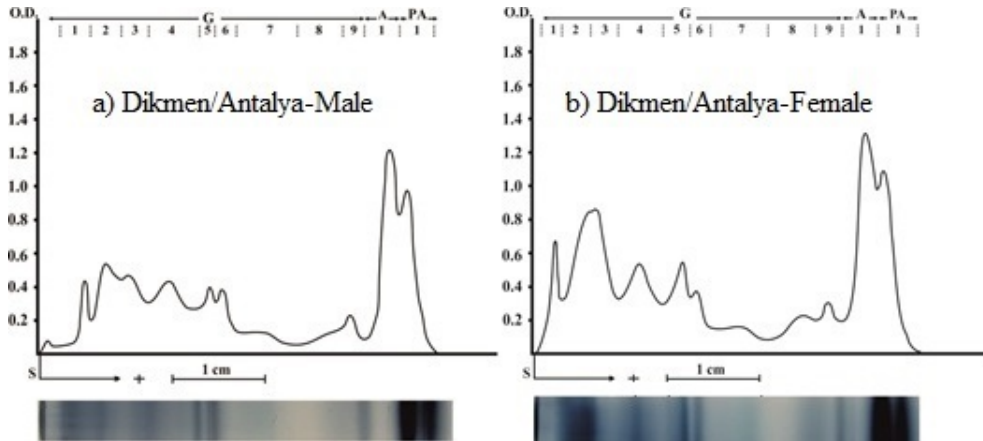


Figure 9. Electrophoretic separation of blood serum protein electropherograms and densitometric curves of the Dikmen population. (OD: optical density. S: Border between the stacking gel and separating gel. G: Globulin region. PE: Prealbumin. A: Albumin region).

Body measurements and rate

The Student's t-test indicated significant differences between the sexes and morphological characters. Summarized statistics and p values from the raw data, ratios and PERCRA index values are given in Table 3. According to the Student's t-test, we couldn't determine statistical significance difference of ($p \leq 0.05$) between males and females in terms of characters from raw data and by the PERCRA index values.

Gündoğmuş (Bayırköy) Population

The Gündoğmuş population is 9 km away from Güzelbağ and near the Bayırköy/Takanlar neighborhood. A total of 20 specimens (5 males, 8 females, 7 juveniles) were found in the area. The weather was cloudy, humid, temperature of 17.5°C and the elevation was 710m a.s.l. Habitat photos of the Gündoğmuş population are in Figure 10.

Table 3. Body measurements, PERCRA index values and student T-test analyses results of Dikmen population. 1: Raw data; 2: PERCRA; N: number of specimens; SD: Standard deviation; SE: Standard error of mean; $p \leq 0.05$. The other abbreviations of characters are given in Materials and Methods.

	Male						T-test	Female						
	N	Mean	Min.	Max.	SD	SE	P	N	Mean	Min.	Max.	SD	SE	
RA	1	6	77.00	70.00	86.00	6.57	2.683	0.552	11	79.09	67.00	91.00	6.98	2.104
TBL	1	6	162.83	146.00	185.00	14.02	5.724	0.708	11	159.82	130.00	195.00	17.87	5.388
	2	6	211.70	191.57	221.05	10.70	4.368	0.142	11	202.12	185.71	219.40	14.25	4.295
LT	1	6	61.83	54.00	71.37	5.75	2.347	0.354	11	58.33	37.93	72.76	9.26	2.792
	2	6	80.42	70.82	86.93	5.67	2.313	0.081	11	73.68	49.26	82.46	9.15	2.759
TL	1	6	85.83	76.00	99.00	9.54	3.894	0.374	11	80.73	61.00	104.00	13.15	3.966
	2	6	111.70	91.57	121.05	10.70	4.368	0.142	11	102.12	85.71	119.40	14.25	4.295
NED	1	6	3.44	2.70	4.12	0.47	0.193	0.166	11	3.79	3.25	4.77	0.42	0.128
	2	6	4.47	3.86	5.01	0.49	0.200	0.190	11	4.79	4.35	5.32	0.36	0.108
DBN	1	6	5.38	4.76	5.81	0.43	0.176	0.610	11	5.52	4.70	6.64	0.67	0.202
	2	6	6.99	6.58	7.64	0.36	0.148	1.000	11	6.99	5.88	8.61	0.78	0.235
ED	1	6	5.19	4.53	6.01	0.48	0.197	0.544	11	4.99	3.44	6.64	0.85	0.257
	2	6	6.75	6.12	7.31	0.42	0.172	0.183	11	6.31	4.25	7.30	0.87	0.263
HL	1	6	19.03	17.80	20.71	1.11	0.455	0.967	11	19.01	17.01	20.64	1.18	0.354
	2	6	24.78	22.96	25.66	1.06	0.432	0.348	11	24.13	21.98	26.96	1.68	0.506
HW	1	6	13.70	13.01	14.51	0.59	0.240	0.457	11	14.01	12.54	16.29	1.10	0.332
	2	6	17.86	16.40	18.90	1.02	0.417	0.840	11	17.75	16.35	19.72	0.91	0.275
PL	1	6	9.09	8.22	9.92	0.60	0.245	0.197	11	9.52	8.38	10.41	0.64	0.194
	2	6	11.90	9.90	14.17	1.58	0.645	0.802	11	12.09	10.89	14.09	1.00	0.301
PW	1	6	3.66	3.14	4.62	0.58	0.239	0.306	11	3.31	2.38	4.42	0.72	0.217
	2	6	4.77	4.04	5.86	0.77	0.314	0.176	11	4.19	3.00	5.20	0.82	0.248
FLL	1	6	26.25	24.31	29.15	1.72	0.703	0.375	11	25.34	22.38	29.13	2.32	0.700
	2	6	34.21	30.95	38.44	2.49	1.018	0.123	11	32.12	28.74	35.40	2.36	0.711
HLL	1	6	29.35	25.57	33.58	2.69	1.097	0.721	11	28.88	25.61	33.86	2.28	0.688
	2	6	38.30	30.81	43.19	4.07	1.660	0.400	11	36.64	32.41	43.00	2.82	0.849
DFHL	1	6	46.85	40.80	54.64	5.18	2.114	0.527	11	44.93	33.28	57.87	6.83	2.058
	2	6	60.98	49.99	66.43	6.03	2.463	0.214	11	56.78	48.23	65.12	6.73	2.029
HPBT	1	5	2.79	1.84	3.81	0.75	0.336							
	2	5	3.68	2.63	4.95	0.92	0.413							
HW/HL	1	6	0.72	0.70	0.74	0.01	0.006	0.217	11	0.74	0.68	0.81	0.04	0.012
TL/TBL	1	6	0.53	0.48	0.55	0.03	0.010	0.136	11	0.50	0.46	0.54	0.04	0.011
PW/PL	1	6	0.40	0.36	0.49	0.05	0.020	0.054	11	0.35	0.28	0.43	0.06	0.017
NED/HL	1	6	0.18	0.15	0.20	0.02	0.008	0.081	11	0.20	0.17	0.24	0.02	0.006

Table 3. (continued)

Juvenile													Adult				
	N	Mean	Min.	Max.	SD	SE	N	Mean	Min.	Max.	SD	SE					
RA	1 8	45.88	34.00	60.00	9.16	3.237	17	78.35	67.00	91.00	6.71	1.627					
TBL	1 8	94.13	72.00	120.00	18.83	6.659	17	160.88	130.00	195.00	16.22	3.935					
	2 8	207.78	159.26	225.58	35.19	12.440	17	205.50	185.71	221.05	13.60	3.298					
LT	1 8	34.89	27.43	44.83	6.18	2.184	17	59.56	37.93	72.76	8.18	1.983					
	2 8	77.22	64.89	72.35	12.94	4.576	17	76.06	49.26	86.93	8.57	2.077					
TL	1 8	48.25	32.00	68.00	14.18	5.013	17	82.53	61.00	104.00	11.95	2.899					
	2 8	107.78	70.83	167.65	35.19	12.440	17	105.50	85.71	121.05	13.60	3.298					
NED	1 8	2.64	1.91	3.64	0.50	0.177	17	3.67	2.70	4.77	0.46	0.112					
	2 8	5.83	4.90	7.85	0.95	0.336	17	4.68	3.86	5.32	0.43	0.103					
DBN	1 8	3.82	3.32	4.55	0.39	0.140	17	5.47	4.70	6.64	0.59	0.142					
	2 8	8.52	6.87	11.26	1.39	0.491	17	6.99	5.88	8.61	0.65	0.157					
ED	1 8	3.71	3.35	4.36	0.38	0.135	17	5.06	3.44	6.64	0.73	0.177					
	2 8	8.26	6.93	10.35	1.18	0.418	17	6.46	4.25	7.31	0.76	0.185					
HL	1 8	12.99	11.10	15.24	1.52	0.538	17	19.02	17.01	20.71	1.12	0.271					
	2 8	28.90	24.58	37.71	4.18	1.477	17	24.36	21.98	26.96	1.49	0.361					
HW	1 8	9.70	8.07	11.46	1.31	0.465	17	13.90	12.54	16.29	0.94	0.229					
	2 8	21.61	18.03	29.12	3.74	1.322	17	17.79	16.35	19.72	0.92	0.223					
PL	1 8	6.40	5.08	8.25	1.07	0.379	17	9.37	8.22	10.41	0.65	0.156					
	2 8	14.22	11.32	18.82	2.56	0.906	17	12.02	9.90	14.17	1.19	0.288					
PW	1 8	2.55	1.76	3.10	0.54	0.192	17	3.44	2.38	4.62	0.68	0.165					
	2 8	5.78	3.75	9.03	1.87	0.661	17	4.39	3.00	5.86	0.83	0.202					
FLL	1 8	17.14	13.45	22.44	3.26	1.153	17	25.66	22.38	29.15	2.12	0.514					
	2 8	38.17	30.94	56.62	8.56	3.027	17	32.86	28.74	38.44	2.55	0.617					
HLL	1 8	19.75	15.26	25.05	3.45	1.219	17	29.04	25.57	33.86	2.36	0.572					
	2 8	44.49	32.50	66.06	11.83	4.184	17	37.22	30.81	43.19	3.29	0.797					
DFHL	1 8	27.07	20.76	36.33	5.88	2.080	17	45.60	33.28	57.87	6.20	1.503					
	2 8	60.42	43.25	94.29	15.82	5.592	17	58.26	48.23	66.43	6.63	1.608					
HPBT	1						5	2.79	1.84	3.81	0.75	0.336					
	2						5	3.68	2.63	4.95	0.92	0.413					
HW/HL	1 8	0.75	0.71	0.83	0.04	0.014	17	0.73	0.68	0.81	0.03	0.008					
TL/TBL	1 8	0.51	0.41	0.63	0.08	0.028	17	0.51	0.46	0.55	0.03	0.008					
PW/PL	1 8	0.40	0.31	0.49	0.07	0.023	17	0.37	0.28	0.49	0.06	0.014					
NED/HL	1 8	0.20	0.17	0.25	0.02	0.008	17	0.19	0.15	0.24	0.02	0.005					



Figure 10. Habitat photos of the Gündoğmuş population.

Colouration and Pattern

Males: Head and background colour of the males is dark brown and white spots on the parotoids are visible. Dorsally, white spots continue along the paravertebral lines until the tail base. On the sides, there are intermittent white stripes which start under the eye level and continue between the fore and hind limbs. The background colour continues to the fingertips.

Females: Head and background colour in females contain scattered white spots on a dark brown colouration. On the sides, intermittent white stripes start under the eye level and ongoing continue between the fore and hind limbs. The background colour continues to the fingertips.

Juveniles: Intense and scattered white spots present at the eyelids around the parotoid glands and yellow spots are visible on the paratoids. White spots on the body continue intermittently to the fingertips on the dark brown background colour. Photos of specimens from Gündoğmuş population are given in Figure 11.

Serological Evaluations

Blood serum proteins of a male and female from Gündoğmuş, were evaluated by the polyacrylamide disc electrophoresis method. Blood serum samples of the male were divided into 12 protein fractions. 10 of them were found in globulin and the others are albumin and pre-albumin, female's blood serum samples were divided into 13 fractions. There are 11 globulin and 1 albumin and 1 pre-albumin proteins. Figure 12 shows the electropho-



Figure 11. Specimens from Gündoğmuş. a) Adult male b) Adult female c-d) Juveniles.

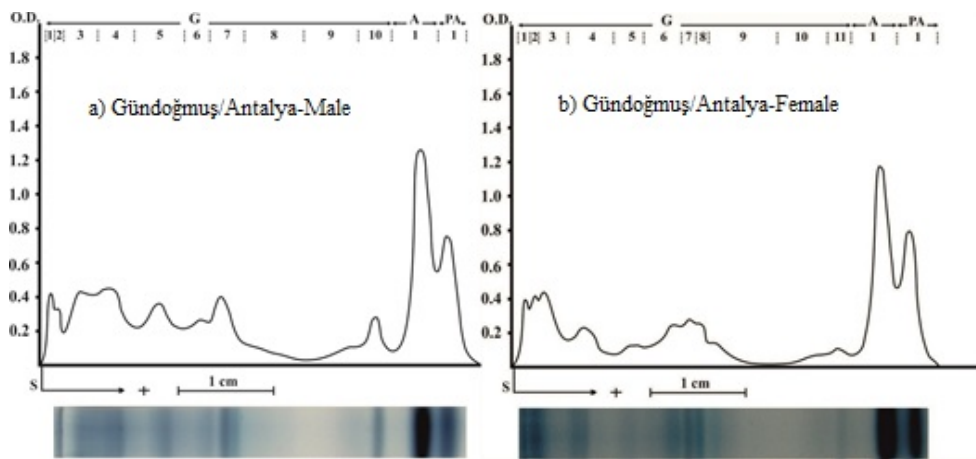


Figure 12. Electrophoretic separation of the Gündoğmuş population, blood serum protein electropherograms and densitometric curves. (OD: optical density. S: Border between the stacking gel and separating gel. G: Globulin region. PE: Prealbumin. A: Albumin region).

Table 4. Body measurements, PERCRA index values and Student's t-test results of the Gündoğmuş population. 1: Raw data; 2: PERCRA; N: number of specimens; SD: Standard deviation; SE: Standard error of mean; $P \leq 0.05$. Other abbreviations of characters are given in Materials and Methods.

		Male					T-test	Female					
		N	Mean	Min.	Max.	SD		N	Mean	Min.	Max.	SD	SE
RA	1	5	77.80	68.00	84.00	8.07	0.346	8	76.88	67.00	84.00	6.98	2.310
	2	5	155.40	145.00	166.00	10.26	0.235	8	152.13	120.00	171.00	18.57	6.140
TBL	1	5	200.48	187.95	213.24	9.86	0.408	8	197.71	179.10	221.43	15.80	4.996
	2	5	56.93	52.91	60.43	3.67	1.641	8	56.91	45.91	63.73	6.57	2.170
LT	1	5	73.43	70.75	77.97	3.20	1.432	8	73.96	68.52	80.73	5.22	1.650
	2	5	77.60	73.00	82.00	3.85	1.720	8	75.25	53.00	89.00	13.51	6.570
TL	1	5	100.48	87.95	113.24	9.86	4.408	8	97.71	79.10	121.43	15.80	4.996
	2	5	3.55	3.00	4.19	0.42	0.190	8	3.56	2.86	4.10	0.41	0.140
NED	1	5	4.57	4.14	5.00	0.40	0.179	8	4.64	3.95	5.29	0.72	0.227
	2	5	4.73	4.44	5.27	0.38	0.168	8	5.12	4.57	5.56	0.31	0.100
DBN	1	5	6.10	5.32	6.53	0.48	0.215	8	6.70	5.92	7.46	0.78	0.246
	2	5	5.15	4.67	5.84	0.48	0.213	8	5.15	4.59	5.57	0.36	0.120
ED	1	5	6.64	6.30	6.96	0.32	0.145	8	6.75	5.53	7.99	1.03	0.325
	2	5	17.75	17.40	18.16	0.31	0.139	8	19.04	16.80	20.78	1.52	0.500
HL	1	5	23.01	20.83	26.37	2.45	1.096	8	24.83	21.87	27.09	2.73	0.862
	2	5	13.48	12.84	14.70	0.75	0.337	8	13.66	11.73	15.14	1.24	0.410
HW	1	5	17.42	15.76	18.88	1.39	0.622	8	17.80	16.32	20.37	1.59	0.503
	2	5	9.41	8.23	9.90	0.67	0.301	8	9.53	8.32	10.94	0.99	0.330
PL	1	5	12.14	11.37	13.69	0.91	0.406	8	12.46	10.70	15.04	1.75	0.555
	2	5	3.09	2.41	4.12	0.68	0.302	8	3.26	2.71	3.76	0.39	0.130
PW	1	5	4.06	2.87	5.89	1.26	0.564	8	4.26	3.79	5.39	0.89	0.280
	2	5	24.53	23.07	25.66	0.94	0.420	8	24.55	20.68	27.08	2.30	0.760
FLL	1	5	31.81	29.37	37.74	3.65	1.631	8	32.01	29.70	37.93	3.21	1.014
	2	5	27.12	26.55	27.57	0.47	0.211	8	27.79	23.15	31.12	3.20	1.060
HLL	1	5	35.17	31.76	40.54	3.86	1.724	8	36.22	31.47	42.34	3.81	1.205
	2	5	42.37	38.17	46.62	3.52	1.574	8	43.68	35.58	48.68	4.85	1.600
DFHL	1	5	54.63	49.69	58.94	3.31	1.479	8	56.77	53.10	62.29	3.82	1.208
	2	5	2.50	2.19	3.06	0.40	0.178	8					
HPBT	1	5	3.21	2.65	3.64	0.36	0.162	8					
	2	5	0.76	0.72	0.84	0.05	0.021	8	0.72	0.66	0.80	0.05	0.014
HW/HL	1	5	0.50	0.47	0.53	0.02	0.011	8	0.49	0.44	0.55	0.04	0.013
TL/TBL	1	5	0.33	0.25	0.43	0.08	0.036	8	0.35	0.26	0.43	0.05	0.015
PW/PL	1	5	0.20	0.17	0.24	0.03	0.012	8	0.19	0.16	0.23	0.02	0.007
NED/HL	1	5						8					

Table 4. (continued)

Juvenile													Adult				
	N	Mean	Min.	Max.	SD	SE	N	Mean	Min.	Max.	SD	SE					
RA	1	7	53.43	48.00	60.00	4.24	1.480	13	77.13	67.00	84.00	7.10	1.840				
TBL	1	7	110.86	91.00	121.00	9.79	3.430	13	158.38	120.00	171.00	15.46	4.120				
	2	7	208.02	182.00	229.17	18.46	6.460	13	109.77	179.10	221.43	12.79	3.410				
LT	1	7	41.48	34.11	46.32	3.71	1.300	13	56.92	45.91	63.73	5.44	1.450				
	2	7	77.84	68.22	85.02	6.93	2.430	13	73.76	68.52	80.73	3.85	1.030				
TL	1	7	57.43	41.00	66.00	8.75	3.060	13	76.15	53.00	89.00	10.62	2.830				
	2	7	108.02	82.00	129.17	18.46	6.460	13	98.77	79.10	121.43	13.75	3.551				
NED	1	7	2.76	2.01	3.56	0.47	0.170	13	3.55	2.86	4.19	0.41	0.106				
	2	7	5.18	4.02	6.42	0.84	0.290	13	4.61	3.95	5.29	0.44	0.120				
DBN	1	7	4.01	3.35	4.70	0.44	0.150	13	4.97	4.44	5.56	0.38	0.100				
	2	7	7.53	6.68	8.55	0.76	0.260	13	6.47	5.32	7.46	0.61	0.160				
ED	1	7	4.37	3.71	5.10	0.46	0.160	13	5.15	4.59	5.84	0.38	0.097				
	2	7	8.16	7.71	8.56	0.38	0.130	13	6.70	5.53	7.99	0.64	0.170				
HL	1	7	15.23	13.02	17.77	1.43	0.500	13	18.26	16.80	20.78	1.34	0.460				
	2	7	28.58	25.18	32.31	2.71	0.950	13	24.13	20.83	27.09	2.06	0.550				
HW	1	7	10.97	9.76	11.78	0.65	0.230	13	13.59	11.73	15.14	1.05	0.280				
	2	7	20.58	19.23	22.75	1.30	0.450	13	17.66	15.76	20.37	1.54	0.397				
PL	1	7	7.57	6.39	8.96	0.79	0.280	13	9.48	8.23	10.94	0.86	0.230				
	2	7	14.24	12.27	16.29	1.75	0.610	13	12.34	10.70	15.04	1.22	0.330				
PW	1	7	2.96	2.47	3.63	0.39	0.140	13	3.20	2.41	4.12	0.51	0.131				
	2	7	5.65	4.27	6.60	0.87	0.310	13	4.18	2.87	5.89	0.85	0.230				
FLL	1	7	19.38	16.39	21.51	1.70	0.600	13	24.54	20.68	27.08	1.84	0.490				
	2	7	36.58	32.78	41.98	3.20	1.120	13	31.93	29.37	37.93	2.00	0.770				
HLL	1	7	21.73	18.53	23.54	1.78	0.620	13	27.53	23.15	31.12	2.48	0.660				
	2	7	40.77	37.06	46.94	3.25	1.140	13	35.81	31.47	42.34	3.57	0.950				
DFHL	1	7	31.94	26.01	35.44	2.93	1.020	13	43.17	35.58	48.68	4.27	1.140				
	2	7	59.95	52.02	67.73	6.00	2.681	13	55.95	49.69	62.29	3.24	0.860				
HPBT	1							5	2.50	2.19	3.06	0.40	0.178				
	2							5	3.21	2.65	3.64	0.36	0.162				
HW/HL	1	7	0.73	0.71	0.75	0.02	0.009	13	0.73	0.66	0.84	0.05	0.013				
TL/TBL	1	7	0.52	0.45	0.56	0.04	0.019	13	0.50	0.44	0.55	0.03	0.009				
PW/PL	1	7	0.40	0.38	0.43	0.02	0.009	13	0.34	0.25	0.43	0.06	0.015				
NED/HL	1	7	0.17	0.15	0.19	0.01	0.006	13	0.19	0.16	0.24	0.02	0.006				

retic separation of blood serum proteins of the Gündoğmuş population.

Body measurements and rates

The Student's t-test indicated significant differences between the sexes and morphological characters. Summarized statistics and p values from the raw data, ratios and PERCRA index values are given in Table 4. According to the Student's t-test, we determined statistical significance difference of ($p \leq 0.05$) between males and females in terms of characters from raw data and by the PERCRA index values (Distance between nostrils).

Güzelbağ Population

A total of 28 specimens (6 males, 12 females, 10 juveniles) were found in Güzelbağ. The weather was rainy, temperature of 18°C and the elevation was 829 m a.s.l. The specimens collected from under the white-striped limestone rocks. The field was smooth open. Habitat photos of the Güzelbağ population are in Figure 13.



Figure 13. Habitat photos of the Güzelbağ population.
Habitat destruction is visible on the right-hand photo.

Colouration and Pattern

Males: Background colour is dark brown and there are markedly large white spots on the head and dorsum, which continue until the fingertips. Yellow spots are visible at posterior of the parotoids. In the sides, there are frag-

mented and discontinuous white stripes which start under the eye level and go on between the fore and hind limbs.

Females: There are white spots at the above the head and yellow ones posterior of the parotoids. Background colour is dark brown but, unlike males, white spots are smaller and less in number. On the sides, there are intermittent white stripes which start under the eye level and continue between the fore and hind limbs.

Juveniles: There are yellow spots at the posterior of the eyelids and the parotoids. Numerous scattered white spots on dark brown background colour continue to the fingertips. Photos of specimens from the Güzelbağ population are in Figure 14.



Figure 14. Specimens from Güzelbağ a) Adult male b) Adult female
c) Juvenile d) View of an adult female, adult male and a juvenile.

Serological Evaluations

Blood serum proteins of a male and female from Güzelbağ population,

were evaluated by the polyacrylamide disc electrophoresis method. Both male and female blood samples were divided into 11 fractions, 9 of them were found in the globulin zone, 1 albumin and 1 pre-albumin proteins. Figure 15 shows the electrophoretic separation of blood serum proteins.

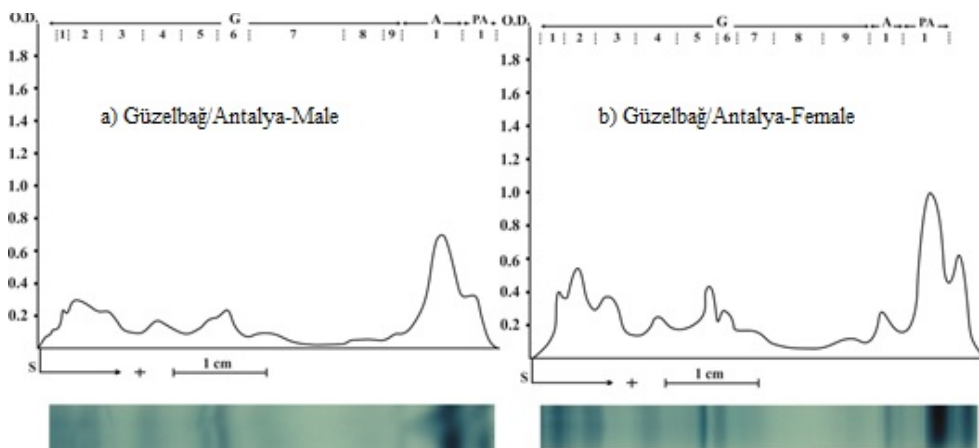


Figure 15. Electrophoretic separation of the blood serum protein electropherograms and densitometric curves of the Güzelbağ population. (OD: optical density. S: Border between the stacking gel and separating gel. G: Globulin region. PE: Prealbumin. A: Albumin region.

Body measurements and rates

The Student's t-test indicated significant differences between the sexes and morphological characters. Summarized statistics and p values from the raw data, ratios and PERCRA index values are given in Table 5. According to the Student's t-test, we could not determine statistical significance difference of ($p \leq 0.05$) between males and females in terms of characters from raw data and by the PERCRA index values.

Türbelinaz Population

30 specimens (7 males, 16 females, 7 juveniles) were found in Türbelinaz. They were found beneath the limestones when the weather was sunny and

Table 5. Body measurements, PERCRA index values and Student's t-test results of Güzelbağ population. 1: Raw data; 2: PERCRA; N: number of specimens; SD: Standard deviation; SE: Standard error of mean; $p \leq 0.05$. The other abbreviations of characters are given in Materials and Methods.

	Male						T-test		Female					
	N	Mean	Min.	Max.	SD	SE	P		N	Mean	Min.	Max.	SD	SE
RA	1 6	75.67	72.00	80.00	3.61	1.476	0.734		12	78.50	68.00	89.00	7.21	2.070
TBL	1 6	140.83	132.00	150.00	6.27	2.561	0.553		12	148.25	127.00	165.00	12.74	3.660
	2 6	186.20	177.50	192.00	5.09	2.079	0.447		12	188.96	180.90	195.24	5.22	1.506
LT	1 6	57.73	47.88	75.12	9.35	3.818	0.566		12	55.93	46.29	65.23	5.47	1.600
	2 6	76.04	66.50	93.90	9.25	3.778	0.304		12	71.18	66.13	73.74	2.00	0.578
TL	1 6	65.17	60.00	70.00	3.92	1.600	0.430		12	69.75	59.00	80.00	6.06	1.740
	2 6	86.20	77.50	92.00	5.09	2.079	0.447		12	88.96	80.90	95.24	5.22	1.506
NED	1 6	3.78	3.15	4.22	0.40	0.163	0.265		12	3.72	3.35	4.30	0.26	0.800
	2 6	4.99	4.38	5.86	0.51	0.209	0.140		12	4.77	4.21	6.14	0.27	0.079
DBN	1 6	5.17	4.88	5.51	0.27	0.110	0.301		12	5.39	4.21	6.25	0.59	0.170
	2 6	6.84	6.31	7.57	0.43	0.174	0.410		12	6.90	5.47	8.17	0.93	0.268
ED	1 6	5.11	4.66	5.65	0.36	0.148	0.156		12	5.68	5.00	6.35	0.43	0.120
	2 6	6.78	6.21	7.85	0.66	0.267	0.246		12	7.16	6.18	8.70	0.75	0.218
HL	1 6	16.65	15.57	17.77	0.90	0.367	0.176		12	17.95	16.42	19.64	1.05	0.300
	2 6	22.01	20.76	23.08	0.74	0.304	0.135		12	22.82	19.19	25.54	1.89	0.545
HW	1 6	13.19	12.67	13.66	0.44	0.179	0.197		12	13.99	12.45	15.77	0.96	0.270
	2 6	17.46	16.14	18.83	0.97	0.395	0.305		12	17.72	16.57	19.28	1.21	0.349
PL	1 6	8.63	7.93	9.12	0.47	0.193	0.178		12	9.51	7.81	10.97	1.10	0.370
	2 6	11.43	9.91	12.28	0.84	0.345	0.153		12	11.94	11.21	13.06	0.58	0.169
PW	1 6	2.66	2.26	3.06	0.31	0.125	0.136		12	3.04	2.53	3.84	0.38	0.110
	2 6	3.53	2.83	4.25	0.52	0.214	0.231		12	3.82	3.12	4.66	0.44	0.128
FLL	1 6	23.47	22.49	25.00	0.90	0.368	0.831		12	24.39	21.52	27.98	1.97	0.570
	2 6	31.05	28.43	32.14	1.33	0.542	0.816		12	30.79	29.73	33.29	1.18	0.342
HLL	1 6	25.85	22.58	27.53	1.77	0.721	0.442		12	27.45	23.26	30.13	2.28	0.660
	2 6	34.17	31.36	36.12	1.92	0.782	0.393		12	34.79	33.10	36.30	1.12	0.322
DFHL	1 6	40.86	35.65	57.05	8.04	3.283	0.731		12	41.02	33.38	50.38	5.21	1.500
	2 6	53.84	47.53	71.31	8.80	3.593	0.521		12	50.69	39.44	58.40	4.38	1.264
HPBT	1 6	2.37	1.87	2.91	0.51	0.207								
	2 6	3.12	2.52	4.04	0.63	0.259								
HW/HL	1 6	0.79	0.73	0.86	0.05	0.020	0.769		12	0.79	0.71	0.86	0.05	0.015
TL/TBL	1 6	0.46	0.44	0.48	0.01	0.006	0.461		12	0.47	0.44	0.49	0.02	0.004
PW/PL	1 6	0.31	0.25	0.35	0.04	0.015	0.538		12	0.32	0.26	0.41	0.04	0.012
NED/HL	1 6	0.23	0.19	0.27	0.03	0.011	0.066		12	0.20	0.18	0.22	0.01	0.004

Table 5. (continued)

	Juvenile						Adult						
	N	Mean	Min.	Max.	SD	SE	N	Mean	Min.	Max.	SD	SE	
RA	1	10	54.90	48.00	65.00	7.77	2.230	18	78.00	68.00	89.00	6.30	1.480
TBL	1	10	101.70	87.00	123.00	14.93	4.290	18	146.59	127.00	165.00	11.53	2.710
	2	10	185.31	175.00	194.12	6.10	1.830	18	188.04	177.50	195.24	4.45	1.020
LT	1	10	38.24	33.85	47.78	5.07	1.460	18	57.13	47.88	75.12	6.85	1.610
	2	10	69.78	58.55	73.51	4.28	1.290	18	72.80	66.13	93.90	5.90	1.350
TL	1	10	46.80	39.00	58.00	7.56	2.120	18	68.59	59.00	80.00	5.87	1.380
	2	10	85.31	75.00	94.12	5.39	1.703	18	88.04	77.50	95.24	5.12	1.207
NED	1	10	2.93	2.10	4.30	0.68	0.190	18	3.71	3.15	4.22	0.31	0.070
	2	10	5.11	4.09	6.94	0.90	0.285	18	4.85	4.21	6.14	0.40	0.094
DBN	1	10	4.15	3.36	5.58	0.62	0.180	18	5.37	4.21	6.25	0.51	0.120
	2	10	7.56	5.33	8.77	1.02	0.322	18	6.88	5.47	8.17	0.79	0.187
ED	1	10	4.32	3.42	5.30	0.59	0.170	18	5.48	4.66	6.35	0.49	0.110
	2	10	7.84	6.41	9.24	0.89	0.281	18	7.03	6.18	8.70	0.73	0.173
HL	1	10	14.32	12.49	16.64	1.50	0.430	18	17.49	15.57	19.64	1.16	0.270
	2	10	25.81	22.09	29.12	1.98	0.626	18	22.55	19.19	25.54	1.64	0.387
HW	1	10	10.87	9.50	12.99	1.21	0.360	18	13.71	12.45	15.77	0.89	0.210
	2	10	19.56	15.94	20.68	1.40	0.441	18	17.63	16.14	19.28	1.14	0.268
PL	1	10	7.01	5.70	9.06	0.96	0.280	18	9.20	7.81	10.97	1.00	0.240
	2	10	12.62	10.31	14.16	1.25	0.370	18	11.77	9.91	13.06	0.72	0.170
PW	1	10	2.54	2.10	3.11	0.27	0.080	18	2.90	2.26	3.84	0.39	0.090
	2	10	4.67	3.92	6.10	0.71	0.210	18	3.73	2.83	4.66	0.48	0.113
FLL	1	10	18.13	15.87	21.38	2.01	0.580	18	24.07	21.52	27.98	1.17	0.400
	2	10	32.58	27.28	35.27	2.10	0.630	18	30.87	28.43	33.29	1.20	0.282
HLL	1	10	20.39	16.94	25.33	2.88	0.930	18	26.88	22.58	30.13	2.20	0.520
	2	10	36.28	32.66	39.46	2.14	0.640	18	34.58	31.36	36.30	1.42	0.335
DFHL	1	10	27.63	21.51	32.88	3.16	0.910	18	40.96	33.48	57.05	6.10	1.430
	2	10	50.46	44.81	56.63	4.16	1.250	18	51.74	39.44	71.31	6.65	1.520
HPBT	1							6	2.37	1.87	2.91	0.51	0.207
	2							6	3.12	2.52	4.04	0.63	0.259
HW/HL	1	10	0.75	0.71	0.79	0.02	0.007	18	0.79	0.71	0.86	0.05	0.012
TL/TBL	1	10	0.46	0.43	0.48	0.02	0.005	18	0.47	0.44	0.49	0.01	0.003
PW/PL	1	10	0.37	0.29	0.47	0.06	0.018	18	0.32	0.25	0.41	0.04	0.009
NED/HL	1	10	0.21	0.16	0.26	0.03	0.011	18	0.21	0.18	0.27	0.02	0.005

clear. Habitat photos of Türbelinaz population are given in Figure 16.



Figure 16. Habitat photos of Türbelinaz population from Türbelinaz/Alanya.

Colouration and Pattern

Males: Yellow spots are visible at the eyelids and posterior of the parotoids. There are white spots in rows extending to the base of the tail on the dorsum. A continuous white stripe is available between the fore and hind limbs.

Females: There are yellow spots on the head and posterior of the parotoids. Scattered white spots are commonly seen on the dorsal surface, on a dark brown background colour. Colour of limbs and the lateral stripes are as in males

Juveniles: Yellow spots on the parotoids and scattered white spots on the eyelids are seen. Other details the same as those adult populations on a dark brown background colour. Dorsal section of the tail is covered with the yellow spots and continues to fingertips. Photos of specimens from the Türbelinaz population are in Figure 17.

Serological Evaluations

Blood serum proteins of a male and female from Türbelinaz, were evaluated by polyacrylamide disc electrophoresis method. Blood serum sample of male was divided into 12 fractions. 10 of them were found in the globulin zone, others are albumin and pre-albumin. Female's blood serum sample was divided into 11 protein fractions. There are 9 globulin and 1 albumin



Figure 17. Specimens from Türbelinaz. a) Adult male b) Adult female c) Juvenile d) Dorsal view of adult female, adult male and juvenile.

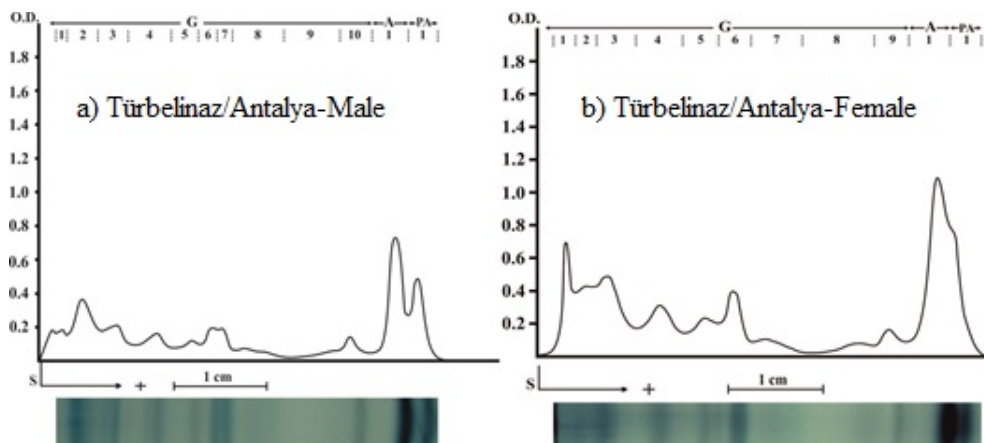


Figure 18. Electrophoretic separation of blood serum protein electropherograms and densitometric curves of the Türbelinaz population (OD: optical density. S: Border between the stacking gel and separating gel. G: Globulin region. PE: Prealbumin. A: Albumin region).

Table 6. Body measurements, PERCRA index values and Student's t-test results of Türbelinaz population. 1: Raw data; 2: PERCRA; N: number of specimens; SD: Standard deviation; SE: Standard error of mean; $p \leq 0.05$. The other abbreviations of characters are given in Materials and Methods.

	Male						T-test	Female					
	N	Mean	Min.	Maks.	SD	SE		N	Mean	Min.	Maks.	SD	SE
RA	1 7	82.70	72.00	87.00	4.73	1.788	0.085	16	77.56	67.00	97.00	9.75	2.510
TBL	1 7	164.71	147.00	172.00	8.83	3.336	0.016	16	147.56	125.00	185.00	19.93	5.130
	2 7	199.30	189.23	207.32	6.23	2.353	0.040	16	189.95	177.78	215.00	10.45	2.530
LT	1 7	61.73	56.22	64.79	3.12	1.177	0.007	16	54.78	47.31	72.69	7.21	1.860
	2 7	74.73	68.60	78.59	3.28	1.238	0.077	16	70.67	61.00	80.06	6.02	1.460
TL	1 7	82.02	74.00	88.00	5.50	2.077	0.006	16	70.00	57.00	92.00	11.33	2.920
	2 7	99.30	89.23	107.32	6.23	2.353	0.040	16	89.95	77.78	115.00	10.45	2.530
NED	1 7	3.43	2.90	3.94	0.36	0.137	0.129	16	3.25	2.21	4.18	0.61	0.153
	2 7	4.15	3.39	4.58	0.44	0.166	0.719	16	4.21	2.76	5.82	0.79	0.190
DBN	1 7	5.45	4.69	6.57	0.64	0.241	0.128	16	4.96	3.36	5.66	0.52	0.130
	2 7	6.60	5.48	7.55	0.74	0.280	0.992	16	6.38	4.98	7.73	0.83	0.208
ED	1 7	5.66	4.56	6.94	0.81	0.305	0.320	16	5.37	4.49	6.86	0.68	0.170
	2 7	6.84	6.02	8.38	0.91	0.345	0.799	16	6.95	5.67	8.26	0.73	0.170
HL	1 7	18.27	16.96	19.81	1.04	0.393	0.951	16	18.62	14.73	22.29	2.30	0.590
	2 7	22.11	20.68	23.41	0.85	0.322	0.008	16	23.67	17.33	27.75	2.42	0.584
HW	1 7	14.07	13.07	14.66	0.63	0.237	0.175	16	13.72	12.16	15.47	1.19	0.310
	2 7	17.04	15.58	17.96	0.80	0.304	0.156	16	17.57	15.91	21.13	1.29	0.310
PL	1 7	9.40	7.68	10.22	0.82	0.309	0.366	16	9.21	8.10	11.32	0.90	0.230
	2 7	11.40	8.97	13.09	1.23	0.464	0.383	16	11.69	10.49	13.60	0.78	0.180
PW	1 7	2.93	2.27	4.01	0.60	0.227	0.513	16	3.09	2.07	4.17	0.50	0.125
	2 7	3.57	2.65	4.89	0.83	0.314	0.161	16	4.00	2.59	5.30	0.82	0.200
FLL	1 7	26.41	24.08	28.07	1.23	0.465	0.002	16	24.04	20.18	28.02	2.49	0.640
	2 7	31.98	30.35	34.23	1.34	0.505	0.032	16	30.31	27.52	32.75	1.49	0.371
HLL	1 7	28.80	24.52	30.55	2.06	0.779	0.135	16	27.67	23.27	34.11	3.46	0.890
	2 7	34.81	33.69	36.75	1.04	0.394	0.665	16	34.51	29.79	40.71	2.79	0.680
DFHL	1 7	46.45	40.67	51.02	4.03	1.524	0.042	16	42.51	35.13	56.14	7.23	1.860
	2 7	56.25	47.21	62.22	4.75	1.797	0.323	16	52.71	38.57	63.75	7.48	1.810
HPBT	1 7	2.54	1.49	4.61	1.00	0.377							
	2 7	3.05	1.80	5.30	1.09	0.414							
HW/HL	1 7	0.77	0.70	0.86	0.05	0.019	0.235	16	0.74	0.68	0.97	0.07	0.017
TL/TBL	1 7	0.50	0.47	0.52	0.02	0.006	0.033	16	0.48	0.44	0.53	0.02	0.005
PW/PL	1 7	0.31	0.23	0.43	0.06	0.024	0.249	16	0.35	0.22	0.44	0.07	0.017
NED/HL	1 7	0.19	0.15	0.21	0.02	0.007	0.115	16	0.17	0.12	0.26	0.03	0.008

Table 6. (continued)

	Juvenile					Adult						
	N	Mean	Min.	Maks.	SD	SE	N	Mean	Min.	Maks.	SD	SE
RA	1 7	56.71	51.00	62.00	5.83	1.830	23	80.32	67.17	97.21	8.46	1.800
TBL	1 7	106.14	86.00	115.00	11.32	3.560	23	156.38	126.00	186.00	17.83	3.800
	2 7	186.94	168.63	201.82	10.62	3.720	23	193.02	166.18	215.00	10.16	2.070
LT	1 7	40.58	37.20	43.97	3.70	1.160	23	58.11	47.31	72.69	6.60	1.410
	2 7	71.57	69.09	74.34	1.78	0.620	23	71.80	57.60	80.06	5.62	1.150
TL	1 7	49.43	35.00	57.00	7.44	2.340	23	76.06	57.78	92.00	10.54	2.240
	2 7	86.94	68.63	101.82	10.62	3.730	23	93.02	66.18	115.00	10.16	2.070
NED	1 7	2.75	2.43	3.36	0.51	0.160	23	3.27	2.21	4.18	0.56	0.117
	2 7	4.87	4.19	6.02	0.72	0.250	23	4.19	2.76	5.82	0.69	0.190
DBN	1 7	4.18	3.36	4.69	0.40	0.130	23	5.20	4.12	6.57	0.59	0.122
	2 7	7.40	6.60	8.28	0.55	0.190	23	6.45	4.94	7.73	0.79	0.165
ED	1 7	4.59	3.93	5.48	0.45	0.140	23	5.50	4.49	6.94	0.76	0.159
	2 7	7.94	7.05	9.61	0.99	0.350	23	6.91	5.67	8.38	0.75	0.155
HL	1 7	14.60	12.71	16.11	1.06	0.330	23	18.64	14.73	22.29	2.17	0.452
	2 7	24.93	20.75	26.07	0.49	0.170	23	23.20	17.33	27.75	2.18	0.455
HW	1 7	10.96	9.72	12.57	0.87	0.270	23	13.89	12.16	15.47	1.26	0.264
	2 7	18.58	16.37	20.07	1.20	0.420	23	17.41	15.58	21.13	1.22	0.254
PL	1 7	7.67	6.92	8.30	0.46	0.174	23	9.27	7.68	11.32	0.94	0.195
	2 7	13.21	11.57	14.31	0.64	0.220	23	11.60	8.97	13.60	1.00	0.208
PW	1 7	2.87	2.05	3.30	0.44	0.165	23	3.04	2.07	4.17	0.52	0.109
	2 7	4.91	3.69	5.69	0.70	0.250	23	3.87	2.59	5.30	0.83	0.170
FLL	1 7	17.97	14.94	20.93	1.94	0.735	23	24.83	20.18	28.07	2.41	0.510
	2 7	30.34	27.68	32.95	1.37	0.480	23	30.82	27.52	34.23	1.58	0.329
HLL	1 7	20.23	17.21	23.04	2.10	0.794	23	28.04	23.27	34.11	3.06	0.660
	2 7	35.06	32.22	37.95	2.06	0.720	23	34.60	29.79	40.71	2.14	0.445
DFHL	1 7	29.63	23.53	34.41	4.46	1.686	23	43.82	35.13	56.14	6.52	1.390
	2 7	51.42	45.13	54.57	4.03	1.410	23	53.79	38.57	63.75	5.97	1.244
HPBT	1						7	2.54	1.49	4.61	1.00	0.377
	2						7	3.05	1.80	5.30	1.09	0.414
HW/HL	1 7	0.75	0.63	0.82	0.06	0.024	23	0.75	0.68	0.97	0.06	0.013
TL/TBL	1 7	0.45	0.40	0.50	0.04	0.014	23	0.48	0.44	0.53	0.02	0.005
PW/PL	1 7	0.36	0.28	0.40	0.05	0.017	23	0.34	0.22	0.44	0.07	0.014
NED/HL	1 7	0.21	0.17	0.25	0.03	0.011	23	0.18	0.12	0.26	0.03	0.006

and 1 pre-albumin proteins. Figure 18 shows the electrophoretic separation of blood serum proteins of Türbelinaz population.

Body measurements and rates

The Student's t-test indicated significant differences between the sexes and morphological characters. Summarized statistics and p values from the raw data, ratios and PERCRA index values are given in Table 6. The abbreviations are provided in the Materials and Methods section. According to the Student's t-test, we determined statistical significance difference of ($p \leq 0.05$) between males and females in terms of characters from raw data and by the PERCRA index values (TBL, LT, TL, HL, FLL, DFHL and TL/TBL).

Cebireis Population

On Cebireis Mountain, near the Yalçı village, Kaplanhanı plateau, Dim river and Kuşyuvası region, we found 40 specimens (6 males, 11 females, 23 juveniles). Cebireis Mountain has the largest distribution of *Lyciasalamandra atifi* among other populations. This population was described as *Lyciasalamandra atifi bayrami* by Yıldız and Akman in 2015. We also applied serological comparison and statistics to facilitate the differences among the populations.

Colouration and Pattern

Males: There are yellow spots on the posterior of the parotoids and continuous white spots are visible on paravertebral lines until the base of the tail. An uninterrupted white stripe starts from the eyes level and continues between the fore and hind limbs at lateral sides. The background colour is dark grey but the dorsal aspect of the tail is dark brown.

Females: The dorsal sides of the head and the back shows grayish dark brown colouration and there are no white spots on the dorsal surface. An uninterrupted white stripe at the lateral sides, and the tail colouration is similar to male specimens. Yellow spots are visible posterior of the parotoids.

Juveniles: Posterior of the eyelids and parotoids have yellow spots and there is an intense speckling of white spots on the entire body. The back-

ground colour is dark brown and yellow spots can be seen on the dorsal surface and the tail. Photos of specimens from Cebireis population are given in Figure 19.



Figure 19. Specimens from Cebireis. a) Adult male b) Adult female
c) Juvenile d) Dorsal view of adult female, juvenile and adult male.

Serological Evaluations

Blood serum proteins of a male and female from Cebireis population were evaluated by the polyacrylamide disc electrophoresis by Yıldız and Akman, 2015. We put the same graphic to compare with the others. Both male and female blood samples were divided into 12 fractions. 10 of them were found in the globulin, 1 albumin and 1 pre-albumin proteins. Figure 20 shows the electrophoretic separation of blood serum proteins.

Body measurements and rates

The Student's t-test indicated significant differences between the sexes and

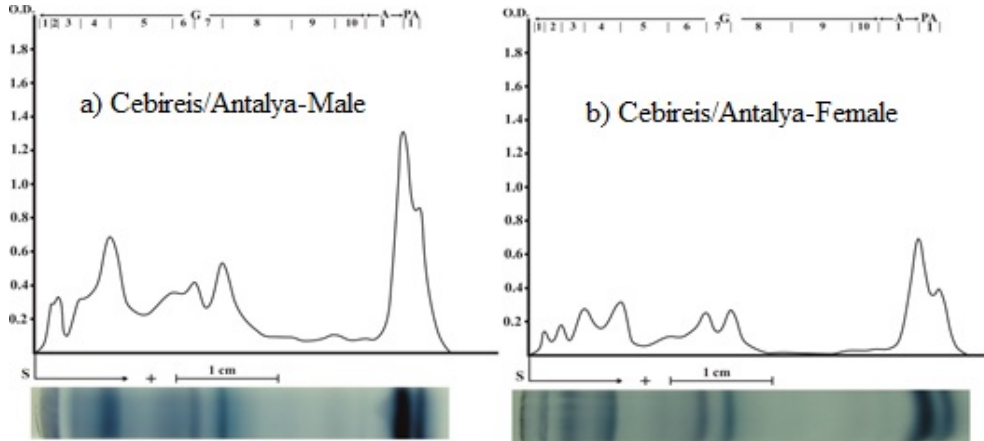


Figure 20. Electrophoretic separation of blood serum protein electropherograms and densitometric curves of the Cebireis population. (OD: optical density. S: Border between the stacking gel and separating gel. G: Globulin region. PE: Prealbumin. A: Albumin region) (From Yıldız and Akman, 2015).

morphological characters. Summarized statistics and P values from the raw data, ratios and PERCRA index values are given in Table 7. The abbreviations are provided in the Materials and Methods section. According to the Student's t-test, we determined statistical significance difference of ($p \leq 0.05$) between males and females in terms of characters from raw data and by the PERCRA index values (RA, TBL, LT, DBN, HW and HLL).

Gazipaşa Population

31 (9 males, 12 females and 10 juveniles) specimens were found during fieldwork in Gazipaşa. *Arbutus ardashne* (the Greek strawberry tree) is abundant at the area, and specimens shelter under limestone slabs at the moisture-holding roots of the trees. Three localities were found by Göçmen et al. 2013 (Karaçukur, Çıgılık, Gürçam) and three new localities were found during our excursion in April 2015. The localities are Daşlıbük mevkii (Çakmak - Çörüş village road), Küçükölü village and Ilıca village; during search the weather was cloudy and temperature was 18°C. Habitat photos

Table 7. (continued)

	Juvenile						Adult					
	N	Mean	Min.	Maks.	SD	SE	N	Mean	Min.	Maks.	SD	SE
RA	1 23	54.35	40.00	65.00	8.51	1.700	17	79.07	66.00	96.00	7.55	1.830
TBL	1 23	98.09	71.00	116.00	14.61	2.920	17	144.31	125.00	167.00	10.31	2.500
	2 23	180.14	165.22	196.23	7.22	1.470	17	180.79	144.77	192.86	12.44	2.930
LT	1 23	37.25	26.18	44.65	5.96	1.190	17	55.45	47.49	66.35	4.79	1.160
	2 23	68.41	57.68	81.75	4.68	0.950	17	69.53	57.64	76.52	4.82	1.140
TL	1 23	43.74	30.00	55.00	7.87	1.570	17	65.24	56.00	76.90	5.31	1.280
	2 23	80.14	65.22	96.23	7.22	1.470	17	80.79	44.87	92.86	12.44	2.930
NED	1 23	2.33	1.62	3.07	0.40	0.080	17	3.45	2.48	4.17	0.53	0.130
	2 23	4.25	3.19	5.40	0.60	0.120	17	4.33	3.56	5.17	0.56	0.130
DBN	1 23	3.93	2.77	4.79	0.53	0.110	17	5.18	4.37	5.95	0.45	0.110
	2 23	7.17	5.89	8.51	0.65	0.130	17	6.54	5.79	7.67	0.49	0.105
ED	1 23	4.43	3.61	5.07	0.39	0.080	17	5.33	4.33	6.45	0.60	0.150
	2 23	8.22	7.02	10.70	0.87	0.180	17	6.72	5.39	8.16	0.92	0.197
HL	1 23	13.63	9.88	15.90	1.63	0.330	17	17.72	15.37	20.16	1.18	0.290
	2 23	25.00	21.02	28.49	1.53	0.310	17	22.33	19.06	25.15	1.84	0.392
HW	1 23	10.41	7.98	11.91	1.11	0.263	17	13.40	11.78	15.03	0.85	0.210
	2 23	19.14	16.98	22.03	1.25	0.250	17	16.89	14.45	18.95	1.21	0.280
PL	1 23	6.73	4.72	8.26	1.00	0.237	17	8.86	7.31	11.02	0.97	0.230
	2 23	12.27	9.82	14.09	1.06	0.220	17	11.20	9.06	12.67	0.98	0.230
PW	1 23	2.05	1.20	2.71	0.41	0.080	17	2.84	1.76	4.37	0.62	0.150
	2 23	3.76	2.61	5.29	0.68	0.140	17	3.56	2.05	5.83	0.82	0.190
FLL	1 23	16.60	11.55	20.82	2.44	0.490	17	22.77	18.25	26.85	2.34	0.570
	2 23	30.35	26.36	35.47	1.82	0.370	17	28.55	23.47	32.21	2.70	0.630
HLL	1 23	18.40	12.90	21.68	2.26	0.450	17	25.59	21.04	31.58	2.26	0.550
	2 23	33.78	29.00	37.30	2.27	0.460	17	32.04	25.76	35.64	2.38	0.560
DFHL	1 23	26.47	17.33	34.35	4.55	0.910	17	38.33	30.72	47.84	5.42	1.310
	2 23	48.31	36.87	56.72	4.38	0.890	17	47.75	36.41	58.00	5.50	1.290
HPBT	1						6	2.95	2.36	4.30	0.76	0.310
	2						6	3.59	2.74	5.51	1.00	0.406
HW/HL	1 23	0.77	0.72	0.84	0.04	0.008	17	0.75	0.68	0.82	0.03	0.006
TL/TBL	1 23	0.43	0.31	0.49	0.04	0.009	17	0.45	0.40	0.48	0.02	0.005
PW/PL	1 23	0.31	0.23	0.41	0.06	0.013	17	0.31	0.23	0.47	0.05	0.012
NED/HL	1 23	0.17	0.14	0.21	0.02	0.005	17	0.19	0.14	0.23	0.03	0.006

of the Gazipaşa population from Daşlıbük mevkii and Gürçam are in Figure 21, Küçükölü and Ilıca village are in Figure 22. This population was described as *Lyciasalamandra atifi oezi* by Tok et al. (2016).



Figure 21. Habitat photos of Daşlıbük in left-hand and Gürçam where *Arbutus ardashne* (the Greek strawberry tree) plants are visible, alongside moisture-retaining limestone slabs in right-hand photo.



Figure 22. Habitat photos from Küçükölü and Ilıca village respectively.

Colouration and Pattern

Males: The background colour is dark brown and there are no white spots on the dorsal surface of the head, but white spots exist along the paravertebral lines until the base of the tail. An uninterrupted white stripe starts from the eye level and continues between the fore and hind limbs at lateral sides.

Females: The background colouration is completely dark brown and

there are no white spots on the dorsal surface of the body. As in the adult males, the white stripe, starts at the eye level continues between the fore and hind limbs.

Juveniles: The dorsal aspect of the head and body have a large amount of white spots, but there is no yellowish colouration on the parotoids. The white stripes between the fore and hind limbs exist as in the males and females, and the white spot on the dorsal surface of the body continues until the tail tip. Photos of specimens from the Gazipaşa population are in Figure 23.



Figure 23. Specimens from Gazipaşa. a) Adult male b) Adult female
c) Juvenile d) Dorsal head view of a juvenile.

Serological Evaluations

Blood serum proteins of a male and female from Gazipaşa population were evaluated by the polyacrylamide disc electrophoresis method. Both male and female blood samples were divided into 13 fractions. 11 of them were found

in the globulin, 1 albumin and 1 pre-albumin proteins. Figure 24 shows the electrophoretic separation of blood serum proteins.

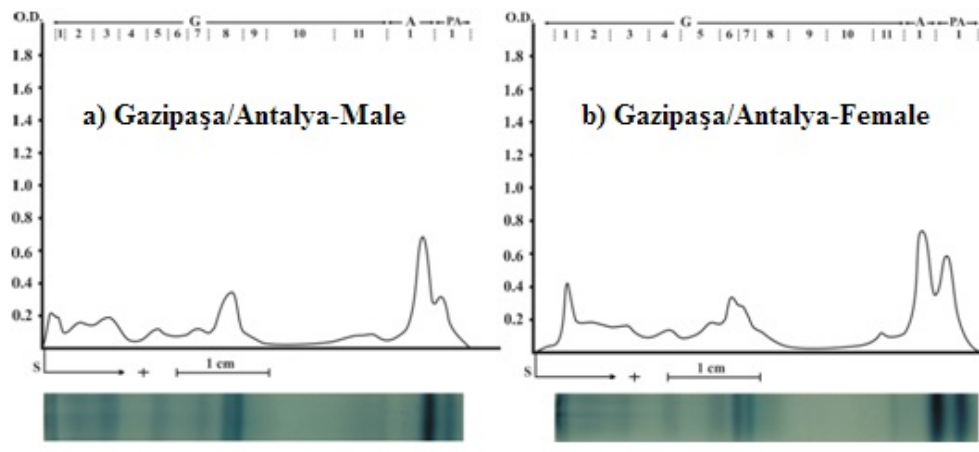


Figure 24. Electrophoretic separation of blood serum protein electropherograms and densitometric curves of the Gazipaşa population. (OD: optical density. S: Border between the stacking gel and separating gel. G: Globulin region. PE: Prealbumin. A: Albumin region).

Body measurements and rates

The Student's t-test indicated significant differences between the sexes and morphological characters. Summarized statistics and p values from the raw data, ratios and PERCRA index values are given in Table 8. According to the Student's t-test, we determined statistical significance difference of ($p \leq 0.05$) between males and females in terms of characters from raw data and by the PERCRA index values (Parotoid length and Parotoid width).

Analysis of variance (ANOVA) has been performed using the raw data of all populations of mature individuals (Table 9). Significant differences ($p \leq 0.05$) were found and discriminant analysis graphics were provided. (Table 10, Figures 25-27) According to ANOVA results, TBL, TL, NED, HL, PL, FLL, and DFHL characters were stated as different in males. NED and HW characters were stated as different in females.

Table 8. Body measurements, PERCRA index values and Student's t-test results of Gazipaşa population. 1: Raw data; 2: PERCRA; N: number of specimens; SD: Standard deviation; SE: Standard error of mean; $p \leq 0.05$. The other abbreviations of characters are given in Materials and Methods.

	Male							T-test	Female						
	N	Mean	Min.	Maks.	SD	N		Mean	Min.	Maks.	SD	N	Mean	Min.	
RA	1	9	75.56	70.00	80.00	3.64	1.215	0.586	12	73.78	66.00	85.00	6.64	1.910	
TBL	1	9	139.67	131.00	149.00	5.29	1.764	0.347	12	133.00	114.00	158.00	11.89	3.420	
	2	9	185.00	176.25	192.00	5.69	1.897	0.437	12	180.44	163.86	188.00	8.52	2.350	
LT	1	9	58.33	53.19	71.77	6.70	2.235	0.065	12	51.86	41.52	60.71	4.79	1.380	
	2	9	77.24	69.61	93.04	8.36	2.787	0.071	12	70.56	60.17	76.41	3.91	1.800	
TL	1	9	64.11	61.00	69.00	3.48	1.160	0.275	12	59.22	45.00	73.00	6.76	1.940	
	2	9	85.00	76.25	92.00	5.69	1.897	0.437	12	80.44	63.86	88.00	8.52	2.350	
NED	1	9	3.55	3.35	3.98	0.23	0.078	0.271	12	3.18	2.48	4.00	0.40	0.120	
	2	9	4.70	4.29	5.31	0.28	0.094	0.663	12	4.46	3.24	5.32	0.66	0.180	
DBN	1	9	4.97	4.19	5.71	0.43	0.144	0.548	12	5.09	4.19	5.96	0.60	0.172	
	2	9	6.59	5.66	7.61	0.53	0.177	0.188	12	6.91	6.07	7.45	0.41	0.119	
ED	1	9	5.06	4.34	5.88	0.52	0.173	0.646	12	5.09	4.23	6.19	0.56	0.162	
	2	9	6.71	5.43	8.05	0.73	0.243	0.363	12	6.86	6.13	7.53	0.44	0.127	
HL	1	9	16.41	15.57	17.43	0.79	0.262	0.657	12	16.62	15.08	20.19	1.54	0.444	
	2	9	21.75	19.86	23.55	1.23	0.411	0.277	12	22.30	18.77	24.09	1.73	0.480	
HW	1	9	12.63	12.05	13.49	0.49	0.164	0.614	12	12.44	10.85	14.31	1.17	0.337	
	2	9	16.73	15.81	17.21	0.41	0.137	0.050	12	17.13	15.96	18.73	0.85	0.240	
PL	1	9	7.72	7.03	8.27	0.39	0.129	0.123	12	7.94	6.75	9.88	1.07	0.310	
	2	9	10.24	9.23	11.13	0.65	0.216	0.020	12	11.06	8.58	12.56	0.99	0.285	
PW	1	9	2.58	2.15	3.70	0.44	0.146	0.145	12	2.71	2.34	3.32	0.48	0.138	
	2	9	3.41	3.05	4.63	0.49	0.163	0.037	12	3.88	3.38	4.84	0.44	0.126	
FLL	1	9	22.79	21.35	25.13	1.13	0.378	0.201	12	21.32	17.12	25.42	2.05	0.590	
	2	9	30.19	27.29	32.16	1.42	0.473	0.238	12	29.03	24.81	31.62	1.93	0.530	
HLL	1	9	25.14	21.65	27.92	1.88	0.627	0.979	12	24.37	17.54	29.82	2.62	0.750	
	2	9	33.35	27.06	37.23	2.95	0.983	0.683	12	33.23	25.42	35.58	2.78	0.770	
DFHL	1	9	38.16	34.00	40.35	2.31	0.770	0.614	12	36.66	27.42	47.47	4.26	1.220	
	2	9	50.57	46.46	56.80	3.32	1.105	0.879	12	49.80	39.74	57.19	5.00	1.380	
HPBT	1	9	2.72	1.69	4.00	0.66	0.220								
	2	9	3.58	2.28	5.00	0.80	0.266								
HW/HL	1	9	0.77	0.71	0.80	0.03	0.011	0.911	12	0.77	0.69	0.94	0.07	0.021	
TL/TBL	1	9	0.46	0.43	0.48	0.02	0.006	0.438	12	0.45	0.39	0.47	0.02	0.006	
PW/PL	1	9	0.33	0.28	0.46	0.05	0.018	0.502	12	0.35	0.31	0.43	0.03	0.010	
NED/HL	1	9	0.22	0.20	0.25	0.02	0.006	0.197	12	0.20	0.17	0.24	0.02	0.007	

Table 8. (continued)

		Juvenile					Adult						
		Maks.	SD	N	Mean	Min.	Maks.	SD	N	Mean	Min.	Maks.	SD
RA	1	10	54.50	44.00	65.00	8.22	2.360	21	75.00	66.00	85.00	5.37	1.170
	2	10	173.80	147.73	186.44	10.28	3.090	21	183.13	163.86	192.00	6.34	1.384
LT	1	10	37.13	28.00	45.44	5.75	1.650	21	55.77	46.41	71.77	6.05	1.320
	2	10	67.95	63.16	70.50	2.71	0.810	21	73.42	60.17	93.04	6.28	1.371
TL	1	10	40.70	21.00	51.00	9.27	2.660	21	63.15	53.00	73.00	5.47	1.190
	2	10	73.80	47.73	86.44	10.28	3.090	21	83.13	63.86	92.00	6.34	1.384
NED	1	10	2.32	1.52	3.48	0.53	0.150	21	3.46	2.59	4.00	0.33	0.072
	2	10	4.21	3.45	5.35	0.52	0.160	21	4.56	3.24	5.32	0.51	0.112
DBN	1	10	4.03	3.20	4.99	0.61	0.180	21	5.08	4.19	5.96	0.52	0.114
	2	10	7.42	6.53	8.68	0.71	0.210	21	6.76	5.66	7.61	0.48	0.104
ED	1	10	4.48	3.32	5.97	0.76	0.220	21	5.14	4.34	6.19	0.53	0.116
	2	10	8.21	6.78	9.79	0.83	0.250	21	6.80	5.43	8.05	0.58	0.127
HL	1	10	13.32	10.22	15.69	1.58	0.450	21	16.59	14.64	20.19	1.25	0.273
	2	10	24.53	22.93	28.30	1.45	0.440	21	22.07	18.77	24.09	1.59	0.347
HW	1	10	10.53	7.68	13.56	1.55	0.490	21	12.80	10.85	14.31	0.93	0.202
	2	10	19.56	17.45	30.82	4.04	1.210	21	16.96	15.81	18.73	0.71	0.154
PL	1	10	6.43	4.48	7.67	0.98	0.280	21	8.09	6.86	10.05	0.88	0.192
	2	10	11.79	10.18	13.95	1.02	0.310	21	10.71	8.58	12.56	0.96	0.209
PW	1	10	2.49	1.61	3.15	0.42	0.120	21	2.78	2.15	3.70	0.48	0.104
	2	10	4.62	3.42	5.64	0.88	0.260	21	3.68	3.05	4.84	0.51	0.110
FLL	1	10	16.28	11.36	19.85	2.66	0.760	21	22.39	18.89	25.42	1.79	0.392
	2	10	29.77	25.82	33.64	2.43	0.730	21	29.53	24.81	32.16	1.43	0.311
HLL	1	10	17.92	12.34	21.09	2.86	0.820	21	25.34	21.56	29.82	2.41	0.525
	2	10	32.79	28.05	35.75	2.55	0.760	21	33.28	25.42	37.23	2.78	0.590
DFHL	1	10	25.83	18.06	32.14	4.07	1.170	21	38.10	32.14	47.47	3.80	0.829
	2	10	47.33	41.05	54.47	3.98	1.190	21	50.13	39.74	57.19	4.28	0.910
HPBT	1							9	2.72	1.69	4.00	0.66	0.220
	2							9	3.58	2.28	5.00	0.80	0.266
HW/HL	1	10	0.79	0.71	1.09	0.11	0.035	21	0.77	0.69	0.94	0.06	0.012
TL/TBL	1	10	0.42	0.32	0.46	0.04	0.012	21	0.46	0.39	0.48	0.02	0.004
PW/PL	1	10	0.39	0.30	0.48	0.06	0.019	21	0.34	0.28	0.46	0.04	0.009
NED/HL	1	10	0.17	0.14	0.19	0.02	0.005	21	0.21	0.17	0.25	0.02	0.005

As a result of discriminant analysis of males, the distinction was done in two steps according to TL and NED/HL. In females, the distinction was also done in two steps according to NED and TL/TBL. When we look at the distinctions among all populations, we can see that the distinction was performed in four steps according to the TBL, NED/HL, ED and PW/PL characters.

Table 9. Results of One-way analysis of variance of all populations (ANOVA) (df: degrees of freedom, F: table values, P: significance level).

Males	df	F	Sig.	Females	df	F	P	Adults	df	F	Sig.
RA	7	0.86	0.54	RA	7	1.24	0.29	RA	7	0.92	0.50
TBL	7	2.71	0.02	TBL	7	2.74	0.01	TBL	7	6.31	0.00
LT	7	1.03	0.42	LT	7	1.32	0.25	LT	7	1.18	0.32
TL	7	18.21	0.00	TL	7	4.41	0.00	TL	7	8.91	0.00
NED	7	2.30	0.04	NED	7	3.92	0.00	NED	7	5.15	0.00
DBN	7	1.02	0.43	DBN	7	3.02	0.01	DBN	7	2.29	0.03
ED	7	0.90	0.52	ED	7	1.58	0.15	ED	7	1.81	0.09
HL	7	6.28	0.00	HL	7	2.83	0.01	HL	7	5.12	0.00
HW	7	1.82	0.10	HW	7	2.50	0.02	HW	7	3.80	0.00
PL	7	3.41	0.00	PL	7	2.36	0.03	PL	7	4.60	0.00
PW	7	1.62	0.15	PW	7	1.48	0.18	PW	7	2.79	0.01
FLL	7	6.49	0.00	FLL	7	3.44	0.00	FLL	7	5.43	0.00
HLL	7	5.91	0.00	HLL	7	2.30	0.03	HLL	7	5.66	0.00
DFHL	7	3.48	0.00	DFHL	7	2.57	0.02	DFHL	7	4.89	0.00
HW/HL	7	0.66	0.71	HW/HL	7	2.21	0.04	HW/HL	7	2.03	0.06
TL/TBL	7	2.56	0.02	TL/TBL	7	4.76	0.00	TL/TBL	7	4.46	0.00
PW/PL	7	1.94	0.08	PW/PL	7	1.08	0.39	PW/PL	7	2.54	0.02
NED/HL	7	4.88	0.00	NED/HL	7	2.50	0.02	NED/HL	7	6.01	0.00

***Lyciasalamandra atifi godmanni* n. ssp.**

Holotype and type locality: ZMADYU 2013/18-6, male, collected by Bayram GÖÇMEN, M. ANIL & Onur OĞUZ on April 15, 2013 in Selge, Antalya, Turkey, 482 m. a.s.l.

Paratypes: ZMADYU 2012/19: 1-8, 2 males, 1 female, 5 juveniles collected by B. GÖÇMEN, B. AKMAN on March 2, 2012; 2013/18: 1-5, 7-18, 9 males, 11 females, 4 juveniles collected by B. GÖÇMEN, M. A. & O. OĞUZ on April 15, 2013 in Selge, Antalya, Turkey, 482 m. a.s.l.

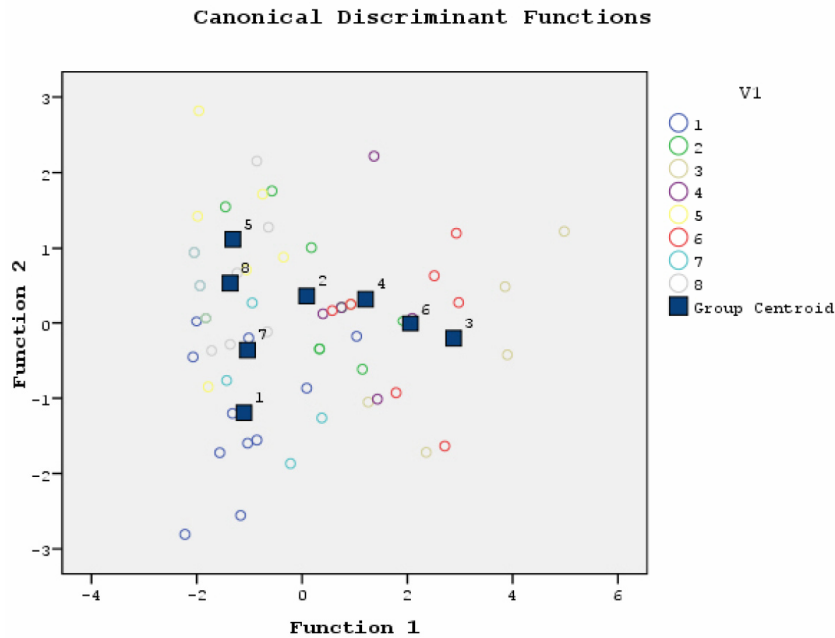


Figure 25. Discriminant (Distinction) distribution of males of all populations in the analysis. (1: Selge, 2: Fersin, 3: Dikmen, 4: Guzelbag, 5: Gündoğmuş, 6: Cebireis, 7: Türbelinaz, 8: Gazipaşa).

Diagnosis: Individuals of the Selge population have reddish dark brown ground colouration. The white stripes begin under the eye line on lateral sides and last until the fore limbs uninterruptedly. So, the individuals of the Selge are different from the other populations because of these morphological features. The population's serological results are different from the others as well (Figure 3).

Etymology: This subspecies is dedicated to Mr. Olaf GODMANN, who significantly contributed to *Lyciasalamandra* studies in Turkey.

Description of the holotype: Total body length 148 mm [100.89 Percra], tail length 71 mm [108.54 Percra]. Eyes big, eye diameter 6.43 mm [4.38 Percra]. Head length and head with 15.92 and 17.75 mm, respectively [20.70 and 12.10 Percra]. Parotoids distinct, parotoid length 12.42 mm [8.46 Percra] and parotoid width 8.85 mm [6.03 Percra]. Hind limb longer

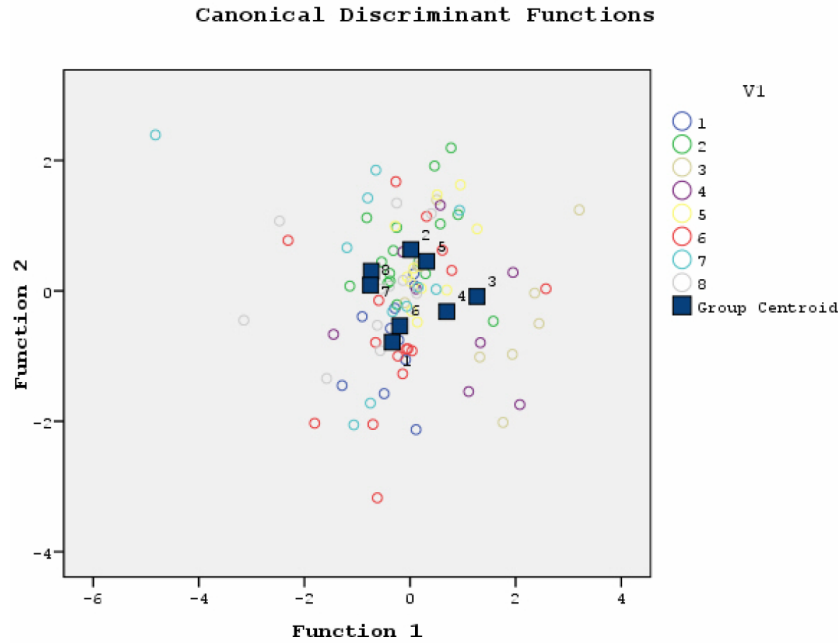


Figure 26. Discriminant (Distinction) distribution of females of all populations in the analysis. (1: Selge, 2: Fersin, 3: Dikmen, 4: Guzelbag, 5: Gündoğmuş, 6: Cebireis, 7: Türbelinaz, 8: Gazipaşa).

than fore limb, hind limb length 23.77 [16.20 Percra], fore limb length 24.2mm [16.49 Percra]. Nostril to eye distance 3.28 mm [2.23 Percra], distance between nostrils 5.43 mm [3.70 Percra]. Ratios HW/HL, TL/TBL, PW/PL and NED/HL are 1.11, 0.70, 0.71 and 0.21, respectively.

Paratypes and variations: Thirty one more specimens collected from Selge were designated as paratypes. Three of eleven males do not have any white spot on the dorsum. In females, two of ten specimens have red-dish colouration in both dorsal and ventral sides of the tail and we did not come across the variations among juveniles. All the specimens has the same white stripe patterns on lateral sides.

Habitat and ecology: Specimens in the Selge population were found on a steep slope with high vegetation (Figure 1). The weather was humid and cloudy, it was noon and temperature was 19.7 °C. They inhabit the edge of a

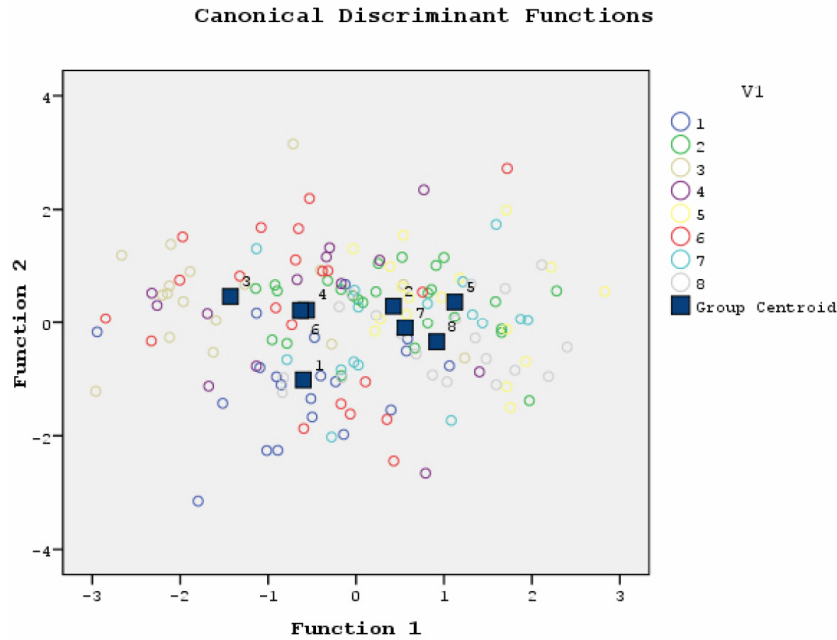


Figure 27. Discriminant (Distinction) distribution of mature specimens of all populations in the analysis. (1: Selge, 2: Fersin 3: Dikmen, 4: Guzelbag, 5: Gündoğmuş, 6: Cebireis, 7: Türbelinaz, 8: Gazipaşa).

steep slope at an elevation of 482 a.s.l.

***Lyciasalamandra atifi veithi* n. ssp.**

Holotype and type locality: ZMADYU 2013/20-1, male, collected by Bayram GÖÇMEN, M. ANIL& Onur OĞUZ on March 16, 2013 in Dikmen village, Akseki, Antalya, Turkey, 889 m a.s.l.

Paratypes: ZMADYU 2012/17: 1-8, 4 females, 4 juveniles collected by B. GÖÇMEN, B. AKMAN, N. İĞCİ, M. VEITH, O. GODMANN on March 8, 2012; 2012/45: 1-2, 1 male, 1 female collected by B. GÖÇMEN, B. AKMAN on April 11, 2012; 2013/20: 2-15, 4 males, 6 female, 4 juveniles collected by B. GÖÇMEN, M. A. & O. OĞUZ on March 16, 2013 in Dikmen village, Akseki, Antalya, Turkey, 889 m. a.s.l.

Diagnosis: In Dikmen population, dark brown ground colour and reddish

fleshy coloured ventral part combine on lateral sides of the body uninterrupted and there are numerous small white spots and no uninterrupted white stripes on lateral sides. With the longest mean total length and absence of the white stripes on lateral sides, this population is different from the others.

Etymology: The subspecific epithet *veithi* is derived from Prof. Dr. Michael VEITH who made valuable contributions to the studies on *Lyciasalamandra* species in Turkey.

Description of the holotype: Total body length 153 mm [188.88 Percra], tail length 72 mm [92.21 Percra]. Eyes big, eye diameter 5.30 mm [6.54 Percra]. Head flat, head length and head with 17.32 and 12.68 mm, respectively [21.38 and 15.65 Percra]. Parotoids distinct, parotoid length 9.62 mm [11.87 Percra] and parotoid width 2.88 mm [3.55 Percra]. Hind limb longer than fore limb, hind limb length 26.78 [33.06 Percra], fore limb length 23.17 mm [28.60 Percra]. Nostril to eye distance 3.31 mm [4.08 Percra], distance between nostrils 4.48 mm [5.53 Percra]. Ratios HW/HL, TL/TBL, PW/PL and NED/HL are 0.73, 0.47, 0.29 and 0.19, respectively.

Paratypes and variations: Twenty four more species collected from Dikmen were designated as paratypes. One of the five males has light brown tail colouration regarding the other males and three of eleven females has light brown tail colouration regarding the other ones. In juveniles, yellow spots on the posterior of the parotoids are visible and in the dorsal side, there are numerous white spots on the head and dorsum. We could not encounter any variation among the juveniles.

Habitat and ecology: Specimens were found sheltering inside walls left over from ancient settlements. It was hard to reach them because of the continuing walls to underground. So, we could reach some of them by digging the mud which exist next to walls. The weather was humid and cloudy at a temperature of 17°C. The vegetation was thin and there were not much trees around (Figure 7). We observed that they shelter almost underground and they were very fearful against humans regarding to other populations.

***Lyciasalamandra atifi kunti* n. ssp.**

Holotype and type locality: ZMADYU 2012/46-7, female, collected by Bayram

GÖÇMEN, Bahadır AKMAN on April 12, 2012 in Güzelbağ, Turkey, 829 m. a.s.l.

Paratypes: ZMADYU 2012/46 1-6, 8-11, 6 females, 4 juveniles collected by B. GÖÇMEN, B. AKMAN on April 11, 2012; ZMADYU 2012/47: 1-9, 5 males, 3 females, 1 juvenile collected by B. GÖÇMEN, B. AKMAN on April 12, 2012; ZMADYU/2013-23: 1-8, 1 male, 3 females, 4 juveniles collected by B. GÖÇMEN, M. A. OĞUZ on March 16, 2013 in Güzelbağ, Antalya, Turkey, 829 m. a.s.l.

Diagnosis: There are markedly large and very intense white spots on the head and dorsum in both males and females. In the sides, there are fragmented and discontinuous white stripes which start under the eye level and go on between the fore and hind limbs. Sexes have also different pattern. Unlike males, white spots are smaller and less in number in females regarding the males. But nevertheless bigger than the other populations.

Etymology: This subspecies is dedicated to Kadir Boğaç KUNT who is an arachnologist in Turkey and contributed to science with valuable researches.

Description of the holotype: Total body length 110 mm [183.33 Percra], tail length 50 mm [83.33 Percra]. Eyes big, eye diameter 5.10 mm [8.50 Percra]. Head at, head length and head with 15.11 and 11.54 mm, respectively [25.18 and 19.23 Percra]. Parotoids distinct, parotoid length 7.36 mm [12.26 Percra] and parotoid width 2.56 mm [4.26 Percra]. Hind limb longer than fore limb, hind limb length 23.008 [38.46 Percra], fore limb length 20.01 mm [33.50 Percra]. Nostril to eye distance 2.87 mm [4.78 Percra], distance between nostrils 4.01 mm [6.68 Percra]. Ratios HW/HL, TL/TBL, PW/PL and NED/HL are 0.76, 0.45, 0.34 and 0.19, respectively.

Paratypes and variations: Twenty seven more specimens collected from the Güzelbağ were designated as paratypes. There are intense and markedly large white spots on the head and dorsum on both males and females. This situation similar with juveniles but two of ten juveniles have yellow flecks on the dorsal side of the tail instead of the dark brown colouration.

Habitat and ecology: The specimens in Güzelbağ population were found under white-striped limestone rocks and smooth open area. The weather was rainy, temperature of 18°C and elevation was 829 m. a.s.l. The vegeta-

tion is low and there are not trees around the field (Figure 13). White stripes on the rocks look like similar with the specimens' intense white spots.

DISCUSSION

Among the eight isolated populations, this study describes three new subspecies of *Lyciasalamandra atifi* from Selge, Dikmen and Güzelbağ region in Antalya regarding morphology and serology.

Yıldız & Akman (2015) reported that the mean body length value of the subspecies *bayrami* is 136 mm (range: 102-171 mm) and Tok et al. (2016) also reported the mean body length of subspecies *oezi* is 139 mm (range: 127-154). These two values are close to each other and lower than the previous studies [158 mm (range: 134-176 mm) by Başoğlu (1967); 161 mm (range: 134-181 mm) by Baran & Üçüncü (1994); 141 mm (range: 105-164 mm) by Öz et al. (2004)]. We stated the mean body length value of the new subspecies *godmanni* n. ssp. is 142 mm (125-159). This value is higher than the subspecies *bayrami* and *oezi* as well. The mean body length value of the new subspecies *veithi* n. ssp. in Dikmen village is different from the other total body length values. It was calculated as 160 mm (range: 130-195 mm). Başoğlu & Baran (1977) calculated the largest specimen as 181 mm. According to these results, with 195 mm total body length, we have encountered the biggest adult specimens so far (Table 3). The third new subspecies *kunti* n. ssp. in Güzelbağ was calculated as 146 mm (range: 127-165) and this value is bigger than the subspecies both *bayrami* and *oezi* as well (Table 5). Thus, Dikmen population has the biggest mean of total body length value among all *L. atifi* populations.

Lyciasalamandra atifi has the largest range among other *Lyciasalamandra* species. The distribution of species was extended 75 km through eastern part of Gazipaşa and reported 1400 m above sea level in Cebireis mountain (Akman et al. 2011; Göçmen et al. 2013). According to Gebhard et al. (1990), *L. atifi* is exist around Manavgat stream. We made two different excursions to that location in November 2013, but we couldn't success to find any specimens.

Göçmen et al. (2013) mentioned that the individuals of Gazipaşa populations show some morphometric differences. They say that the specimens from around Gazipaşa, including juveniles, do not have yellow colouration and further research is required in order to clarify their taxonomic status. Although this study finished in 2015 as a Master Thesis by mentioning morphology, serology and statistics differences of Gazipaşa population and it was about to be published, this population was described as *Lyciasalamandra atifi oezi* by Tok et al. (2016) regarding to colour pattern. During our excursion, we noted that the specimens from Gazipaşa region where hiding under limestone slabs near the roots of *Arbutus ardashne* (Greek strawberry tree) plants, which retain water abundantly as well.

The Dikmen population was reported for the first time by Başoğlu & Baran (1977). According to their investigation, this population was similar in morphology with the type locality. But we found that the Dikmen population is not compatible with the type locality because of the absence of lateral stripes on the sides. Individuals in the Dikmen population are also extremely fearful of humans when compared with the individuals of other populations. Furthermore, Fersin, Gündoğmuş and Türbelinaz populations fit properly to the diagnostic features of the description of *Lyciasalamandra atifi* (Başoğlu 1967). Among all populations, reddish dark brown colouration is visible in Selge population regarding the others' colour pattern and the white stripes on lateral sides are only visible uninterruptedly in the Selge population. So, we named the Selge population as *Lyciasalamandra atifi godmanni* n. ssp.

We stated the Dikmen population as *Lyciasalamandra atifi veithi* n. ssp. especially because of the absence of the white stripes on lateral sides, being isolated from the others, having serological differences and mentioned morphometric features on this study. Güzelbağ population was also recorded for the first time by Göçmen et al. (2013) and they say that Güzelbağ populations show some morphometric differences by being much more white-spotted than any other known *L. atifi* populations. There are big, with very intensive white spots on the surfaces of individuals. Our study results agree with them and we named the Güzelbağ population as *Lyciasalamandra atifi kunti* n. ssp.

As we can see the results of ANOVA and discriminant analysis, almost all the populations were calculated as different according to statistics (Table

10, 11, 12). But we applied serology techniques to be sure the distinction degrees among the populations as well. Electropherograms and densitometric curves of blood samples were taken from two males and two females per population and compared with each other. Equal amounts of albumin and pre-albumin proteins were defined as one fraction in all the populations. It was observed that the males in Selge, Fersin, Gündoğmuş, Türbelinaz and *Lyciasalamandra atifi bayrami* populations' globulin areas were divided into 10 fractions. However, the males of the new subspecies *veithi* n. ssp. from Dikmen and *kunti* n. ssp. from Güzelbağ populations were divided into 9 fractions at the globulin areas. Globulin areas in females of the Fersin, the new subspecies *veithi* and *kunti* n. ssp. and Türbelinaz populations were divided into 9 fractions. Globulin areas in females of the new subspecies *godmanni* n. ssp. from Selge and *L. atifi bayrami* populations were divided into 10. In the females of Gündoğmuş and *L. atifi oezi* populations' globulin areas were divided into 11 fractions. Furthermore, unlike other populations, the greatest fraction number in globulin areas was observed in the *Lyciasalamandra atifi oezi* population for the first time. Males and females both had 11 fractions at globulin areas.

Veith et al. (2008) also showed that the Selge population has different haplotypes among the *Lyciasalamandra atifi* populations. It was determined that except of the Fersin, Gündoğmuş and Türbelinaz populations, the other *Lyciasalamandra atifi* populations which are isolated in different habitats, are not compatible with the diagnostic characteristics of the species description given by Başoğlu (1967). The distribution of these isolated populations is in an area about 190 km from Selge to Gazipaşa. Accordingly, it was determined that the some isolated populations in the distribution area are different from each other in morphological, colour-pattern and serological aspects. Examination of the blood-serum protein analysis shows that they are different, and populations with equal numbers of blood serum proteins appear to be incompatible among each other in terms of colour-pattern characteristics. There are also differences among them in terms of measurements and ratios in statistics. Thus, the taxonomic status of each population was reassessed and revealed that three new subspecies (*L. atifi godmanni* n. ssp., *L. atifi veithi* n. ssp. and *L. atifi kunti* n.

ssp.) had to be established. However, the taxonomic status of populations will become more clear with the conclusion of ongoing genetic studies.

ACKNOWLEDGEMENT. The study was produced from MSc thesis of first author and supervised by second author. We would like to express our appreciation to the Ege University Scientific Research Project Commission, which supported this study in a Project (No: 2013-Fen-010) and also grateful to Dr. Bahadır AKMAN and PhD student Mert KARIŞ (Ege University, Faculty of Science, Department of Biology, Zoology Section) for their assistances during our trips.

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