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Comparative morphology of *Darevskia parvula* (Lantz-Cyren 1936) (Sauria: Lacertidae) subspecies in Northeastern Anatolia, Turkey

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Abstract. This study was designed to determine the degree of morphological differentiation between the subspecies of *Darevskia parvula* from northwestern Anatolia. The meristic pholidolial characters, metric dimensions and color-pattern features of specimens of both subspecies obtained from 10 different localities in the northeastern Anatolia, Turkey are given in detail and compared with regard to literature. In addition, thirty-six morphological characters were compared statistically and 66.7% of them showed differences between two subspecies.

Key words: *Darevskia parvula,* rock lizard, distribution, meristic pholidolial characters, metric dimensions, northeastern Anatolia.

Introduction

Darevskia parvula was first described as *Lacerta saxicola parvula nov. var.* Lantz & Cyrén 1913 based on specimens collected from the regions of Artvin, Ardanuç and Borçka in Turkey (Lantz & Cyrén 1913). It includes two subspecies (*D. p. parvula* and *D. p. adjarica*) and is known west and southwest of Georgia and in Turkey (Darevsky 1967, Darevsky & Eiselt 1980, Baran & Atatür 1998, Sindaco et al. 2000). The nominate race lives around Artvin, Ardahan and Bayburt, while the distribution range of *D. p. adjarica* includes the coast of Rize and Artvin in Turkey (Baran & Atatür 1998, Sindaco et al. 2000).

This form was accepted as a variety of *Lacerta saxicola* by Lantz & Cyren (1913) whereas it was evaluated as a subspecies of *Lacerta saxicola* by Nikolsky (1913). According to Bodenheimer (1944), *L. s. parvula* is one of the subspecies of *L. saxicola* inhabiting in Anatolia. Darevsky (1967) stated that the specimens obtained from northeast Anatolia show important differences in terms of meristic pholidolial characters from specimens collected from other areas within the distribution range of the subspecies. According to his results, these differences could represent a cline among the populations of this subspecies. Clark & Clark (1973) found the new locality for *L. s. parvula* from 15 km E of Artvin in Turkey. They also stated that the specimens of *L. s. parvula* differ completely from other rock lizard specimens obtained from same locality and should therefore be accepted as a different species. According to Başoğlu & Baran (1977), the distribution zone of *L. saxicola parvula* includes Anatolia and Caucasia. They also gave the detailed distribution map of *L. saxicola parvula* in Turkey. Darevsky & Lukina (1977) reexamined

Clark and Clark's rock lizard specimens collected from Anatolia and included them into five different species or subspecies. They included three specimens captured from 5 km W of Hopa in *L. parvula.* Three specimens collected from 15 km E of Artvin and Arsin were accepted as a hybrid form of *L. parvula* and *L. rudis* (Darevsky & Lukina 1977). Darevsky & Eiselt (1980) described as a new subspecies of this lizard from Mestia Region, Georgia, as *Lacerta parvula adjarica*. Baran et al (1997) examined the *Lacerta parvula* specimens collected from Çamlıhemşin in terms of pholidolial features and morphometric measurements and included them into the subspecies *Lacerta parvula adjarica*. Arribas (1999) stated that rock lizard species were different from other species of the genus *Lacerta* with respect to certain morphological (pholidolial characters and color-pattern features), osteological, karyological and behavioural features. He therefore assigned rock lizard species to a newly erected genus: *Darevskia*. A phylogeny of the Caucasian rock lizard (genus *Darevskia*) was constructed using mitochondrial DNA sequence and alloyzme data (Murphy et al. 2000). Murphy et al. (2000) placed all fifteen heterogamic rock lizard species into three major clades: *caucasica*, *saxicola* and *rudis*. According to the results of the present study, *Darevskia parvula* should be included in the *rudis* clade. Ilgaz (2004) examined specimens of 6 rock lizard species captured from northeastern Turkey in terms of morphological characters as wells as ecological features of biotopes. He also tried to fill a gap related to their distribution pattern in northeastern Anatolia.

In this study, specimens of *D. parvula* collected from new localities (Yusufeli and Kılıçkaya) were also evaluated from the point of view of morphological features beside those collected from the known distribution area of Northeast Anatolia and the distribution area of the species was enlarged. Also, the existing two subspecies were compared morphologically with the help of statistical methods and similarities and differences were shown. Finally, ecological features of the habitats in which specimens are captured were described.

Materials and Methods

A total of 221 specimens collected from ten localities in 2001 and 2002 were used (see Appendix 1. for locality data and sample sizes). The study area covered the northeastern part of Turkey (Fig. 1). Color slides of the specimens were taken and the specimens were then fixed with 5% formaldehyde in 70% ethanol and then preserved in 70% ethanol according to the method described by Başoğlu & Baran (1977). The specimens were incorporated into the collection of ZDEU (Zoology Department Ege University) and kept in the Zoology Lab of the Department of Biology at Buca Education Faculty, Buca, İzmir, Turkey.

The following metric dimensions were taken using dial calipers with an accuracy of 0.02 mm: Snout-vent length (SVL): Tip of snout to anal cleft. Tail length (TL): Anal cleft to tip of tail. Pileus width (PW): At widest point between parietal plates. Pileus length (PL): Tip of snout to posterior margins of parietals. Head width (HW): At widest point of head. Head length (HL): Tip of snout to posterior margin of ear opening. Furthermore, morphometric indexes were calculated: Pileus index (PI) [(PW / PL) X 100], head index (HI) [(HW / HL) X 100], PLI [pileus length index, (PL/SVL) X 100], PWI [pileus width index, (PW/SVL) X 100], HWI [head width index (HW/SVL) X 100], HLI [head length index (HL/SVL) X 100] and TLI [tail length index (TL/SVL) X 100].

Meristic pholidolial characters considered here consisted of the following counts: Supraciliar granules (left-right) (SCGa-SCGb), supraciliar plates (left-right) (SCPa-SCPb), supralabial plates (left-right) (SRLa-SRLb), sublabial plates (left-right) (SLa-SLb), transverse series of gular scales between inframaxillary symphysis and collar (MG), temporal scales 1 (transverse rows of temporal scales between

masseteric and tympanic) (left-right) (TS1a-TS1b), temporal scales 2 (longitudinal rows of temporal scales between tympanic and parietal) (left-right) (TS2a-TS2b), temporal scales 3 (longitudinal rows of temporal scales between supratemporal and masseteric) (left-right) (TS3a-TS3b), posttemporal plates (left-right) (POTa-POTb), ventral plates (transverse and longitudinal) (TVP and LVP), preanals 1 (number of preanals located anterior of anals) (PA1), preanals 2 (number of preanals surrounding anals) (PA2), femoral pores (left-right) (FPa-FPb), longitudinal rows of scales on ventral surface of thigh between the femoral pores and the outer row of enlarged scales (left-right) (LSa-LSb), subdigital lamellae in the 4th toe (left-right) (SDLa-SDLb), tibial scales (scales lying on dorsal surface of ankle between the large scales (TS) and transversal series of dorsal scales at the midtrunk (DS). The shapes of the submaxillaries were also examined.

In order to compare similarities and differences between sexes, an independent t-test was applied to the metric dimensions of two subspecies. For statistical analyses, metric dimension indexes and ratios [(PI), (HI), (PLI), (PWI), (HWI), (HLI) and (TLI)] were used to test for similarities and differences. Indexes were used due to an uncertainty regarding age groups and because it is unknown whether growth is isometric or not. Data were examined for conformation to the assumption of normality (the Kolmogorov-Smirnov test) and homogeneity (F_{max}). The metric dimension indexes showing differences between sexes were discarded in the further analyses. Later on, one-way variance analyses (ANOVA) were applied to the metric dimensions of the two subspecies according to those metric dimensions indexes not showing sexual dimorphism between sexes. According to the meristic pholidolial characters, the existence of sexual dimorphism between males and females was tested by the Kolmogorov-Smirnov test, and meristic pholidolial characters showing sexual dimorphism were discarded in the further analyses. The Mann-Whitney U test was then applied for comparing two subspecies according to those meristic pholidolial characters not showing sexual dimorphism. The significance level for all statistical tests was set at 0.05. Statistical analyses were carried out using the program SPSS 11.0 (Spss Inc., 1989-2001) and STATISTICA 6.0 (StatSoft Inc., 2001) statistical packages.

Results

Darevskia parvula parvula (Lantz-Cyren 1913)

Meristic Pholidolial Characters and Metric Dimensions

The rostral usually was separated from the internasal (91.5%). The postorbital was separated from the parietal (53.7%) or was in contact at least on one side (46.3%). The

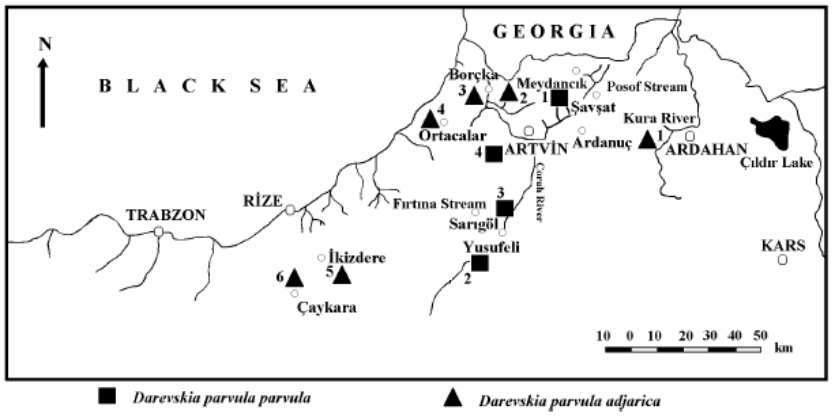

Figure 1. The map showing the localities in which specimens were collected.

masseteric was moderately sized and usually distinct (98.8%). The large supratemporal plate mostly ended sharply like a nail in general (97.6%); it was usually three times larger than the posttemporal plates located posterior to supratemporal (63.4%) in the examined specimens. The number of posttemporal plates located posterior to the supratemporal ranged from 4–8 with a mean of 5.95 (SD: 0.83). Two PA1 were usually present (93.9%). The dorsal scales were small and smooth. Descriptive statistics of meristic pholidolial characters of *D. p. parvula* specimens are given in Table 1. The configuration of the 6th submaxillary plate: 42.7% (35 specimens) of type C, 30.5% (25 specimens) of type A, 20.7% (17 specimens) of type B, 4.9% (4 specimens) of type E and 1.2% (1 specimen) of type D (Fig. 2). As understood from the values given above, the 6th submaxillary plate was usually flat (93.9%) (Fig. 2). The mean SVL of *D. p. parvula* specimens was 51.89 mm (SD: 3.76). The maximum total length was measured as 179.92 mm (SD: 15.40) for a female specimen. The descriptive statistics of the metric dimensions are given in Table 2.

Color and Pattern Features

The ground color of the head is greenish brown or grayish brown with various-sized black points or spots. The ground color of the dorsum is brownish grey, dirty green or ivy-green with black spots centered by a brown circle. These spots are dense near the tail on the dorsum (Fig. 3) and form two transverse lines. The dark-colored, broad temporal stripe that starts at the posterior side of the head covers many irregular ocelli with white centers. In contrast to other rock lizard species, there are no bluish ocelli at the level of the fore and hind limbs in *D. p. parvula*. Supraciliar stripes consisting of interrupted white spots continue at the base of the tail. The ground color of the fore- and hind limbs is yellowish brown or greyish brown with small black points. The lower sides of the head and extremities, venter and lower side of the tail are red without any maculation. The outer ventral plates cover infrequent bright bluish ocelli.

Ecological and Biological Observations

Darevskia p. parvula specimens were captured in clefts in vertical rock zones and under stones lacking in vegetation. Four different collection areas had mainly *Abies nordmanniana*, *Picea orientalis*, *Fraxinus excelsior*, *Juglans regia*, *Populus sp.*, *Juniperus ablonga, Pinus brutia*, *Picea orientalis*, *Carpinus orientalis*, *Tilia sp.* and *Fraxinus ornus*. The altitude where the sampling was carried out ranged from 600 m to 1650 m a.s.l. The air temperature ranged from 20 to 30°C at the time of collection between 09.00 and 16.00 (between 4 and 8 July in 2001 and 2002). The syntopic amphibian and reptile species in the collection areas were *Natrix tessellata* (Laurenti 1768), *Platyceps najadum* (Eichwald 1831), *Cyrtopodion kotschyi* (Steindachner 1870), *Darevskia rudis* (Bedriaga, 1886), *Natrix natrix* (Linneaus 1758) and *Rana ridibunda* (Pallas 1771).

Darevskia parvula adjarica
(Darevsky-Eiselt 1980)

Meristic Pholidolial Characters and Metric Dimensions

The rostral was usually separated from the internasal (64.6%). The postorbital was separated from the parietal (61.5%) or was in contact at least on one side (38.5%). The

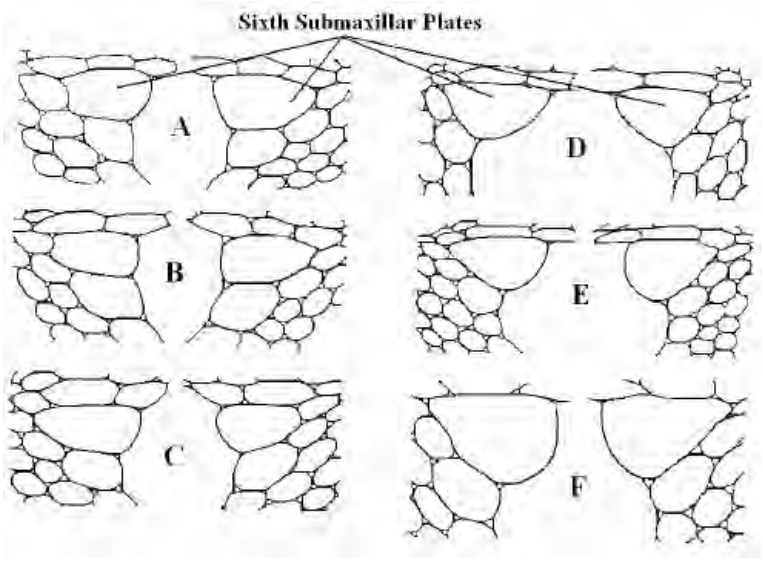

Figure 2. Variation of the 6th submaxillary plates (A – C, *D. p. parvula*; D – F, *D. p. adjarica*) (left – right). Modified from Darevsky & Eiselt (1980).

Figure 3. Dorsolateral view of *D. p. parvula* from Şavşat. Photo by Semih Üçüncü. [ZDEU 149/2001. 1♂ (left), 7♀ (right)]

Figure 4. Dorsolateral view of *D. p. adjarica* from Borçka. Photo by Semih Üçüncü. [ZDEU 115/2002. 1♂]

Table 1. Descriptive statistics of meristic pholidolial characters obtained from *Darevskia parvula parvula specimens*. For abbreviations, see the text (N: number of specimens; min: minimum value; max: maximum value; SD: standard deviation; SE: standard error of the mean)

	Overall					
Characters	**N**	**Mean**	**min**	**max**	**S.D.**	**S.E**
SCGa	82	11.86	10.00	14.00	1.07	0.12
SCGb	82	11.87	10.00	14.00	0.91	0.10
SCPa	82	6.11	5.00	7.00	0.35	0.04
SCPb	82	6.09	5.00	8.00	0.44	0.05
SRLa	82	4.43	4.00	5.00	0.50	0.06
SRLb	82	4.41	4.00	5.00	0.49	0.06
SLa	82	6.14	5.00	7.00	0.39	0.04
SLb	82	6.16	5.00	7.00	0.40	0.05
MG	82	26.99	23.00	31.00	1.77	0.20
STP	82	2.74	2.00	4.00	0.53	0.06
TS2a	81	2.67	2.00	4.00	0.60	0.07
TS2b	81	2.75	2.00	4.00	0.57	0.07
TS1a	82	2.93	2.00	5.00	0.77	0.09
TS1b	82	2.96	2.00	5.00	0.76	0.09
TS3a	82	1.76	1.00	3.00	0.59	0.07
TS3b	82	1.76	1.00	3.00	0.59	0.07
POT	82	5.95	4.00	8.00	0.83	0.84
TVP	82	6.00	6.00	6.00	0.00	0.00
LVP	82	25.33	23.00	29.00	1.44	0.16
PA1	82	1.93	1.00	2.00	0.25	0.03
PA2	82	6.34	4.00	9.00	0.97	0.11
FPa	82	20.47	17.00	25.00	1.74	0.20
FPb	82	20.18	16.00	25.00	1.76	0.20
LSa	82	5.04	4.00	6.00	0.62	0.07
LSb	82	5.04	4.00	6.00	0.62	0.07
SDLa	82	30.14	26.00	33.00	1.65	0.19
SDLb	82	30.18	26.00	39.00	1.90	0.22
TS	82	15.74	13.00	19.00	1.31	0.15
DS	82	58.93	52.00	71.00	3.44	0.39

	Males					
Characters	**N**	**Mean**	**min**	**max**	**S.D.**	**S.E**
SCGa	42	11.88	10.00	14.00	1.06	0.16
SCGb	42	11.88	10.00	14.00	0.94	0.15
SCPa	42	6.17	6.00	7.00	0.38	0.06
SCPb	42	6.17	6.00	7.00	0.38	0.06
SRLa	42	4.43	4.00	5.00	0.50	0.08
SRLb	42	4.36	4.00	5.00	0.48	0.07
SLa	42	6.19	6.00	7.00	0.40	0.06
SLb	42	6.17	6.00	7.00	0.38	0.06
MG	42	26.64	23.00	30.00	1.46	0.23
STP	42	2.83	2.00	4.00	0.49	0.08
TS2a	41	2.66	2.00	4.00	0.53	0.08
TS2b	41	2.68	2.00	4.00	0.53	0.08
TS1a	42	2.88	2.00	5.00	0.80	0.12

Table 1. (Continued)

	Males					
Characters	**N**	**Mean**	**min**	**max**	**S.D.**	**S.E**
TS1b	42	2.88	2.00	5.00	0.80	0.12
TS3a	42	1.71	1.00	3.00	0.55	0.09
TS3b	42	1.71	1.00	3.00	0.55	0.09
POT	42	5.95	4.00	7.00	0.79	0.12
TVP	40	6.00	6.00	6.00	0.00	0.00
LVP	42	24.43	23.00	26.00	0.83	0.13
PA1	42	1.90	1.00	2.00	0.30	0.05
PA2	42	6.33	4.00	9.00	1.12	0.17
FPa	42	20.67	17.00	25.00	2.03	0.31
FPb	42	20.26	16.00	25.00	2.10	0.32
LSa	42	5.12	4.00	6.00	0.55	0.08
LSb	42	5.12	4.00	6.00	0.55	0.08
SDLa	42	30.21	27.00	33.00	1.57	0.24
SDLb	42	30.12	27.00	33.00	1.47	0.23
TS	42	15.93	13.00	19.00	1.40	0.22
DS	42	59.26	52.00	71.00	3.66	0.57

	Females					
Characters	**N**	**Mean**	**min**	**max**	**S.D.**	**S.E**
SCGa	34	11.82	10.00	14.00	1.09	0.19
SCGb	34	11.85	10.00	14.00	0.89	0.15
SCPa	34	6.03	5.00	7.00	0.30	0.05
SCPb	34	6.00	5.00	8.00	0.49	0.08
SRLa	34	4.44	4.00	5.00	0.50	0.09
SRLb	34	4.47	4.00	5.00	0.51	0.09
SLa	34	6.09	5.00	7.00	0.38	0.07
SLb	34	6.15	5.00	7.00	0.44	0.07
MG	34	27.41	24.00	31.00	2.03	0.35
STP	34	2.62	2.00	4.00	0.55	0.09
TS2a	34	2.68	2.00	4.00	0.68	0.12
TS2b	34	2.82	2.00	4.00	0.63	0.11
TS1a	34	3.00	2.00	4.00	0.74	0.13
TS1b	34	3.06	2.00	4.00	0.70	0.12
TS3a	34	1.82	1.00	3.00	0.63	0.11
TS3b	34	1.82	1.00	3.00	0.63	0.11
POT	34	5.94	4.00	8.00	0.89	0.15
TVP	34	6.00	6.00	6.00	0.00	0.00
LVP	34	26.44	23.00	29.00	1.24	0.21
PA1	34	1.97	1.00	2.00	0.17	0.03
PA2	34	6.35	5.00	8.00	0.77	0.13
FPa	34	20.24	17.00	23.00	1.28	0.23
FPb	34	20.09	18.00	23.00	1.26	0.22
LSa	34	4.94	4.00	6.00	0.69	0.12
LSb	34	4.94	4.00	6.00	0.69	0.12
SDLa	34	30.06	26.00	33.00	1.77	0.30
SDLb	34	30.26	26.00	39.00	2.34	0.40
TS	34	15.50	13.00	17.00	1.16	0.20
DS	34	58.53	54.00	66.00	3.15	0.54

Table 2. Descriptive statistics of metric dimensions obtained from *Darevskia parvula parvula.* For abbreviations, see the text.

	Overall					
Characters	**N**	**Mean**	**min**	**max**	**S.D.**	**S.E**
PL	76	11.92	9.42	13.94	1.22	0.14
PW	76	6.12	4.76	7.56	0.69	0.08
HW	76	7.10	5.76	8.64	0.79	0.09
HL	76	12.94	10.40	14.98	1.29	0.15
SVL	76	52.24	41.20	59.92	4.32	0.50
TL	17	108.06	85.00	130.00	13.24	3.21
TBL	17	160.66	128.70	187.42	16.91	4.10
PI	76	51.33	41.79	56.42	2.35	0.27
HI	76	54.81	49.78	59.70	2.02	0.23
PLI	76	22.83	19.83	27.14	1.57	0.18
PWI	76	11.71	10.05	13.53	0.86	0.10
HWI	76	13.58	11.43	15.58	0.95	0.11
HLI	76	24.79	21.47	28.28	1.61	0.18
TLI	17	205.61	171.90	232.64	18.01	4.37

	Males					
Characters	**N**	**Mean**	**min**	**max**	**S.D.**	**S.E**
PL	42	12.72	9.74	13.94	0.90	0.14
PW	42	6.57	4.92	7.56	0.55	0.08
HW	42	7.61	5.78	8.64	0.66	0.10
HL	42	13.84	10.66	14.98	0.95	0.15
SVL	42	53.66	41.20	59.92	3.82	0.59
TL	9	115.33	92.00	130.00	12.73	4.24
TBL	9	170.30	142.52	187.42	14.68	4.89
PI	42	51.63	46.59	56.42	2.14	0.33
HI	42	54.98	49.78	59.70	2.24	0.34
PLI	42	23.72	21.18	27.14	0.97	0.15
PWI	42	12.24	10.89	13.53	0.57	0.09
HWI	42	14.19	12.51	15.58	0.65	0.10
HLI	42	25.81	23.56	28.28	0.89	0.14
TLI	9	210.24	171.90	232.64	22.30	7.43

	Females					
Characters	**N**	**Mean**	**min**	**max**	**S.D.**	**S.E**
PL	34	10.93	9.42	13.64	0.75	0.13
PW	34	5.56	4.76	6.42	0.37	0.06
HW	34	6.46	5.76	7.20	0.37	0.06
HL	34	11.84	10.40	12.82	0.61	0.10
SVL	34	50.50	41.66	56.60	4.32	0.74
TL	8	99.88	85.00	114.00	8.41	2.97
TBL	8	149.81	128.70	168.94	12.38	4.38
PI	34	50.95	41.79	56.22	2.57	0.44
HI	34	54.60	51.64	59.41	1.71	0.29
PLI	34	21.72	19.83	25.65	1.46	0.25
PWI	34	11.05	10.05	12.86	0.68	0.12
HWI	34	12.84	11.43	14.27	0.71	0.12
HLI	34	23.54	21.47	26.52	1.39	0.24
TLI	8	200.39	186.44	213.06	10.71	3.79

masseteric was distinct and usually moderately sized (70.8%). The large supratemporal plate usually ended sharply like a nail (70.0%), it was usually larger than the posttemporal plates located at the posterior end of the supratemporal three times (76.2%). The number of posttemporal plates located posterior to the supratemporal ranged from 2-6 with a mean of 3.5 (SD: 0.80). Two PA1 were usually present (76.2%). The dorsal scales were small and smooth. The descriptive statistics of meristic pholidolial characters of *D. p. adjarica* specimens are given in Table 3. The configuration of 6th submaxillary plate: 45.4% (59 specimens) of type E, 30.0% (39 specimens) of type D, 20.0% (20 specimens) of type F, 3.1% (4 specimens) in type C and 1.5% (2 specimens) of type A (Fig. 2). As understood from the values given above, the 6th submaxillary plate was usually swollen and triangular (95.4%). The mean SVL of *D. p. adjarica* specimens was 52.24 mm (SD: 4.32). The maximum total length measured was 187.42 mm (SD: 14.68) for a male specimen. The descriptive statistics of the metric dimensions are given in Table 4.

Color and Pattern Features

The coloration and pattern of *D. p. adjarica* specimens is clearer than in the nominate race. The ground color of the head is brown or yellowish brown. On the top of the head, small black spots are irregularly present. The ground color of the dorsum is clear or dark brown (Fig. 4). The temporal stripes form a longitudinal black maculation and run from the posterior of head to 2/3 the length of the tail; they are dark brown or brownish-black with dense, irregularly dispersed white ocelli running from at the base of the forelimbs to the base of the tail. The supraciliar stripes are composed of interrupted, dense white spots; these spots are alternating or serrated staffs running from the posterior of the head to the tail tip. The tops of the fore- and hind limbs are brown or yellowish brown with irregularly dispersed, small black spots. The gular region, throat and the lower side of the head and extremities are red or dark red, without any maculation. The outer ventral plates usually lack spots, but sometimes smaller blue ocelli are visible at the level of the forelimbs. The venter is red or dark red without any maculation.

Ecological and Biological Observations

Darevskia p. adjarica specimens were collected from clefts in flat rock zones, under stones, the walls of buildings used as tea stores or slopes of a hill covered by small stones between 08.00 and 15.30 hours cloudy or sunny weather conditions. The collection localities were not far away from water, such as streams or rivers, and forest zones, mainly including *Abies nordmanniana*, *Picea orientalis*, *Corylus maxima*, *Camelia sinensis*, *Cupressus sempervirens*, *Alnus glutinosa*, *Castanea sativa*, *Pinus nigra*, *Carpinus orientalis*, *Alnus glutinosa*, *Carpinus orientalis*, *Castanea sativa* and *Fagus orientalis*. The altitude ranged from 700 - 1620 m a.s.l., temperature was between 16 and 31°C (between 6 July and 8 September in 2001 and 2002). The syntopic reptile and amphibian species were *Darevkia rudis* (Bedriaga 1886), *D. clarkorum* (Darevsky-Vedmederja 1977), *D. derjugini* (Nikolskij 1898), *Anguis fragilis* Linnaeus 1758, *Bufo bufo* (Linneaus 1758), *Dolicophis caspius*, (Gmelin 1789), *Platyceps najadum* (Eichwald 1831), *Coronella austriaca* (Laurenti 1768), *Mertensiella caucasica* (Waga 1876), *Ommatotriton vittatus* (Jenyns 1835),

Pelodytes caucasicus (Boulenger 1896) and *Natrix natrix* (Linneaus 1758).

Statistical Analyses

The Kolmogorov-Smirnov test revealed sexual dimorphism in only one character (TVP) in both subspecies ($Z = 3.446$, $p = 0.000$ for *D. p. adjarica*; $Z = 3.309$, $p = 0.000$ for *D. p. parvula*). Thus, TVP was excluded from further analysis of meristic pholidolial characters. The nominate race and *D. p. adjarica* were compared with each other in terms of meristic pholidolial characters by using the Mann-Whitney U test. The results show that the two subspecies are differentiated from each other in 23 meristic pholidolial characters [SCGa, SCGb, SCPa, SCPb, SRLa, SRLAB, SLa, SLb, MG, STP, TS2a, TS2b, PA1, FPa, FPb, LSa, LSb, SDLa, SDLb, DS, POT, TS3a and TS3b ($p<0.05$)].

The independent t-tests showed sexual dimorphism in PLI, PWI, HWI, HLI and TLI characters of *D. p. adjarica* ($p<0.05$). There were differences in four indices [PLI, PWI, HWI and HLI ($p<0.05$)] between females and males specimens of *D. p. parvula*. Thus, five characters (PLI, PWI, HWI, HLI and TLI) were excluded from further analysis of metric characters. According to results of the one-way ANOVA test comparing the two subspecies based on metric characters that do not show sexual dimorphism, the characters PI and HI differs significantly ($p<0.05$).

Discussion

A total of 13 rock lizard species including *D. parvula* inhabit Anatolia (Baran & Atatür 1998, Sindaco et al. 2000). The distribution zone of *D. parvula* covers west and southwest Georgia except for northeastern Turkey (Darevsky 1967, Darevsky & Eiselt 1980, Baran & Atatür 1998, Sindaco et al. 2000). *D. parvula* is currently recognized as being composed of two subspecies (*D. p. parvula* and *D. p. adjarica*) throughout its range (Darevsky & Eiselt 1980) and was included in the *rudis* clade based on mitochondrial DNA sequence and alloyzme data (Murphy et al. 2001).

Although *D. p. adjarica* has approximately the same SVL measurements and swollen body, it differs from the nominate race in having lower values of certain meristic pholidolial characters (especially the percentage of the border of the supratemporal plate to parietal plate, the length of border of the supratemporal plate to parietal is 45.3%), three-cornered 6th submaxillary plates whose edges are swollen and curled (94.9%), one large preanal (53.1%) (9.2% for nominate race) or two preanals (46.9%) (90.8% for *D. p. parvula*) and the characteristic color-pattern of the body (Darevsky & Eiselt 1980).

Based on the configuration of 6th submaxillary plate, one of the diagnostic characters distinguishing the two subspecies, Darevsky & Eiselt (1980) designated six different types (Fig. 2). Of the specimens investigated here, 93.9% belonged to the nominate race, where the 6th submaxillary plate is flat, this plate was three-cornered and the edges were swollen and curled in 6.10% (5 specimens). In Darevsky & Eiselt (1980), 63.3% of the specimens had a flat plate. The percentage I obtained was considerably higher than the value given in Darevsky & Eiselt (1980). *D. p. adjarca* is distinguished from the nominate race in that the 6th submaxillary plates are three cornered with swollen and curled edges (Darevsky & Eiselt 1980). Of the specimens belonging to *D. p. adjarica* examined in the

Table 3. Descriptive statistics of meristic pholidolial characters obtained from *Darevskia parvula adjarica* specimens. For abbreviations, see the text.

	Overall					
Characters	**N**	**Mean**	**min**	**max**	**S.D.**	**S.E**
SCGa	139	11.11	4.00	15.00	1.54	0.14
SCGb	139	11.21	4.00	16.00	1.66	0.15
SCPa	139	5.91	4.00	7.00	0.60	0.05
SCPb	139	5.94	4.00	7.00	0.39	0.03
SRLa	139	4.09	3.00	5.00	0.30	0.03
SRLb	139	4.02	3.00	5.00	0.30	0.03
SLa	139	6.02	5.00	8.00	0.39	0.03
SLb	139	6.03	5.00	7.00	0.40	0.04
MG	139	25.62	21.00	30.00	1.79	0.16
STP	139	3.10	2.00	4.00	0.48	0.04
TS2a	139	2.06	1.00	5.00	0.63	0.06
TS2b	139	2.07	1.00	5.00	0.65	0.06
TS1a	139	2.71	1.00	5.00	0.96	0.09
TS1b	139	2.73	1.00	5.00	0.91	0.08
TS3a	127	1.57	1.00	4.00	0.65	0.06
TS3b	127	1.57	1.00	4.00	0.65	0.06
POT	139	3.50	2.00	6.00	0.80	0.07
TVP	139	6.00	6.00	6.00	0.00	0.00
LVP	139	24.53	21.00	28.00	1.71	0.15
PA1	139	1.75	1.00	2.00	0.43	0.04
PA2	139	6.40	4.00	8.00	0.84	0.08
FPa	139	18.56	13.00	22.00	1.62	0.15
FPb	139	18.49	14.00	23.00	1.65	0.15
LSa	139	4.75	4.00	6.00	0.59	0.05
LSb	139	4.75	4.00	6.00	0.59	0.05
SDLa	139	27.73	22.00	33.00	2.08	0.19
SDLb	139	27.74	22.00	33.00	2.05	0.18
TS	139	15.60	13.00	20.00	1.24	0.11
DS	139	54.41	47.00	62.00	3.13	0.28

	Males					
Characters	**N**	**Mean**	**min**	**max**	**S.D.**	**S.E**
SCGa	61	11.18	4.00	15.00	1.79	0.23
SCGb	61	11.16	4.00	16.00	1.82	0.23
SCPa	61	5.93	4.00	7.00	0.54	0.07
SCPb	61	5.98	5.00	7.00	0.22	0.03
SRLa	61	4.02	3.00	5.00	0.22	0.03
SRLb	61	3.98	3.00	5.00	0.29	0.04
SLa	61	6.02	5.00	7.00	0.39	0.05
SLb	61	6.05	5.00	7.00	0.46	0.06
MG	61	25.56	21.00	30.00	1.96	0.25
STP	61	3.10	2.00	4.00	0.47	0.06
TS2a	61	2.10	1.00	3.00	0.57	0.07
TS2b	61	2.08	1.00	3.00	0.56	0.07
TS1a	61	2.56	1.00	5.00	0.94	0.12
TS1b	61	2.59	1.00	5.00	0.94	0.12

Table 3. (Continued)

	Males					
Characters	**N**	**Mean**	**min**	**max**	**S.D.**	**S.E**
TS3a	55	1.51	1.00	3.00	0.54	0.07
TS3b	55	1.51	1.00	3.00	0.54	0.07
POT	61	3.43	2.00	6.00	0.87	0.11
TVP	61	6.00	6.00	6.00	0.00	0.00
LVP	61	23.33	21.00	26.00	1.22	0.16
PA1	61	1.70	1.00	2.00	0.46	0.06
PA2	61	6.34	5.00	8.00	0.77	0.10
FPa	61	18.61	13.00	22.00	1.70	0.22
FPb	61	18.48	14.00	23.00	1.71	0.22
LSa	61	4.70	4.00	6.00	0.61	0.08
LSb	61	4.70	4.00	6.00	0.61	0.08
SDLa	61	27.95	22.00	33.00	2.20	0.28
SDLb	61	27.97	22.00	33.00	2.14	0.27
TS	61	15.64	13.00	20.00	1.35	0.17
DS	61	54.66	47.00	62.00	3.44	0.44

	Females					
Characters	**N**	**Mean**	**min**	**max**	**S.D.**	**S.E**
SCGa	64	11.05	8.00	14.00	1.25	0.16
SCGb	64	11.25	8.00	15.00	1.50	0.19
SCPa	64	5.89	4.00	7.00	0.65	0.08
SCPb	64	5.91	4.00	7.00	0.50	0.06
SRLa	64	4.00	3.00	5.00	0.36	0.04
SRLb	64	4.06	3.00	5.00	0.30	0.04
SLa	64	6.03	5.00	8.00	0.40	0.05
SLb	64	6.02	5.00	7.00	0.33	0.04
MG	64	25.69	21.00	29.00	1.63	0.20
STP	64	3.09	2.00	4.00	0.50	0.06
TS2a	64	2.03	1.00	5.00	0.69	0.09
TS2b	64	2.06	1.00	5.00	0.73	0.09
TS1a	64	2.86	1.00	5.00	0.96	0.12
TS1b	64	2.86	1.00	5.00	0.87	0.11
TS3a	58	1.62	1.00	4.00	0.75	0.10
TS3b	58	1.62	1.00	4.00	0.75	0.10
POT	64	3.58	2.00	6.00	0.73	0.09
TVP	64	6.00	6.00	6.00	0.00	0.00
LVP	64	25.67	23.00	28.00	1.26	0.16
PA1	64	1.80	1.00	2.00	0.41	0.05
PA2	64	6.45	4.00	8.00	0.91	0.11
FPa	64	18.52	14.00	22.00	1.56	0.19
FPb	64	18.50	14.00	22.00	1.60	0.20
LSa	64	4.80	4.00	6.00	0.57	0.07
LSb	64	4.80	4.00	6.00	0.57	0.07
SDLa	64	27.52	24.00	31.00	1.95	0.24
SDLb	64	27.53	24.00	31.00	1.95	0.24
TS	64	15.56	14.00	19.00	1.13	0.14
DS	64	54.17	47.00	60.00	2.81	0.35

Table 4. Descriptive statistics of metric dimensions obtained from *Darevskia parvula adjarica.* For abbreviations, see the text.

	Overall					
Characters	**N**	**Mean**	**min**	**max**	**S.D.**	**S.E**
PL	125	11.96	9.24	15.62	1.21	0.11
PW	125	6.39	5.00	8.44	0.71	0.06
HW	125	7.49	5.60	10.05	0.93	0.08
HL	125	12.87	10.38	16.43	1.24	0.11
SVL	125	51.89	41.52	62.28	3.76	0.34
TL	30	104.00	82.00	121.00	10.15	1.85
TBL	30	156.26	127.78	179.92	13.17	2.40
PI	125	53.41	42.92	63.64	2.65	0.24
HI	125	58.14	45.66	68.53	3.61	0.32
PLI	125	23.05	20.09	26.76	1.51	0.13
PWI	125	12.30	10.14	14.21	0.93	0.08
HWI	125	14.42	11.35	17.93	1.28	0.11
HLI	125	24.80	21.54	27.87	1.59	0.14
TLI	30	199.29	161.23	236.22	15.79	2.88

	Males					
Characters	**N**	**Mean**	**min**	**max**	**S.D.**	**S.E**
PL	61	12.71	10.80	15.62	1.02	0.13
PW	61	6.76	5.80	8.44	0.60	0.08
HW	61	7.93	6.58	10.05	0.90	0.11
HL	61	13.66	11.72	16.43	1.06	0.14
SVL	61	52.85	45.50	62.28	3.42	0.44
TL	17	107.76	94.00	121.00	7.73	1.87
TBL	17	160.32	142.50	176.26	9.80	2.38
PI	61	53.16	48.58	58.03	1.98	0.25
HI	61	58.00	45.66	67.41	3.74	0.48
PLI	61	24.04	21.34	25.28	1.02	0.13
PWI	61	12.78	10.81	14.21	0.67	0.09
HWI	61	14.99	12.60	17.93	1.16	0.15
HLI	61	25.85	23.07	27.87	1.24	0.16
TLI	17	205.65	167.20	236.22	16.05	3.89

	Females					
Characters	**N**	**Mean**	**min**	**max**	**S.D.**	**S.E**
PL	64	11.25	9.24	13.84	0.93	0.12
PW	64	6.04	5.00	7.88	0.63	0.08
HW	64	7.06	5.60	8.88	0.75	0.09
HL	64	12.11	10.38	14.46	0.88	0.11
SVL	64	50.97	41.52	60.92	3.87	0.48
TL	13	99.08	82.00	119.00	11.09	3.07
TBL	13	150.95	127.78	179.92	15.40	4.27
PI	64	53.65	42.92	63.64	3.16	0.40
HI	64	58.26	49.56	68.53	3.50	0.44
PLI	64	22.10	20.09	26.76	1.27	0.16
PWI	64	11.85	10.14	14.08	0.91	0.11
HWI	64	13.87	11.35	17.89	1.15	0.14
HLI	64	23.80	21.54	27.07	1.20	0.15
TLI	13	190.98	161.23	200.00	11.28	3.13

present study, 95.4% had three cornered with swollen and curled edges of 6th submaxillary plates, whereas it was being 4.6% as flat. Of the 177 specimens investigated by Darevsky & Eiselt (1980), the corresponding value was 94.9%, almost identical for the specimens examined in the present study.

The present investigation specimens of the nominate form showed that 77 (93.2%) had 2 preanal plates at the anterior of the anal whereas 5 specimens (6.1%) had 1. The corresponding values in the study of Darevsky & Eiselt (1980) were 90.8% and 9.2% respectively. These percentages are quite similar (Fig. 5). On the other hand, the percentage of animals with two preanal plates is higher than that given in Darevsky (1967). The investigation of specimens of *D. p. adjarica* yielded 76.2% of two preanal plates at the anterior of the anal plate and 23.8% of one preanal plate. In the study of Darevsky & Eiselt (1980), 53.1% of the investigated specimens had one preanal plate at the anterior of the anal plate. The percentage of having one preanal plate determined in the present study is quite higher that of Darevsky & Eiselt (1980) (Fig. 5). On the other hand, the number of preanal plates surrounding the anal plate is similar to that given for this subspecies by Baran et al. (1997).

Darevskia p. adjarica differs from the nominate form in the color-pattern (Darevsky & Eiselt 1980). *Darevskia p. adjarica* differs from nominate race in the coloring of the temporal band (varies from dark brown to brownish black), as well as in the supraciliar band sometimes clearly wavy with a toothed strip or consists of a series of whitish spots. One characteristic that distinguishes *D. p. adjarica* from the nominate form is that the outermost ventral plates are little or much blue spotted.

Darevsky (1967) reported that frequent syntopic is a prevalent feature of rock lizard species within the Caucasus and evidently in Asia Minor. According to Darevsky (1967), *D. parvula* shares the same biotopes with *D. rudis rudis* in the Adzharia and with *D. r. obscura* in Georgia. In this study, *D. parvula* was syntopic with *D. rudis* in Hatila, Borçka, Çermik and Ortacalar. The vertical distribution of specimens ranged from 550 to 1650 m a.s.l. Darevsky (1967) reported that vertical distribution of *D. parvula* to range from 100 to 1600 m. a.s.l. in Transcaucasia. All the different biotopes of the rock lizard species observed within the Caucasus were classified into four basic types by Darevsky (1967). According to his study, *D. parvula* prefers dry and moderately dry rocks and located on slopes with xerophytic shrubby and grass vegetation. In this study, the specimens of both subspecies usually were found in rocky zones without dense vegetation on river banks.

Statistical analyses of the morphological characters of the two subspecies verified statistically significant differences in 24 characters. Thus, of the 36 characters examined, 66.7% discriminated the two subspecies. Comparative assessments of the other characters and dimensions measured in the present study with those reported in previous studies are given in Table 5. With regard to SCG, TS1, TS2 and MG counts for *D. p. parvula*, the specimens had lower values than those given by Darevsky (1967) and Darevsky & Eiselt (1980). DS counts were similar to those given in previous studies (Table 5). Baran & Atatür (1998) reported that the DS number at the mid-trunk ranged

Table 5. Comparison of metric dimensions and meristic pholidolial characters of the specimens examined in this study with those given in previous studies. [A: Darevsky (1967), B: Darevsky & Eiselt (1980), C: Baran et al. (1997), D: This study (* the values are used for right side of the body)].

		D. parvula parvula		
		A (N= 90)	**B (N= 94)**	**D (N= 82)**
	Sex	**min.-(mean)-max.**	**min.-(mean)-max.**	**min.-(mean)-max.**
SVL	♂♂	47.0-(51.86)-57.0	44.0-(52.60)-60.0	41.20-(53.66)-59.92
	♀♀	46.0-(50.87)-56.0	40.0-(49.00)-57.0	41.66-(50.50)-56.60
HL	♂♂	----	----	10.66-(13.84)-14.98
	♀♀	----	----	10.40-(11.84)-12.82
HW	♂♂	----	----	5.78-(7.61)-8.64
	♀♀	----	----	5.76-(6.46)-7.20
TL	♂♂	83.0-(109.46)-111.0	94.0-(110.40)-133.0	92.00-(115.33)-130.00
	♀♀	71.0-(100.89)-120.0	67.0-(97.00)-119.0	85.00-(99.88)-114.00
DS	♂♂+♀♀	50.0-(58.91)-70.0	51.0-(60.70)-69.0	52.0-(58.93)-71.0
SCG	♂♂+♀♀	6.0-(12.64)-24.0	10.0-(13.60)-23.0	10.0-(11.87)-14.0*
TS1	♂♂+♀♀	----	1.0-(3.20)-5.0	2.0-(2.96)-5.0*
TS2	♂♂+♀♀	----	1.0-(3.10)-4.0	2.0-(2.67)4.0*
MG	♂♂+♀♀	22.0-(27.51)-33.0	23.0-(28.10)-35.0	23.0-(26.99)-31.0
LVP	♂♂	20.0-(23.65)-26.0	21.0-(25.10)-28.0	23.0-(24.43)-26.0
	♀♀	23.0-(25.60)-28.0	26.0-(27.60)-30.0	23.0-(26.44)-29.0
FP	♂♂+♀♀	14.0-(19.34)-27.0	18.0-(21.60)-26.0	16.0-(20.18)-25.0*
SDL	♂♂+♀♀	----	24.0-(29.30)-36.0	26.0-(30.18)-39.0*
PA2		----	----	4.0-(6.4)-8.0
POT	♂♂+♀♀	2.0-(4.02)-7.0	----	4.0-(5.95)-8.0*

		D. parvula adjarica		
		B (N= 177)	**C (N= 43)**	**D (N= 130)**
	Sex	**min.-(mean)-max.**	**min.-(mean)-max.**	**min.-(mean)-max.**
SVL	♂♂	41.0-(51.30)-57.0	46.70-(51.10)-54.44	45.50-(52.85)-62.28
	♀♀	41.0-(50.10)-57.0	39.76-(47.94)-51.60	41.52-(50.97)-60.92
HL	♂♂	----	11.80-(13.13)-14.70	11.72-(13.66)-16.43
	♀♀	----	10.06-(11.22)-13.22	10.38-(12.11)-14.46
HW	♂♂	----	7.44-(8.54)-9.60	6.58-(7.93)-10.05
	♀♀	----	6.34-(7.17)-8.18	5.60-(7.06)-8.88
TL	♂♂	63.0-(96.30)-120.0	----	94.0-(107.76)-121.0
	♀♀	61.0-(96.3)-120.0	----	82.0-(99.08)-119.0
DS	♂♂+♀♀	50.0-(56.80)-66.0	45.0-(53.97)-60.0	47.0-(54.41)-62.0
SCG	♂♂+♀♀	6.0-(11.50)-18.0	----	4.0-(11.21)-16.0*
TS1	♂♂+♀♀	1.0-(2.20)-4.0	1.0-(1.67)-3.0	1.0-(2.73)-5.0*
TS2	♂♂+♀♀	1.0-(1.90)-4.0	----	1.0-(2.07)-5.0*
MG	♂♂+♀♀	21.0-(26.70)-32.0	20.0-(23.28)-27.0	21.0-(25.62)-30.0
LVP	♂♂	22.0-(24.10)-28.0	----	21.0-(23.33)-26.0
	♀♀	24.0-(26.4)-29.0	----	23.0-(25.67)-28.0
FP	♂♂+♀♀	15.0-(18.20)-22.0	15.0-(18.25)-21.0	14.0-(18.49)-23.0*
SDL	♂♂+♀♀	24.0-(28.6)-32.0	----	22.0-(27.74)-33.0*
PA2		----	4.0-(6.55)-8.0	4.0-(6.40)-8.0
POT	♂♂+♀♀	----	----	2.0-(3.5)-6.0

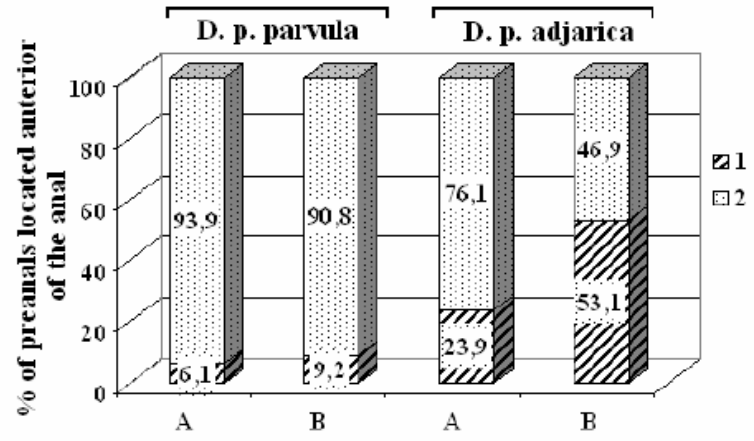

Figure 5. Comparison of the specimens examined in this study with those given by Darevsky and Eiselt (1980) from the viewpoint of percentage of the preanals situated anterior to the anal [A: This study, B: Darevsky & Eiselt (1980)].

from 50 to 70 for *D. parvula*. Regarding SVL, the present male specimens were slightly larger than males measured by Darevsky (1967) and Darevsky & Eiselt (1980) whereas female specimens were similar to those measured by Darevsky (1967) and smaller than those measured by Darevsky & Eiselt (1980).

With regard to DS counts for *D. p. adjarica*, the specimens had lower values than those given by Darevsky & Eiselt (1980) but higher values than those given by Baran et al. (1997). The TS1 and TS2 counts in the present study were slightly higher than in Darevsky & Eiselt, (1980) and Baran et al. (1997). The MG and LVP counts of *D. p. adjarica* were slightly lower than those given by Darevsky & Eiselt (1980) as were SVL and TL of both sexes (Darevsky & Eiselt 1980, Baran et al. 1997).

Darevsky (1967) noted that the fairly distinct differences in metric dimensions in different populations of rock lizard species could be correlated with the elevation of their habitat. He also reported that the variation in the number of transverse rows of pectoral and ventral scales is generally highest in specimens from populations at maximum altitudes. Studying other populations, it should be determined whether the morphological differences found here change vertically, and whether they correspond to other ecological conditions.

In conclusion, the meristic pholidolial characters, metric dimensions and color-pattern features of the specimens obtained from 10 different localities along the eastern Black Sea coast of Turkey were similar to those of *D. p. parvula* and *D. p. adjarica*, except for certain characters mentioned in detail above. An additional important result of the present study is filling the gap related to the distribution of *D. parvula* by collecting new specimens from new localities such as Yusufeli and Kılıçkaya.

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Appendix 1. Locality data and sample sizes

Darevskia parvula parvula **(Lantz-Cyren, 1913) (N = 82)**

1. ZDEU 149/2001. 6 (♂♂), 4(♀♀), 2(juv.), 15 km W of Şavşat, 04.07.2001, Leg. Y. KUMLUTAŞ, K. OLGUN, Ç. ILGAZ, A.AVCI, F. İRET
2. ZDEU 90/2002. 16(♂♂), 12(♀♀), 30 km SW of Yusufeli, 06.07.2002, Leg. İ. BARAN, Y. KUMLUTAŞ, Ç. ILGAZ, A. ÖZDEMIR
3. ZDEU 98/2002. 7(♂♂), 8(♀♀), 4(juv.), between Kılıçkaya and Karadağ, 07.07.2002, Leg. İ. BARAN, Y. KUMLUTAŞ, Ç. ILGAZ, A. ÖZDEMIR
4. ZDEU 101/2002. 13(♂♂), 10(♀♀), Hatila Valley, Artvin, 08.07.2002, Leg. İ. BARAN, Y. KUMLUTAŞ, Ç. ILGAZ, A. ÖZDEMIR

Darevskia parvula adjarica **(Darevsky-Eiselt, 1980) (N = 139)**

1. ZDEU 152/2001. 4(♂♂), 7(♀♀), 2(juv.), 19 km W of Ardahan, 06.07.2001, Leg. Y. KUMLUTAŞ, K. OLGUN, Ç. ILGAZ, A.AVCI, F. İRET
2. ZDEU 157/2001. 7(♂♂), 5(♀♀), 10 km E of Borçka, 07.07.2001, Leg. Y. KUMLUTAŞ, K. OLGUN, Ç. ILGAZ, A.AVCI, F. İRET
3. ZDEU 115/2002. 19(♂♂), 16(♀♀), 10 km W of Çermik, 12.07.2002, Leg. İ. BARAN, Y. KUMLUTAŞ, Ç. ILGAZ, A. ÖZDEMIR
4. ZDEU 125/2002. 5(♂♂), 5(♀♀), 2(juv.), 24 km W of Ortacalar, 13.07.2002, Leg. İ. BARAN, Y. KUMLUTAŞ, Ç. ILGAZ, A. ÖZDEMIR
5. ZDEU 140/2002. 13(♂♂), 15(♀♀), 12 km SE of İkizdere, 06.09.2002, Leg. İ. BARAN, Y. KUMLUTAŞ, Ç. ILGAZ, A. AVCI
6. ZDEU 152/2002. 13(♂♂), 16(♀♀), 1(juv.), 10 km N of Çaykara, 08.09.2002, Leg. İ. BARAN, Y. KUMLUTAŞ, Ç. ILGAZ, A. AVCI.