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MORPHOLOGICAL REEVALUATION ON THE SUBSPECIFIC POSITION OF *Darevskia derjugini* IN TURKEY

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In this study, we present new morphological comparison between *Darevskia derjugini derjugini* and *Darevskia derjugini barani* in Turkish populations. Totally 55 specimens (21 for *D. d. derjugini* and 34 for *D. d. barani*) were used for the comparisons. Independent T-Test results indicated that the morphological characters used in discrimination of the two subspecies were not different in the specimens. The results of canonical discriminant analyses did not exhibit sufficiently distinction between two subspecies because many individuals overlapped between the *D. d. derjugini* and *D. d. barani* populations for both meristic and metric characters. In conclusion, we decided that only nominate subspecies, *Darevskia derjugini derjugini* live in Turkey

Keywords: *Darevskia derjugini derjugini*; *Darevskia derjugini barani*; pholidosis; metric; meristic; canonical discriminant analyses.

INTRODUCTION

Darevskia derjugini (Nikolsky, 1898) is a polytypic species belonged to genus *Darevskia* represented with 31 species and the complex of species has six subspecies distributed from Great Caucasus to eastern Black Sea region (Clark, 1972; Clark and Clark, 1973; Tenie, 1978; Bischoff, 1982, 1984; Mulder, 1995; Baran et al., 1998; Franzen, 1999; Franzen, 2000; Kutrup, 2001; Ryanbinina et al., 2002; Bischoff et al., 2005; Tuniyev et al., 2006). Only two subspecies occur in Turkey where *D. d. derjugini* is distributed in the south of Artvin Province and *D. d. barani* is distributed throughout the coastal Black Sea. *D. d. barani* was separated from the nominotypical subspecies with higher dorsal scales, temporal shields, supraciliary granules, femoral pores and longer head length by Bischoff (1982). In addition, Bischoff (1982) reported that the habitats of two subspecies were ecologically different each other. In last decades, Georgian populations of *D. d. derjugini* and *D. d. barani* have been examined based on molecular data (Ryanbinina et al., 2002; Kosushkin and Grechko, 2013). The Georgian populations of *D. d. derjugini* and *D. d. barani* were not genetically different according to results of Ryanbinina et al. (2002) and Kosushkin and Grechko (2013). However, they did not present any morphological data and there were no Turkish populations of the two subspecies. The validity of morphological discrimination of *D. d. derjugini* and *D. d. barani* performed by Bischoff (1982) on 34 specimens of *D. d. barani* and only 4 specimens of *D. d. derjugini* for Turkish populations needs to be reevaluated.

In the present study, we aimed to assess validity of subspecific status of D. *derjugini* in Turkey, 1) using more individuals belonged to the populations of two subspecies, 2) reexamining some morphological characters (meristic and metric) and some color-pattern features of the species.

MATERIAL AND METHODS

During the field studies, a total of 55 specimens [21 specimens (11 ♂♂, 8 ♀♀, 2 subadults) for *D. d. derjugini* and 34 specimens (10 ♂♂, 22 ♀♀, 2 subadults) for *D. d. barani*] were caught from 9 different populations in Turkey between 2014 and 2015 (Fig. 1). The materials were deposited in the Zoology Laboratory (Collection name: KZL) of the Department of Biology at the Faculty of Science, Karadeniz Technical University (Table 1). The meristic and metric characters of the specimens were recorded following the systems of Baran (1977), Bischoff (1982) and Bischoff et al. (2005). The morphometric features of the specimens were measured

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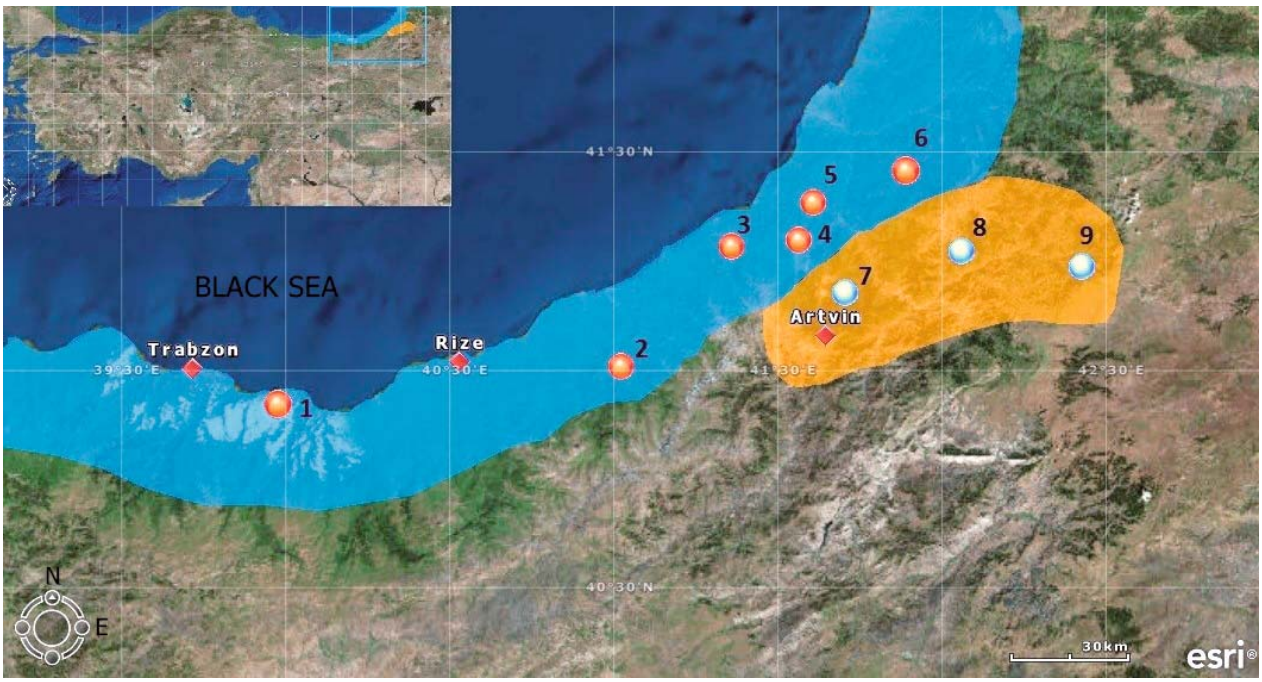

Fig. 1. The map showing sampling areas of the *Darevskia derjugini* (blue color area indicates *D. d. barani* and orange color area indicates *D. d. derjugini*): **1**, Dilek Village; **2**, Ülküköy Village; **3**, Kamilet Valley; **4**, between Kavgadüzü and Yukarı Balaban; **5**, Çifteköprü Village; **6**, between Borçka and Camili; **7**, Hatila Valley; **8**, Pırnallı Village; **9**, Şavşat.

using a digital caliper to an accuracy of 0.1 mm. The following pholidolial characteristics were evaluated: supraciliar granules (right-left, SCGa-SCGb), loreal plates back of postnasal plates and front of preocular plates (right-left, LOa-LOb), supraciliar plates (right-left, SCPa-SCPb), supralabial plates (right-left, SRLa-SRLb, number of labials both anterior and posterior to center of eye), sublabial plates (right-left, SLPa-SLPb), inframaxillar plates (right-left, IMa-IMb), transversal series of gular scales between inframaxillar symphysis and collar (MG), collar (C), supratemporals (right-left, STa-STb), temporal plates (T); transversal ventral plates (TVP), femoral pores (right-left, FPa-FPb), subdigital lamellae in the 4th toe (SDL), transversal series of dorsal scales at the midbody (DS), the dorsal scales in contact with 10 ventral plate (VDS) and number of preanal scales surrounding anals (PA1) and all plates surrounding anal plate (PA2). The morphometric measurements in this study following: 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

TABLE 1. The Localities of Collected Individuals Belonging to *D. derjugini*

Locality	Subspecies	Collection No.	The number of individuals	Altitude, m a.s.l.	Coordinates
Arsin-Dilek Village	*D. d. barani*	KZL-4	7	210	40°55′11.3″ N 39°57′56.1″ E
Arhavi-Kamilet Valley	*D. d. barani*	KZL-52	4	450	41°15′6″ N 41°21′18.2″ E
Between Borçka and Camili	*D. d. barani*	KZL-86	2	1068	41°27′14.2″ N 41°52′49.6″ E
Borçka-Çifteköprü Village	*D. d. barani*	KZL-39	9	296	41°22′37.6″ N 41°35′51.8″ E
Murgul – Kavgadüzü – Yukarı Balaban	*D. d. barani*	KZL-82	8	781	41°18′26.4″ N 41°31′9.8″ E
Çamlıhemşin – Ülküköy Village	*D. d. barani*	KZL-111	4	502	40°59′11.1″ N 40°57′53.9″ E
Artvin – Pırnallı Village	*D. d. derjugini*	KZL-11	6	1484	41°16′18.5″ N 42°02′55.6″ E
Artvin – Hatila Valley	*D. d. derjugini*	KZL-45	3	968	41°10′41.5″ N 41°42′10.6″ E
Artvin – Şavşat	*D. d. derjugini*	KZL-159	12	1592	41°14′14″ N 42°25′19.4″ E

parietals; head width (HW), at widest point of head; head length (HL), tip of snout to posterior margin of ear opening; total body length (TBL), tip of snout to tip of tail. Furthermore, some morphometric indexes and ratios were calculated: head index (HI = head width/head length); pileus index (PI = pileus width/pileus length); anal index (AI = anal plate width/anal plate length); head length/SVL × 100; hindlimb length/SVL × 100. Morphometric measurements for the subadult specimens were not included to calculations.

Normality of the distribution of all meristic and metric characters for both subspecies was tested by One-Sample Kolmogorov – Smirnov test ($P \geq 0.05$). Because the parameters were normally distributed, independent sample *t*-test was used to compare the subspecies. The morphometric data were standardized by log-transformations in order to reduce the effect of variation in individual size (Castellano and Giacoma, 2000). In order to estimate the morphological differentiation among the populations and ascertain structural relationships among specimens without a priori subdivision of the specimens into discrete groups, we analyzed the morphological characteristics by using Principle Component Analysis (PCA) based on the correlation matrix (Castellano and Giacoma, 1998; Tarknishvili et al., 1999; Bülbül and Kutrup, 2013) after testing for sampling adequacy by KMO and Bartlett's test. Factor loadings were also estimated in order to detect the impact power of each meristic and metric character. Canonical Discriminate Analysis (CDA) was used to classify individuals into the predetermined groups. All statistical analyses were performed by IBM SPSS ver. 21.0 for Windows.

RESULTS

Morphological Features of *Darevskia derjugini derjugini* (Nikolsky, 1898)

There was a contact between rostral and internasal plates in 19 (90.5%) specimens. The occipital plate was in contact with the interparietal plate in all specimens. The postorbital plates were in contact with parietal plates in each side of the head in 9 (42.9%) specimens while they were not in contact in 10 (47.6%) specimens. Only in 2 (9.5%) specimens, the postorbital plates were in contact with parietal plates in one side of the head. The first supratemporal plates were bigger from the others in each side of the head. All individuals had four supraocular plates on the each side of the head. The supranasal plate was separated from anterior loreal plates above nostrils in all specimens. The postnasal plate was single on each side in all specimens. The loreal, inframaxillar, supralabial and sublabial plates in front of the subocular plates were always 2 – 2 (100%), 5 – 5 (100%), 6 – 6 (100%) and 4 – 4 (100%), respectively. All specimens had a big masseteric plate in each side of the head. The row of supraciliar granules for all individuals was complete in 16 (76.2%) specimens. The dorsal body scales in the midbody were small and smooth. Subdigital lamellae in 4th toe were smooth. Anal plate was single in all specimens. The mean SVL of the *D. d. derjugini* specimens was 52.8 ± 1.1 mm. The maximum total length of the *D. d. derjugini* was measured as 142.7 mm for females and 129.4 mm for males. The descriptive statistics of the meristic and metric ratio characteristics of all specimens of *D. d. derjugini* are given in Table 2.

Morphological Features of *Darevskia derjugini barani* (Bischoff, 1982)

Rostral and internasal plates were in contact in 31 (91.2%) specimens while they were clearly separated in 3 (8.8%) specimens. The occipital plate was in contact with the interparietal plate in 31 (91.2%) specimens while there was no contact in 3 (8.8%) specimens. The postorbital plates were in contact with parietal plates in each side of the head in 13 (38.2%) specimens while they were not in contact in 21 (61.8%) specimens. The first supratemporal plates were bigger from the others in each side of the head. All individuals had 4 supraocular plates on the each side of the head. The supranasal plate was separated from anterior loreal plates above nostrils in all specimens. The postnasal plate was single on each side in all specimens. The loreal, inframaxillar, supralabial and sublabial plates in front of the subocular plates were 2 – 2 (97.1%), 5 – 5 (100%), 6 – 6 (97.1%) and 4 – 4 (97.1%), respectively. All specimens had a big masseteric plate in each side of the head. The row of supraciliar granules for all individuals was complete in 29 (85.3%) specimens. The dorsal body scales in the midbody were small and smooth. Subdigital lamellae in 4th toe were smooth. Anal plate was single in all specimens. The mean SVL of the *D. d. barani* specimens was 49.8 ± 0.6 mm. The maximum total length of the *D. d. barani* was measured as 133.5 mm for females and 119 mm for males. The descriptive statistics of the metric and meristic characteristics of all specimens of *D. d. barani* are given in Table 3.

Statistical Comparison of the Subspecies

Independent sample *t*-test was used to compare all meristic and metric characteristics of both subspecies. SCPb ($t = 2.087$; $df = 31.705$; $P < 0.05$) and VDS ($t = –3.120$; $df = 29.903$; $P = 0.004$) for the meristic characters and HW ($t = –2.851$; $df = 51$: $P = 0.006$), PW ($t = –2.069$ $df = 52$; $P = 0.043$) and HI ($t = –2.649$;

df = 49; *P* = 0.11) for the metric characters were found significantly different between the subspecies.

In the PCA, 4 factors for meristic and 3 factors for metric characters were found. The components explained all variability for both meristic (76.53%) and metric (82.97%) characters. The first component included DS; the second component included T; the third component included SCGa and SCGb; the fourth component included VDS for meristic characters. For the metric characters, the first component included HL and PL; the second component included HI and PI; the third component included SVL and HL/SVL × 100 (Table 4). Other morphological characters were not included to PCA because they were not found strong in the analysis.

The meristic and metric characters, found in PCA, were used in the CDA. Three significant functions for meristic and two significant functions for metric characters were obtained in the CDA. According to CDA results, five meristic and two metric characters were used in discrimination of two subspecies (Table 5). Other morphological characters were not included to CDA because they were not found strong in the analysis. The resulting canonical discriminant analysis (CDA) did not show significant differences between both meristic and metric characters for both subspecies. In order to graphically display the true variations existing among a priori groups, the individual specimen scores were plotted for the resultant canonical varieties. According to our CDA data, no distinction was found between the subspecies for both meristic and metric characters, although many individuals showed overlapping between the *D. d. derjugini* and *D. d. barani* populations (Fig. 2).

TABLE 2. Descriptive Statistics of the Meristic and Metric Characters (in mm) of the Specimens Belonging to *D. d. barani*

Character	Males				Females				All specimens			
	N	range	mean	S.E.	*N*	range	mean	S.E.	*N*	range	mean	S.E.
SCGa	10	6 – 13	9.6	0.8	22	5 – 13	9.8	0.5	34	5 – 13	9.7	0.4
SCGb	10	5 – 12	8.8	0.8	22	6 – 13	9.8	0.4	34	5 – 13	9.5	0.4
SCPa	10	5 – 7	5.8	0.2	22	5 – 7	5.8	0.1	34	5 – 7	5.8	0.1
SCPb	10	5 – 7	6.1	0.2	22	5 – 7	5.8	0.1	34	5 – 7	5.9	0.1
SLPa	10	4 – 4	4.0	—	22	4 – 5	4.1	0.1	34	4 – 5	4.0	0.0
SLPb	10	4 – 5	4.1	0.1	22	4 – 4	4.0	—	34	4 – 5	4.0	0.0
SBLPa	10	6 – 7	6.1	0.1	22	6 – 6	6.0	—	34	6 – 7	6.0	0.0
SBLPb	10	6 – 7	6.1	0.1	22	6 – 6	6.0	—	34	6 – 7	6.0	0.0
MG	10	16 – 22	19.1	0.5	22	15 – 22	19.0	0.4	34	15 – 22	18.9	0.3
C	10	5 – 9	7.0	0.4	22	4 – 9	6.8	0.3	34	4 – 9	6.9	0.2
STa	10	2 – 4	3.0	0.2	22	2 – 4	3.2	0.1	34	2 – 4	3.1	0.1
STb	10	2 – 4	3.2	0.2	22	2 – 4	3.4	0.1	34	2 – 4	3.3	0.1
TVP	10	22 – 26	24.5	0.4	22	23 – 29	25.8	0.3	34	22 – 29	25.4	0.2
VDS	10	24 – 30	26.6	0.7	22	22 – 32	25.9	0.6	34	22 – 32	26.0	0.4
PA1	10	2 – 4	3.1	0.3	22	2 – 5	3.4	0.2	34	2 – 5	3.2	0.2
PA2	10	7 – 11	9.4	0.4	22	7 – 11	9.4	0.3	34	7 – 11	9.4	0.2
FMPa	10	11 – 13	11.8	0.3	22	10 – 14	11.6	0.3	34	10 – 14	11.6	0.2
FMPb	10	9 – 13	11.4	0.3	22	9 – 13	11.4	0.2	34	9 – 13	11.4	0.2
SDL	10	21 – 25	23.0	0.5	22	20 – 26	22.6	0.4	34	20 – 26	22.7	0.3
DOR	10	41 – 46	44.0	0.5	22	37 – 48	44.3	0.6	34	37 – 48	44.2	0.4
T	9	16 – 32	23.9	1.5	22	14 – 36	25.0	1.1	33	14 – 36	24.6	0.9
HW	10	5.6 – 7.8	7.0	0.2	21	6.0 – 7.9	7.3	0.1	31	5.6 – 7.9	7.2	0.1
HL	10	11.1 – 12.5	11.8	0.2	22	10.8 – 12.6	11.8	0.1	32	10.8 – 12.6	11.8	0.1
PW	10	4.9 – 6.1	5.6	0.1	22	4.2 – 6.2	5.6	0.1	32	4.2 – 6.2	5.6	0.1
PL	10	10.2 – 12.1	11.0	0.2	22	10.1 – 11.9	10.9	0.1	32	10.1 – 12.1	10.9	0.1
SVL	10	44.2 – 49.5	46.7	0.5	22	45.6 – 56.5	51.3	0.6	32	44.2 – 56.5	49.8	0.6
PI	10	48.0 – 56.0	51.3	0.7	22	48.6 – 57.7	52.5	0.5	31	48.0 – 57.7	52.2	0.4
HI	10	48.6 – 67.5	59.6	1.8	21	53.9 – 66.8	62.1	0.6	32	48.6 – 67.5	61.3	0.7
AI	10	1.4 – 2.1	1.8	0.1	22	1.5 – 2.2	1.8	0.0	32	1.4 – 2.2	1.8	0.0
HL/SVL × 100	10	23.0 – 28.0	25.2	0.5	22	21.5 – 28.8	23.1	0.3	32	21.5 – 28.8	23.8	0.3
HLimb/SVL × 100	10	47.5 – 55.9	52.0	1.0	22	42.2 – 53.0	47.0	0.6	32	42.2 – 55.9	48.6	0.7

Note. Here and thereafter: *N*, the number of individuals; S.E., standard error.

Color-Pattern Features of Two Subspecies

There were no differences between two subspecies with regard to color-pattern features. The top of the head was reddish, and it had rarely small spots. The middle of dorsum coloration was grayish or dark brown. It had small scattered black spots. The dark colored lateral bands covered sides of head and body. The dorsum sides of the lateral bands were darker than the ventral sides. The lateral band was dark brown and black in males while it was light brown in females. There were black lines in each lateral sides of the tail for both sexes and the white lines were present under the black line for both sides of the tail. The ventral region of the some female specimens had more dark spots, but these spots were very rarely for males. The outmost row of the ventral plates had blue spots in only males. All of the color-patterns seen in the populations of two subspecies were very similar to each other.

DISCUSSION

Morphological characteristics (metric and meristic) of animals were commonly used in descriptions of species and subspecies (Ilgaz, 2007, 2009). Comparing these characters between populations was used formerly *t*-test by many scientists (Bischoff, 1982, 1984; Tuniyev and Tuniyev, 2008), but recently most complex statistic methods (e.g., CDA and PCA) have also been used in taxonomy (Tuniyev et al., 2011, 2012, 2013; Arribas et al., 2013; Bülbül and Kutrup, 2013).

In the present study, meristic and metric characters of the specimens from six previously unstudied localities (Dilekin Trabzon Province, Kamilet, between Borçka

TABLE 3. Descriptive Statistics of the Meristic and Metric Characters of the Specimens Belonging to *D. d. derjugini*

Character	Males ($N = 11$)			Females ($N = 8$)			All specimens			
	range	mean	S.E.	range	mean	S.E.	*N*	range	mean	S.E.
SCGa	5 – 11	8.7	0.6	6 – 12	9.3	0.7	21	5 – 12	9.1	0.4
SCGb	4 – 11	8.5	0.7	5 – 12	8.6	0.8	21	4 – 12	8.6	0.5
SCPa	5 – 6	5.6	0.2	6 – 6	6.0	—	21	5 – 6	5.8	0.1
SCPb	4 – 6	5.6	0.2	5 – 6	5.6	0.3	21	4 – 6	5.5	0.2
SLPa	4 – 4	4.0	—	4 – 4	4.0	—	21	4 – 4	4.0	—
SLPb	4 – 4	4.0	—	4 – 4	4.0	—	21	4 – 4	4.0	—
SBLPa	6 – 6	6.0	—	6 – 6	6.0	—	21	6 – 6	6.0	—
SBLPb	6 – 7	6.1	0.1	6 – 6	6.0	—	21	6 – 7	6.1	0.1
MG	15 – 23	18.1	0.6	19 – 21	19.3	0.5	21	15 – 23	18.5	0.4
C	6 – 8	7.2	0.2	6 – 8	7.1	0.2	21	6 – 8	7.1	0.2
STa	3 – 4	3.3	0.1	3 – 4	3.3	0.2	21	3 – 4	3.2	0.1
STb	3 – 4	3.3	0.1	3 – 4	3.3	0.2	21	3 – 4	3.2	0.1
TVP	22 – 28	24.1	0.6	24 – 27	25.9	0.4	21	22 – 28	24.9	0.4
VDS	21 – 36	29.2	1.4	25 – 35	29.6	1.1	21	21 – 36	29.0	0.9
PA1	2 – 4	2.9	0.3	2 – 5	3.3	0.3	21	2 – 5	3.1	0.2
PA2	8 – 10	9.3	0.2	7 – 10	9.0	0.3	21	7 – 11	9.3	0.2
FMPa	10 – 13	11.0	0.3	8 – 12	11.0	0.5	21	8 – 13	11.1	0.2
FMPb	10 – 13	11.0	0.3	9 – 13	11.0	0.4	21	9 – 13	11.0	0.2
SDL	20 – 26	23.1	0.6	22 – 26	23.9	0.5	21	20 – 26	22.4	0.4
DOR	40 – 47	43.0	0.7	37 – 48	44.1	1.4	21	37 – 48	43.1	0.7
T	13 – 30	22.5	1.6	23 – 29	26.4	0.8	21	13 – 30	23.8	1.0
HW	7.1 – 8.6	7.9	0.2	7.0 – 8.1	7.4	0.1	19	7.0 – 8.6	7.7	0.1
HL	10.9 – 13.5	12.1	0.3	10.9 – 13.5	11.8	0.3	19	10.9 – 13.5	12.0	0.2
PW	5.4 – 6.6	6.0	0.1	5.1 – 6.4	5.7	0.1	19	5.1 – 6.6	5.9	0.1
PL	10.2 – 12.0	11.1	0.2	10.0 – 12.4	11.0	0.3	19	10.0 – 12.4	11.1	0.2
SVL	42.3 – 52.5	47.8	0.9	48.9 – 58.3	52.8	1.1	19	42.3 – 58.3	49.9	0.9
PI	52.2 – 57.1	54.1	0.5	49.9 – 54.5	52.3	0.5	19	49.9 – 57.1	53.3	0.4
HI	62.1 – 69.2	65.1	0.6	60.3 – 67.0	62.7	1.0	19	60.3 – 69.2	64.1	0.6
AI	1.5 – 2.1	1.7	0.1	1.4 – 1.9	1.6	0.1	19	1.4 – 2.1	1.7	0.0
HL/SVL × 100	22.3 – 27.0	25.4	0.5	20.7 – 24.4	22.4	0.4	19	20.7 – 27.0	24.1	0.5
HLimb/SVL × 100	45.4 – 53.6	50.9	0.8	43.0 – 50.9	46.9	0.8	19	43.0 – 53.6	49.2	0.7

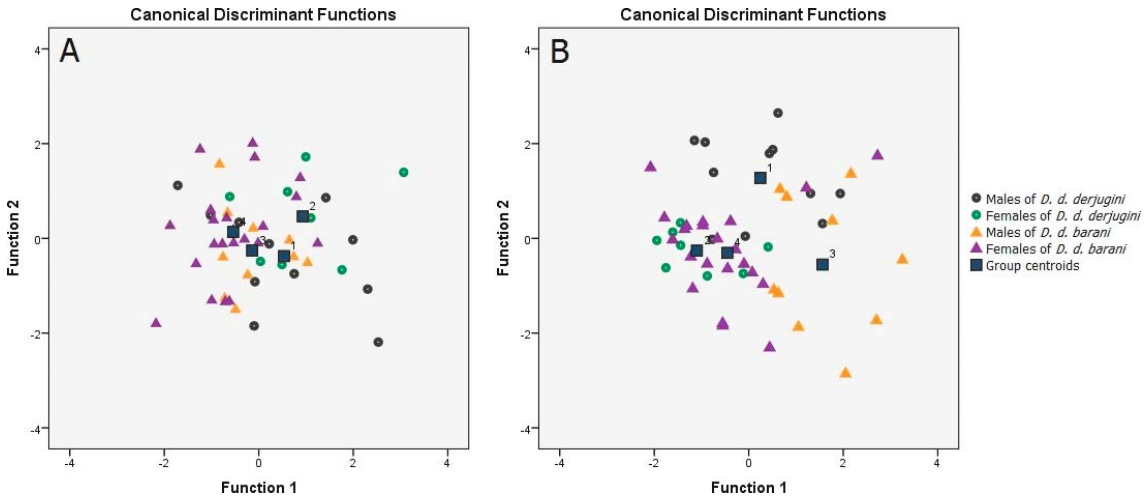

Fig. 2. Two-dimensional scatterplot of *Darevskia derjugini* in space of CDA function by the standardized meristic (A) and metric (B) characters.

and Camili, Çifteköprü for *D. d. barani* and Hatila and Pırnallı in Artvin Province for *D. d. derjugini*) belonging to D. *derjugini* in the eastern Black Sea region were compared with the literature (Bischoff, 1982) and taxonomic position of two subspecies in Turkey was reevaluated.

Four morphological characters (SCG, T, SDL and TVP) and two metric ratios (HLimb/SVL × 100 and HL/SVL × 100) belonging to D. b. *barani* were different from the data in the study of Bischoff (1982). When compared the results for *D. d. derjugini*, five morphological characters (SCG, MG, T, DS and SDL) and two metric ratios (HLimb/SVL × 100 and HL/SVL × 100) were different between two studies (Table 6).

In his study including Caucasian region (Georgia, Russia, and Turkey), Bischoff (1982) reported that SCG, T, DS and FMP characters used in discrimination of the subspecies were 7.4, 25.8, 42.2, and 10.6, respectively in four specimens of *D. d. derjugini* collected from Turkey. However, these characters were found as 9.1, 23.8, 43.1, and 11.1, respectively for 21 specimens of *D. d. derjugini* in the present study. Although Bischoff (1982) reported that SCG, T, DS and FMP were 8.9, 30.6, 43.9, and 12.1, respectively for the 34 *D. d. barani* specimens from Turkish populations, we found these characters in 34 specimens of the same subspecies as 9.7, 24.6, 44.2, and 11.6, respectively (Table 6).

TABLE 4. Factor Loadings on the First Principal Components Extracted from the Correlation Matrix of the Meristic and Metric Characters for Individuals of *D. derjugini*

Meristic character	Components			
	1	2	3	4
DS	1.0			
T		0.9		
SCGa			1.0	
SCGb			0.9	
VDS				0.9
Metric character	**Components**			
	1	2	3	
PL	1.0			
HL	0.9			
HI		0.9		
PI		0.8		
HL/SVL × 100			0.9	
SVL			0.9	

TABLE 5. Standardized canonical coefficients for meristic and metric characters of *D. derjugini*.

Meristic character	1	2	3
SCGa	0.2	–0.6	–1.6
SCGb	–0.6	0.5	1.6
VDS	0.9	0.2	0.2
T	0.4	0.9	–0.1
DS	–0.1	0.4	–0.1
Eigenvalues	0.4	0.1	0.1
% of variance	71.0	18.3	10.7
Wilks' lambda	0.305	0.558	0.849
Significance	0	0.13	0.212
Metric character	**1**	**2**	
SVL	1.0	–0.2	
HI	0.4	0.9	
Eigenvalues	0.8	0.3	
% of variance	74.1	25.9	
Wilks' lambda	0.446	0.788	
Significance	0	0.004	

TABLE 6. Comparison of Some Morphological Characters of Our Specimens with those Given by Bischoff (1982)

Character	Bischoff (1982)				This study			
	D. d. barani		*D. d. derjugini*		*D. d. barani*		*D. d. derjugini*	
	N	mean (max – min)	*N*	mean (max – min)	*N*	mean (max – min)	*N*	mean (max – min)
SCG	34	8.9 (3 – 13)	4	7.4 (6 – 9)	34	9.7 (5 – 13)	21	9.1 (5 – 12)
MG	34	18.7 (16 – 22)	4	16.5 (16 – 18)	34	18.9 (15 – 22)	21	18.5 (15 – 23)
T	34	30.6 (20 – 51)	4	25.8 (20 – 32)	34	24.6 (14 – 36)	21	23.8 (13 – 30)
DS	34	43.9 (41 – 49)	4	42.2 (41 – 44)	34	44.2 (37 – 48)	21	43.1 (37 – 48)
FMP	33	12.1 (9 – 14)	4	10.6 (10 – 12)	34	11.6 (10 – 14)	21	11.1 (8 – 13)
SDL	33	25.0 (22 – 29)	4	24.7 (23 – 27)	34	22.7 (20 – 26)	21	22.4 (20 – 26)
TVP	12 ♂♂	22.2 (20 – 23)	1	22.0 (—)	10	24.5 (22 – 26)	11	24.1 (22 – 28)
	14 ♀♀	24.6 (21 – 26)	1	26.0 (—)	22	25.8 (23 – 29)	8	25.9 (24 – 27)
HL/SVL × 100	26	22.7 (19.9 – 25.0)	3	22.9 (21.4 – 25.6)	32	23.8 (21.5 – 28.8)	19	24.1 (20.7 – 27.0)
HLimb/SVL × 100	26	49.9 (40.8 – 57.9)	3	50.5 (48.3 – 53.4)	32	48.6 (42.2 – 55.9)	19	49.2 (43.0 – 53.6)
AI	26	1.7 (1.6 – 1.9)	3	1.8 (1.6 – 1.9)	32	1.8 (1.4 – 2.2)	19	1.7 (1.4 – 2.1)

Based on the pholidolial comparisons, Bischoff (1982) reported that the means of the numbers of dorsal scales, temporal shields, supraciliar granules and femoral pores were higher in *D. d. barani* than *D. d. derjugini*. In contrary, our results did not exhibit any significant distinction with these pholidolial characters. Furthermore, Bischoff (1982) found that *D. d. barani* had longer head length while there was no significant difference in the present study. The differences based on pholidolial and morphometric characters reported by Bischoff (1982) may be resulted of a few specimens (only four specimens) of *D. d. derjugini* from Turkey. Therefore, these differences in the study of Bischoff (1982) may be considered an intraspecific variation for D. *derjugini* instead of subspecies distinction.

On the other hand, the independent sample *t*-test results of our study showed that SCPb and VDS from meristic character and HW, PW and HI from metric character were significantly different between two subspecies. However, these characters were not strong for discrimination of both subspecies because they did not exhibit any distinction in the canonical discriminant analyses.

In conclusion, we examined morphologic variations in Turkish populations of two subspecies belonging to *D. derjugini* and we found that the five morphological characters used in discrimination of both subspecies by Bischoff (1982) were not different in our specimens. Recently, the validity of some subspecies whose descriptions were performed according to a few morphological characteristics has been examined by molecular studies and these subspecies have been reported as invalid (Podnaret al., 2003; Poulakakis et al., 2003; Podanar et al., 2005; Bellati et al., 2011; Marzahn et al., 2016). Because the SCPb, VDS, HW, PW, and HI characters in our study were not strongly differentiated in CDA, we decided that only nominate subspecies, *Darevskia derjugini derjugini* live in Turkey. Our decision is consistent with the molecular data of Ryanbinina et al. (2002) and Kosushkin and Grechko (2013) based on the genetic similarity of Georgian populations of both subspecies. The morphological and ecological investigations of Bischoff (1982) were insufficient to determine subspecies of the species. Based on comprehensive molecular and morphological comparisons on Turkish and Georgian populations of *D. derjugini*, the validity of the *D. d. barani* subspecies may be elucidated in detail.

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