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MORPHOLOGICAL CHARACTERISTICS OF AN INSULAR POPULATION OF THE DALMATIAN ALGYROIDES (*Algyroides nigropunctatus* DUMERIL & BIBRON, 1839) (LACERTIDAE) FROM THE SKADAR LAKE (MONTENEGRO)

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Key words:
lacertid lizard, morphometric traits, meristic traits, qualitative traits, Skadar Lake.

SYNOPSIS

Here we present data on the external morphology of an insular population of the lacertid lizard Dalmatian Algyroides (*Algyroides nigropunctatus*) from the island of Bisage in Lake Skadar in Montenegro. Morphological characteristics were examined on the basis of descriptive statistics for 14 morphometric, 16 meristic and percentages of states for 10 qualitative traits. We tested the diagnostic characters used to describe two subspecies of this species and confirmed that the studied population from the island of Bisage belong to nominal subspecies *A. nigropunctatus nigropunctatus*.

Ključne riječi:
lacertidni gušter, morfometrijski karakteri, meristički karakteri, kvalitativni karakteri, Skadarsko jezero.

SINOPSIS

MORFOLOŠKE KARAKTERISTIKE OSTRVSKE POPULACIJE LJUSKAVOG GUŠTERA (*Algyroides nigropunctatus*, Dumeril & Bibron, 1839) (LACERTIDAE) SA SKADARSKOG JEZERA (CRNA GORA)

U ovom radu analizirane su spoljašnje morfološke odlike populacije ljuskavog guštera (*Algyroides nigropunctatus*) sa ostrva Bisage na Skadarskom jezeru. Predstavljeni su rezultati deskriptivne statistike za 14 morfometrijskih, 16 merističkih i procentualna zastupljenost stanja 10 kvalitativnih karaktera. Na taj način su provjereni dijagnostički karakteri koji su korišćeni za opisivanje dvije podvrste ove vrste, i potvrđeno da populacija sa Bisaga pripada nominalnoj podvrsti *A. nigropunctatus nigropunctatus*.

INTRODUCTION

The Dalmatian Algyroides is a Balkan subendemic lacertid lizard. It usually occupies degraded scrub and rocky cliff areas, in places associated with the Mediterranean climate along the coastal region of the Adriatic and Ionian seas (BEJAKOVIĆ et al., 1996; CHONDROPOULOS, 1997).

Its occurrence in Montenegro is restricted to the Mediterranean part (DŽUKIĆ, 1970; DŽUKIĆ & PASULJEVIĆ, 1979; CRNOBRNJA-ISAILOVIĆ & DŽUKIĆ, 1995, 1997; BEJAKOVIĆ et al., 1996; AJTIĆ et al., 2005), occasionally spreading inland through the canyons along with the influences of Mediterranean climate (AJTIĆ et al., 2005).

In the Skadar Lake region, which is characterized by very diverse herpetofauna (CRNOBRNJA-ISAILOVIĆ & DŽUKIĆ, 1995, 1997), the Dalmatian Algyroides occupies its banks and some of the islands along the foothils of the Rumija Mountain (BEJAKOVIĆ et al., 1996). The population studied here inhabits the island of Bisage, one of about forty islands of different size of Skadar Lake south archipelago. Vegetation is characterized by dense tree vegetation and grassy fields with boulders of various sizes among large stony patches. *Podarcis melisellensis* inhabits grassy areas of this island too.

The Dalmatian Algyroides is a small, oviparous, diurnal lizard with to some extent flattened morphology. It is a very skilful climber and if disturbed, vanishes very rapidly. Mainland populations hibernate, but on the southern Ionian islands this species seems to remain active throughout the year.

Up to now, the Balkan populations of the Dalmatian Algyroides have been included in some phylogenetic analyses (PODNAR & MAYER, 2006; PAVLIČEV & MAYER, 2009), sexual size and shape dimorphism studies (LJUBISAVLJEVIĆ et al., 2011), and analyses of life-history traits (BEJAKOVIĆ et al., 1996). Although specimens from the Skadar Lake population were included in some of these studies, complete descriptive data on morphological characters have not been published until now.

MATERIAL AND METHODS

The specimens of *A. nigropunctatus* were collected on the island of Bisage in Lake Skadar in Montenegro (42°06'N, 19°21'E) (Fig. 1). Specimens were preserved with 70% ethanol and stored in the Herpetological Collection of the Natural History Museum of Montenegro in Podgorica (see POLOVIĆ, 2011) and Dr Georg Džukić's Herpetological Collection of the Institute for Biological Research in Belgrade. A total of 60 males and 37 females were examined. The maturity of each specimen was determined on the basis of reproductive characterizations previously used in other lacertid species (see, for example, TOMAŠEVIĆ-KOLAROV et al., 2010).

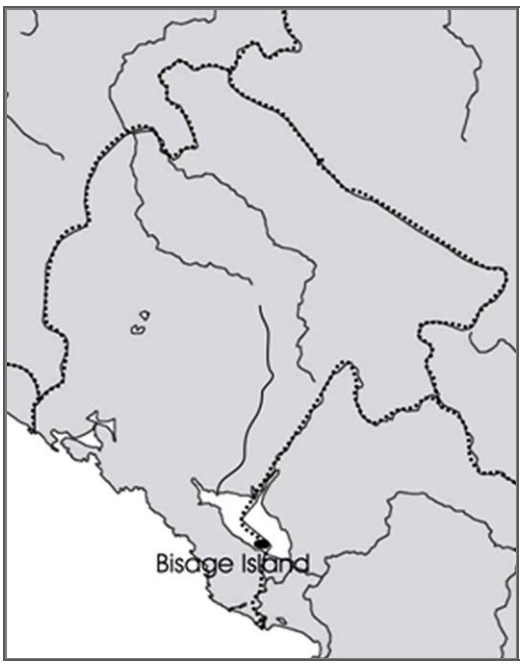

Figure 1: Location of *A. nigropunctatus* population used in this study.

Specimens were examined for the following characters:

MORPHOMETRIC CHARACTERS: 1.Tot – total length (only in specimes with intact tails) , 2. Lcor – snout-vent length, 3. Lcd – tail length (only in specimes with intact tails), 4. Lcap – head length, 5. Ltcap - head width, 6. Altcap - head height, 7. Lfo – mouth length, 8. Ltfo – mouth width, 9. Lpil – pileus length, 10. Ltpil – pileus width, 11. Lpa – forelimb length, 12. Lpp – hindlimb length, 13. Ldg – length of fourth toe on hindlimb, 14. Pap – distance between fore and hind limbs.

MERISTIC CHARACTERS included the numbers of: 1. SOC – supraocular scales, 2. SCL - supraciliary scales, 3. GRA - supraciliary granules, 4. TMP – temporal scales, 5. STMP - supratemporal scales, 6. SLB- supralabial scales anterior to subocular, 7. SAS – supralabials scales anterior to subocular scale, 8. SUB – sublabial scales, 9. GUL – gular scales along the throat midline, 10. COL – large collar scales, 11. VNT – inner ventral scales counted longitudinally, 12. DOR – dorsal scales around mid-body, 13. PAN – praeanal scales surrounding anteriorly the anal plate, 14. FPO – femoral pores, 15. FEM – femural scales, 16. SDG – lamellar scales under the fourth toe.

QUALITATIVE CHARACTERS: (I) row of supraciliary granules: a—complete, b—incomplete to one side of the body, c—incomplete; (II) number of postnasal scales: a—one, b—two, c—one on the one side and two on the other side; (III) number of frenal scales: a—one, b—two, c—one on the one side and two on the other side; (IV) number of frenoocular scales: a—one, b—two, c—one on the one side and two on the other side; (V) number of preocular scales: a—one, b—two, c—one on the one side and two on the other side; (VI) number of postocular scales: a—three, b—four, c—three on the one side and four on the other side; (VII) number of submaxilar

scales: a—five, b—six, c—five on the one side and six on the other side; (VIII) contact between the interparietal and occipital scales: a—lack of contact, b—contact present; (IX) masseteric plate: a—distinct, b— distinct just on the one side, c—indistinct; (X) arrangement of supranasals: a—in broad contact, b—in contact at one point, c— not in contact, d—separated by insertion of additional plate.

Symetrical characters were taken from both sides of the body. Data processing concerned the mean of the right and left values for quantitative traits, while for qualitative traits a combination of both sides was used.

The body and head dimensions were taken with digital callipers to the nearest 0.01 mm. Scale counts were taken under a stereoscopic microscope.

Descriptive statistics (mean, standard error, range) for quantitative traits, and percentages of states for each qualitative trait were calculated. Statistical analyses were carried out using the computer package Statistica (STATISTICA for Windows. StatSoft, Inc., Tulsa, OK, USA).

RESULTS AND DISCUSSION

QUANTITATIVE TRAITS

Descriptive statistics of morphometric and meristic characters of adult males and females are presented in Tables 1 and 2.

Table 1: Descriptive statistics of 14 morphometric characters of adult male and female *A. nigropunctatus* of the Skadar lake population studied. Sample size (N), mean value (in mm), range, standard error (SE). Abbreviations of characters are given in "Material and Methods".

	males					females				
character	N	Mean	Min	Max	SE		N	Mean	Min	Max
Tot	23	186.30	154.00	209.00	3.23	12	164.83	125.00	181.00	4.42
L.cor	60	61.31	50.93	69.98	0.66	37	58.23	49.03	63.90	0.65
L.cd	23	125.50	103.07	142.50	2.28	12	106.61	85.37	117.29	3.04
L.cap	60	16.42	13.59	17.92	0.17	37	14.08	12.10	15.18	0.13
Lt.cap	60	9.83	8.18	11.04	0.12	37	8.33	7.40	9.37	0.08
Alt.cap	60	7.09	5.43	8.75	0.10	37	5.85	4.74	6.70	0.07
L.fo	60	13.64	11.05	15.84	0.16	37	11.57	9.86	12.86	0.12
Lt.fo	60	9.47	7.75	10.73	0.11	37	7.88	5.51	8.96	0.10
L.pil	60	15.50	12.58	17.16	0.17	37	13.29	11.44	14.33	0.11
Lt.pil	60	7.45	5.75	8.24	0.08	37	6.42	5.40	7.00	0.05
L.pa	60	20.73	17.14	23.59	0.20	37	18.41	16.27	19.80	0.14
Lpp	60	35.98	30.29	39.40	0.32	37	31.21	26.93	33.72	0.23
Ldg	60	11.73	9.65	12.87	0.11	37	10.44	8.95	11.54	0.08
Pap	60	27.24	21.82	32.06	0.37	37	28.07	22.36	31.64	0.37

Table 2. Descriptive statistics of 16 meristic characters of adult male and female *A. nigropunctatus* of the Skadar lake population studied. Sample size (N), mean value (in mm), range, standard error (SE). Abbreviations of characters are given in "Material and Methods".

	males					females				
character	N	Mean	Min	Max	SE	N	Mean	Min	Max	SE
SOC	60	4.08	3.50	5.00	0.03	37	4.09	3.50	4.50	0.04
SCL	60	5.91	4.00	6.50	0.06	37	5.82	4.00	7.00	0.10
GRA	60	10.49	8.50	12.00	0.11	37	10.61	9.00	12.00	0.10
TMP	60	19.81	15.00	27.00	0.36	37	19.64	11.50	28.50	0.74
STMP	60	3.33	2.50	4.00	0.05	37	3.30	3.00	4.00	0.07
SLB	60	7.40	6.50	8.50	0.06	37	7.76	6.50	9.00	0.10
S. A. S	60	4.37	4.00	5.00	0.05	37	4.57	4.00	5.50	0.08
SUB	60	7.10	5.50	9.00	0.06	37	7.01	5.50	8.50	0.08
GUL	60	18.88	17.00	21.00	0.13	37	19.14	17.00	22.00	0.19
COL	60	8.67	7.00	10.00	0.09	37	8.14	7.00	10.00	0.14
VNT	60	23.71	22.00	25.00	0.08	37	25.51	24.00	27.00	0.13
DOR	60	22.10	20.50	25.00	0.11	37	21.82	20.50	24.00	0.15
PAN	60	9.42	8.00	10.00	0.09	37	9.30	7.00	11.00	0.15
FPO	60	16.56	15.00	19.00	0.10	37	15.39	13.00	17.00	0.16
FEM	60	3.53	2.50	4.00	0.06	37	3.23	2.00	4.00	0.07
SDG	60	24.89	22.00	27.00	0.15	37	23.99	22.00	26.50	0.17

Maximum total length value was 180 mm and 209 mm, for females and males, respectively. These values were in accordance with literature data (RADOVANOVIĆ, 1951; BISCOFF, 1981; MRŠIĆ, 1987; GLANDT, 2009). Our total length values for complete sample were between 125 - 209 mm, which is broader range than those (14 - 18 cm) reported by RADOVANOVIĆ (1951). Maximum snout-vent length (Lcor) value was 69,98 mm for males, which is in accordance with literature data for males and for this species as whole (up to 70 mm, ARNOLD & BURTON, 1978; BISCHOFF, 1981; ARNOLD & OVENDEN, 2002; VALAKOS et al., 2008; GLANDT, 2009; KWET, 2009), Our measures showed that average snout-vent length (Lcor) value for females were 58,23 ± 0,65 mm, and for males were 61,31 ± 0,66 mm. While male data were in accordance with literature data [61,27 ± 1,06 mm (BEJAKOVIĆ et al.,1996)], females showed greater mean Lcor than previously reported [56,71 ± 1,30 mm (BEJAKOVIĆ et al., 1996)]. According to literature data, specimens from southern part of species range (from Corfu) have greater snout-vent length (between 62 – 69 mm) and tail length (up to 145 mm) value, then specimens from northern part of range (Rovinj, Istra) with snout-vent length between 53 - 57 mm and tail length up to 130 mm (BISCHOFF, 1981). The snout-vent length values of the specimens from the island of Bisage varied in a broader range (49.03 - 69,98 mm) than previously mentioned values for southern and northern populations of the species (BISCHOFF, 1981). Maximum tail length (L.cd) was 142,5 mm, recorded for males, was mainly in

agreement with previously mentioned literature data (up to 145 mm) for specimens from southern part of the species range, but it was also greater than previously mentioned literature value (of about 130 mm) for northern part of the range (BISCHOFF, 1981). No concrete literature data are available regarding the head, limbs and other morphometric characters here analysed.

Concerning meristic characters, variation range of supralabial scales (SLB) were in agreement with literature data [(7 – 9 (RADOVANOVIĆ, 1951)], and number of 4 – 5.5 supralabial scales in front of the subocular (S.A.S) were mainly in agreement with those previously reported for this species [usual number of 5 scales (RADOVANOVIĆ, 1951; BISCHOFF, 1981)]; but sometimes could be 4 or 6 scales (BISCHOFF, 1981). The range of gular (GUL: 17 – 23) and collar (COL: (7 – 10) scales in our sample were in agreement with range previously recorded [GUL: 17 – 23; COL: the most frequent 7 – 9, but also could be 10 scales, (BISCHOFF, 1981, RADOVANOVIĆ, 1951)]. The number of ventral scales (VNT: 22 – 27) varied in a broader range than it was described for this species by RADOVANOVIĆ (1951) (VNT: 22 – 25) and in a slightly narrower range than it was described by BISCHOFF (1981) (VNT: 21 – 27). The number of dorsal scales (DOR) reported for this species by BISCHOFF (1981) (DOR: 11 – 12 big dorsal scales and 5 – 6, sometimes 9, smaller lateral scales) were not in agreement with our number (DOR: 22). Also the number of dorsal scales previous reported by ARNOLD & OVENDEN (2002) (DOR: 20 – 29) varied in broader range then number of scales in our results (DOR: 20.5 – 25). The number of praeanal scales (PAN: 7 – 11), femoral pores (FPO: 13 – 19) varied in a broader range than it was described for this species [PAN: 8 – 10 by BISCHOFF (1981); FPO: 14 – 18 by RADOVANOVIĆ (1951)]. The number of lamellar scales under the fourth toe (SDG: 17 – 23) in our sample were in agreement with range previously recorded (BISCHOFF, 1981).

QUALITATIVE TRAITS

Percentages of states for qualitative traits of adult males and females are presented in Table 3. In general, analysed individuals are characterised by the presence of complete row of supraciliary granules (Ia), two postnasal scales (IIb), one frenal, frenoocular and praeocular scale (IIIa, IVa, Va), three postocular scales (VIa), six submaxilar scales (VIIb), lack of contact between the interparietal and occipital scales (VIIIa), distinct masseteric plate (IXa) and supranasals in broad contact. The predominance of specimens with 2 postnasal scales, and distinct masseteric plate we found in this study, were also considered as characteristics for this species by BISCHOFF, 1981.

	males (N = 60)	females (N = 37)
character	%	%
IA	93.33	100.00
IB	6.67	0.00
IC	0.00	0.00
IIA	26.67	8.11
IIB	58.33	75.68
IIC	15.00	16.22
IIIA	98.33	100.00
IIIB	0.00	0.00
IIIC	1.67	0.00
IVA	98.33	97.30
IVB	0.00	0.00
IVC	1.67	2.70
VA	68.33	59.46
VB	11.67	10.81
VC	20.00	29.73
VIA	81.67	59.46
VIB	1.67	13.51
VIC	16.67	27.03
VIIA	6.67	0.00
VIIB	75.00	81.08
VIIC	18.33	18.92
VIIIA	58.33	64.86
VIIIB	41.67	35.14
IXA	93.33	97.30
IXB	6.67	2.70
IXC	0.00	0.00
XA	100.00	100.00
XB	0.00	0.00
XC	0.00	0.00
XD	0.00	0.00

Table 3. Percentages of states of qualitative traits (in %) in *A. nigropunctatus* of the Skadar lake population. Abbreviations of characters are given in "Material and Methods".

CONCLUSION

Existing literature data about external morphologic characteristics of *Algiroides nigropunctatus* were based on traditional descriptive statistics, of several morphological characteristics on pooled or small samples. Even so, specimens from Montenegro have never been included. Most of the values or percentages of occurrences obtained from our analysis of external morphology of the *Algyroides nigropunctatus* are in accordance (or within the variation range) with previous

studies of the species. We also tested here the diagnostic characters used to describe two subspecies of this species and confirmed that studied population from Bisage Island belong to nominal subspecies *A. nigropunctatus nigropunctatus.*

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