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A New Record of *Acanthodactylus cantoris* (Sauria: Lacertidae) and Its Comparison with Closely Related *A. blanfordi* in South-eastern Iran

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Abstract A new record of *Acanthodactylus cantoris* from Sistan and Baluchistan in southeastern Iran is presented in this paper, and this lizard is found occurring in the coastal area of the Persian Gulf from Govater to Chabahar. This species is mainly sympatric with *A. blanfordi*, and their habits and habitats support their close relationship within the cantoris group. In total, 29 specimens of *A. cantoris* (n = 12) and *A. blanfordi* (n = 17) were compared morphologically using statistical methods. The occurrence of *A. cantoris* in Iran has been questioned for a long time by different herpetologists, and the distribution, ecology and taxonomy of this newly recorded species were investigated and provided in this paper. An updated identification key for the species of *Acanthodactylus* in Iran is given.

Keywords new record, *Acanthodactylus cantoris*, *Acanthodactylus blanfordi*, Sistan, Baluchistan, Iran

1. Introduction

Use of "group" for the genus *Acanthodactylus* was suggested for the first time by Salvador (1982) in his comprehensive review on the genus. Based on Salvador's suggestion, the genus *Acanthodactylus* was divided into nine species groups for easier and more comprehensive investigations of the genus. Though species groups are not mentioned in the International Code of Nomenclature, they have been applied for some polytypic taxa among different animals below the generic level (McCune, 1994; Stensland *et al.*, 2003; Kun, 2004). The "*cantoris*" group used in this paper includes six species: *A. schmidti* Haas, 1957; *A. arabicus* Boulenger, 1918; *A. cantoris* Günther, 1864; *A. blanfordi* Lataste, 1881; *A. haasi* Leviton & Anderson, 1967; and *A. gongrorhynchatus* Leviton & Anderson, 1967. They all are characterized by having four suboculars which are separated from lip, four series of scales found on fingers, of which only three are visible laterally, and a swollen snout. *A. cantoris* has previously been divided into four subspecies. However, these four subspecies are now recognized as full species, that is, *A. cantoris*, *A. blanfordi, A. arabicus* and *A. schmidti* (Arnold, 1983).

Boulenger (1918), in his review of the genus *Acanthodactylus* based on the examination of 700 specimens in the British Museum collections, described two varieties for *A. cantoris* as *A. cantoris* var. *blanfordi* and *A. cantoris* var. *arabicus*. Also, Anderson (1963), in a comprehensive analysis of Iranian herpetofauna, discussed the Persian subspecies of *A. cantoris*.

Acanthodactylus cantoris is distributed in the northwest of India and northeast of Pakistan, northward to eastern Afghanistan (Arnold, 1983). There are strong similarities between *A. cantoris* and *A. blanfordi*, and their most significant differences are pertaining to osteology characters. Since the differences in dorsal and gular scale counts do not always separate them, they can be distinguished by hemipenial features, and the separation

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of postfrontal and postorbital bones in *A. blanfordi* and fusion of these bones in *A. cantoris*. Also, the results of the comprehensive studies done by the authors (Rastegar-Pouyani *et al.*, 2011; Heidari *et al.*, 2012) on sexual dimorphism showed sexual dimorphism in some metric and meristic characters, and the analyses of geographic variation in *A. blanfordi* showed that some morphological characters are significantly varied from east to west of its distribution area.

2. Material and Methods

In this study, different populations of *A. blanfordi* and *A. cantoris* from different localities were statistically compared with six metric and eight meristic characters. Specimens were collected from southeastern Iran during a long-term expedition in 2010–2011, that is, along the coastal areas of the Persian Gulf from Govater to Chabahar including Govater, Pasabandar, Rimdan, Negur, 250 Mil**,** Beris and Chabahar. Sampling sites are presented in Figure 1, and *A. blanfordi* and *A.cantoris* are shown in Figure 2. All the specimens were released into their natural habitats after comparison, examination, measurement and tissue collection.

Also, tissue samples of the specimens were collected for pending molecular investigation of these two sympatric taxa and other similar species. The measured characters include: snout-vent length (SVL): from tip of snout to caudal edge of anal scales; tail length (TL): from caudal edge of anal scales to tip of tail, on complete original tails only; head width (HW): at the widest point

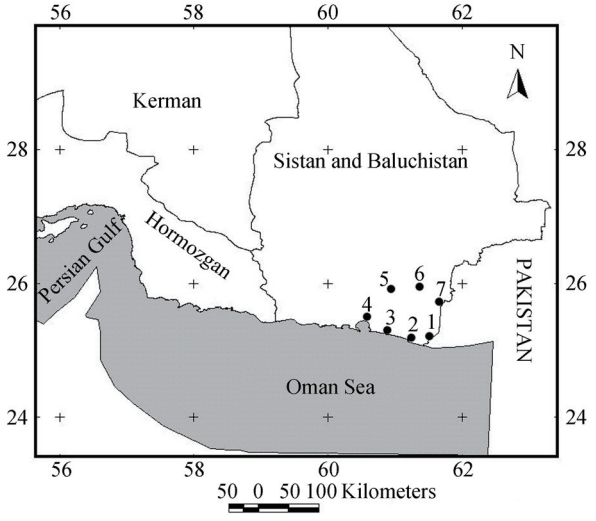

Figure 1 The sampling sites for *A. blanfordi* and *A. cantoris* in Sistan and Baluchistan, southeastern Iran. 1: Govater; 2: Pasabandar; 3: Beris; 4: Chabahar; 5: Negur; 6: Rimdan; 7: 250 Mil.

Figure 2 The two examined species. A: *A. cantoris*; B: *A. blanfordi.*

of head; head length (HL): from tip of snout to posterior edge of tympanum; fore limb length (FLL); hind limb length (HLL); number of ventral scale rows at widest part of body (VR); number of ventral scales in a longitudinal series (VS); subdigital lamellae under the fourth toe ($SL4^{th}T$); number of collar scales (NCS); number of dorsal scales at widest part of body (DS); number of gular scales in mid-line from anterior postmentals to collar scales (GS); number of left femoral pores (LFP); and number of supralabials (SUL).

The characters were compared among and across all specimens. One-way ANOVA was used to compare the populations and determine the distinctiveness of the populations. For all the statistical tests, the significance level was set at 0.01. Statistical analyses were carried out using the Software SPSS (Version 18).

To determine if significant differences exist among the means, the One-way ANOVA was applied for six

metric and eight meristic characters. For each species, the number of individuals, mean and standard deviations, *P* and *F* values, minimum, maximum, and 95% confidence interval for the mean were considered.

3. Results

The results showed significant differences in all morphological characters except VR, femoral pores and SUL (Table 1). The specimens of *A. blanfordi* are characterized by their smaller size, lower DS and GS, and higher NCS (Table 1**).**

Table 1 shows that the most significant difference between the two species is SVL, that is, *A. cantoris* has a longer snout to vent length than *A. blanfordi*. Also, based on Table 1, all metric characters show significant differences at the level of 0.01. In addition to the statistically examined characters, we compared the populations of the two species in some other morphological characters: *A. cantoris* has larger dorsal scales and more keeled (mucronate), with dorsal scales being larger than lateral ones, while *A. blanfordi* has smaller scales, being equal in size dorsally and laterally. The two rows of femoral pores in *A. cantoris* meet midventrally on the body, but those in *A. blanfordi* are separated by a single scale. Anterior edge of ear opening in *A. cantoris* is found with three to four pectinate scales. Supralabials in *A. cantoris* with black spots on each labial form black lines, but in *A. blanfordi* the labials are uniformly whitish. A comparison of some metric and meristic characters in the studied specimens with those mentioned in literature (Salvador, 1982) is summarized in Table 2.

Key to the species of *Acanthodactylus* in Iran

1a. Three rows of scales around fingers……..……..2
1b. Four rows of scales around fingers…….…….....4
2a. Two supraoculars……..…….....……..*A. micropholis*
2b. Four supraoculars ...…….....…….…….....3
3a. Ventrals usually in 10 straight longitudinal rows..…….....…….....*A. boskianus*
3b. Ventrals usually in 8 straight longitudinal rows…….....*A. nilsoni*
4a. Four supralabials anterior to subocular…….....….*A. grandis*
4b. Five supralabials anterior to subocular …….....5
5a. Scales on the posterior dorsum doubling the size of those in the center of the dorsum and those on the sides of the body…….....……*A. schmidti*
5b. Dorsal scales equal in size with laterals…….....6
6a. Dorsal scales large, and ear opening pectinate anteriorly by three or four scales……..……*A. cantoris*
6b. Dorsal scales small and ear opening without pectinate scales…….....…..*A. blanfordi*

4. Discussion

Acanthodactylus blanfordi and *A. cantoris* are closely related and display a remarkable superficial similarity (Salvador, 1982). So far, six species of *Acanthodactylus* have been documented for Iran (Anderson, 1999). Based on the present study, we add the seventh species, *A. cantoris*, to this list. Without a comparative statistical analysis of some important metric and meristic characters, it is difficult to distinguish the two closely related species (*A. blanfordi* and *A. cantoris*). Based on a comprehensive morphological comparison, the two species discussed in this paper are now considered belonging to two completely different taxa at the specific level. Since the range of metric and meristic characters coincides with the data for these species in Salvador (1982), by just comparing the two species it was clear that they are different and belong to two different species. But for stronger and more robust results in order to verify the occurrence of *A. cantoris* in Iran, we tried to carry out a statistical analysis on *A. blanfordi* and *A. cantoris* as the most closely related and sympatric species. These two species were collected at the same locality, as syntopic species and associated with loose sand habitats. The distribution range of *A. cantoris* in Iran seems to be restricted to the southern coastal line of the Oman Sea, extending toward northern mainland regions. This may be due in part to the time of entrance of *A. cantoris* which may have entered southeastern Iran from southwestern Pakistan much later than *A. blanfordi*, but this needs to be verified by molecular studies to make clear the distribution pattern and entrance time of these species to southern and southeastern Iran. It is not easy to discern the relationships within the *A. cantoris* group with certainty mostly due in part to the presence of

Table 1 Comparison of the characters of the two species *A. balanfordi* and *A. cantoris*.

Characters	*A. blanfordi* (n = 17)		*A. cantoris* (n = 12)		*F* value	*P* value
	Mean ± SD	Range	Mean ± SD	Range		
SVL	35.5 ± 3.7	31.1–46.1	52.2 ± 1.9	48.2–55.2	199.5	0
TL	69 ± 9.1	56–88.2	97.4 ± 12.1	71.7–110.5	42.8	0
HL	8.87 ± 0.9	7.6–11.0	12.3 ± 0.6	11.1–13.2	117.4	0
HW	5.1 ± 0.6	4.1–6.0	7.3 ± 0.9	5.1–8.3	71.2	0
FLL	12.6 ± 1.6	10.1–15.4	19.5 ± 2.6	17.0–27.2	74.6	0
VR	30.2 ± 1.4	28–32	30.2 ± 0.9	29–32	0	0.9
VS	12 ± 0.7	11–13	13.9 ± 0.5	13–15	55.2	0
SL4T	20.6 ± 1.5	18–23	23 ± 1.5	20–25	17.9	0
HLL	25.4 ± 2.4	22.5–30.2	35.1 ± 2.0	31.3–38.1	123.4	0
NCS	11.1 ± 0.4	10–12	9.3 ± 0.8	8–10	48.6	0
DS	56.4 ± 2.3	52–60	62±3.3	58–68	27.6	0
GS	33.8 ± 2.2	31–38	36.1 ± 2.3	33–40	8	0
LFP	19.5 ± 0.9	18–21	19.7 ± 2.3	18–21	0.09	0.76
SUL	6 ± 0.2	6–7	6 ± 0.0	6–6	0.71	0.41

Table 2 Comparison of the morphological data from this study and those from literature (e. g., Salvador, 1982).

Characters	*A. blanfordi* (Our data)	*A. blanfordi* (Salvador, 1982)	*A. cantoris* (Our data)	*A. cantoris* (Salvador, 1982)
Supraoculars (anterior to subocular)	4	4	4	4
Supralabials	5	5	5	5
Ventrals	11–13	12–14	13–15	12–14
Scale rows around fingers	4	4	4	4
Gular scales	31–38	28–35	33–40	23–30
Collars	10–12	7–11	8–10	–
Dorsal scales	52–60	37–50	58–68	48–52
Femoral pores	18–21	14–22	18–21	19–23
Lamellae under 4th toe	18–23	20–23	20–25	20–24

apomorphies in the group, but *A. blanfordi*, *A. schmidti* and *A. arabicus* all differ from *A. cantoris* in their narrower premaxillae, more asymmetrical hemipenes and usually high number of ventrals (Arnold, 1983). In comparison, due to the presence of a high degree of similarity between *A. blanfordi* and *A. cantoris* in pholidosis, coloration, and color pattern, our statistical analysis in morphological characters shows the presence of *A. cantoris* in our materials leading to making clear decisions on the occurrence of *A. cantoris* in southeastern Iran.

More studies and extensive field work are needed to understand the exact distributional pattern of *A. cantoris* westward into Hormozgan Province in Iran.

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