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A specific pholidotic character in *Acanthodactylus boskianus boskianus* (DAUDIN, 1802)

(Squamata: Sauria: Lacertidae)

Ein besonderes Pholidose-Merkmal von *Acanthodactylus boskianus boskianus* (DAUDIN, 1802)

(Squamata: Sauria: Lacertidae)

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KURZFASSUNG

Die Unterscheidung zwischen *Acanthodactylus boskianus asper* (AUDOUIN, 1827) und *A. b. boskianus* (DAUDIN, 1802) war wegen der Variabilität innerhalb der ersteren Form immer wieder Diskussionsgegenstand. Wir beschreiben ein bis jetzt übersehenes qualitatives Pholidose-Merkmal, das zwar bei *A. b. boskianus* aber weder bei *A. b. asper* noch bei mehreren anderen Taxa der Gattung vorkommt, und zwar einen vertebralen Streifen von kleineren Rückenschuppen. Die Klärung der systematischen Bedeutung benötigt weitere Untersuchungen.

ABSTRACT

The distinction of *Acanthodactylus boskianus asper* (AUDOUIN, 1827) from *A. b. boskianus* (DAUDIN, 1802) has always been debated, due to the variation within the former. We describe an overlooked qualitative pholidotic character that occurs in *A. b. boskianus* but not in *A. b. asper* or several other congeneric taxa, namely a vertebral track of smaller dorsal scales. Understanding its systematic implication requires further research.

KEY WORDS

Reptilia: Squamata: Sauria: Lacertidae: *Acanthodactylus boskianus*, distinction, systematics, morphology, pholidosis, dorsal scutellation, scale size, Middle East, Levant, Egypt

INTRODUCTION

We report the discovery of an overlooked and specific character state, that is likely to help resolve a long-standing gaping problem in Saharo-Sindian herpetology. The species, or complex (vide HARRIS & ARNOLD 2000), *Acanthodactylus boskianus* (DAUDIN,1802) is widely distributed throughout the Saharo-Arabian deserts, mainly in sandy habitats, and is often common and conspicuous in the landscape (SALVADOR 1982; ANDERSON 1898). In the west, its distribution extends to Morocco and Mauritania (SALVADOR 1982) and eastwards it reaches southeastern Turkey in the north (BÖHME 1973; BARAN & ATATUR 1998) and the whole Arabian Peninsula and western Iran in the south (ANDERSON 1999; RASTEGAR-POUYANI 1999). In Africa it extends southwards to about 15°N (SALVADOR 1982).

Over this vast area, the species shows considerable variation, some of which presumably is geographical, in size, proportions (mensural characters) and scutellation (meristic characters). But any geographical coherence is rather befogged by intra-population variation (WERNER 1971; SALVADOR 1982; ARNOLD 1983; ANDERSON 1898; DISI et al. 2001; BAHA EL DIN 2006). Some authors, notably BOULENGER (1918, 1921) and BAHA EL DIN (2006), recognized two or three geographical subspecies: Namely, besides (1) the small-scaled nominal form *A. b. boskianus* (high count of dorsals across mid-body) in the Nile delta, (2) the medium-size-scaled *A. b. euphraticus* BOULENGER, 1919 in southeastern Anatolia, northern Iraq and western Iran, and (3) the large-scaled *A. b. asper* (AUDOUIN, 1827) throughout

most of the species' wide range (usually low but very variable count of dorsals). The two first populations appear to be defined by lacking "*asper*" genes, although the amplitude of variation in *A. b. euphraticus* is unclear (Reed & Marx 1959; Salvador 1982). Scale size is the dominant distinguishing character between the subspecies but is in part accompanied by other pholidotic differences. Both *A. b. boskianus* and *A. b. euphraticus* could in principle differ from *A. b. asper* also in characters that have not been examined. In contrast, other authors, notably Salvador (1982), Leviton et al. (1992) and Disi (2011), despaired of accepting an intra-specific taxonomic subdivision at the current state of knowledge. Probably by mistake, Saleh (1997) pooled "*A. b. boskianus* (Daudin, 1803)" and "*A. b. asper* (Audouin, 1829)" under the heading "*Acanthodactylus boskianus asper* (Daudin, 1802)".

Interstingly, the distinction of *Acanthodactylus boskianus asper* (Audouin, 1827) from *A. b. boskianus* (Daudin,1802) was always debated - already in the description of "*Lacerta aspera*" (Audouin, 1827) (Gilad et al. 2012). However, one qualitative pholidotic feature that appears to distinguish between *A. b. boskianus* (Daudin, 1802) and *A. b. asper* (Audouin, 1809), escaped all authors' notice. Namely, in the former, the dorsal scutellation includes a vertebral tract of small scales, not conspicuously but distinctly smaller than those on its right and left; we describe, document and discuss this discovery.

MATERIALS EXAMINED

Museum specimens, mostly fixed with 10% formalin and stored for many years in 70-75% ethanol (mostly denatured with 5% methanol), and photographs of such specimens (marked *), as follows. Museum acronyms follow Leviton et al. (1985) except AIC = Adel Ibrahim Collection (Suez), FTHM = Farhang Torki Herpetological Museum (Nourabad City), RUZM = Razi University Zoology Museum (Kermanshah), ZCT = Zoological Collection at Taraghen (Ibrahim 2008).

Acanthodactylus aegyptius Baha El Din, 2007: Israel (n = 10): HUJR 2064, 2245, 5095, 5350, 7462, 7803, 11380-81, 13935-36.

Acanthodactylus ahmaddisii Werner, 2004: Jordan (n = 1): HUJR 1296 (holotype).

Acanthodactylus bershebensis Moravec, Baha El Din, Seligmann, Sivan & Werner, 1999: Israel (n = 10): HUJR 18387-95, 19177.

Acanthodactylus boskianus asper (Audouin, 1827 ("1809")): Egypt, mainland: unknown locality (n = 2): MNHN 8293, 1999.8220. Egypt, mainland: Noncoastal (n = 29): HUJR 1344, 6151, 6153; SMF 21354-5, 39154-39176, 86886. Egypt, Sinai: center and south (n = 178): HUJR between catalogue numbers 1336 and 19307. Egypt, Sinai: north (n = 9): AIC 1998.139, 2001.028, 2001.068, 2002.020, 2002.034, 2002.045, 2005.002, 2005.003, 2005.014. Israel (n = 194): HUJR between catalogue numbers 1336 and 19307. Jordan (n = 11): HUJR 1335, 1338, 1341, 1661, 5041-3, 5046, 5053, 10542, 10649. Syria (n = 7): HUJR 2418-9, 10426, 10430-1, 10645, 10647. SW Libya (n = 2): AIC 1572, 2006.

Acanthodactylus boskianus boskianus (Daudin, 1802): Egypt: unknown locality (n = 2): MNHN 2762 (holotype), 2767. Egypt: Mediterranean-coastal region (n = 9): BMNH 1927.8.13.52*; FMNH 78949*, 167874-5*, 167955*,167964*; SMF 75242, 13631-2.

Acanthodactylus boskianus euphraticus Boulenger, 1919: Western Iran (n = 4): CAS 203484*; FTHM 006503*, 006504*; RUZM 62*.

Acanthodactylus erythrurus (Schinz, 1833) sspp.: Southern Morocco (n = 2): S. Fahd field photographs*. Northeastern Morocco (n = 1): S. Fahd field photographs*.

Acanthodactylus grandis Boulenger, 1909: Jordan (n = 3): HUJR 1030-31, 10543. Syria (n = 5): HUJR 10538, 10566, 10643-44, 10646.

Acanthodactylus longipes Boulenger, 1918: SW Libya (n = 1), AIC photo in HUJR*.

Acanthodactylus opheodurus Arnold, 1980**:** Israel (n = 14): HUJR 1583, 1899, 2661-2, 2893, 5789, 5962, 6205 13339, 13340, 17959, 19149, 19189-90.

Acanthodactylus pardalis (Lichtenstein, 1823): Egypt (n = 10): HUJR 18990-99.

Acanthodactylus robustus Werner, 1929: Aharoni Collection (n = 10): HUJR 5357-66.

Acanthodactylus schreiberi schreiberi Boulenger, 1878: Cyprus (n = 10): HUJR 19549-58.

Acanthodactylus schreiberi syriacus Boettger 1878: Israel (n = 24): HUJR 2590, 2726, 2853, 2969, 6925, 7022, 7318, 12751, 12782, 13291-2,13508, 13675, 13841, 14381, 14399, 14400, 17568-17570, 17819, 17822, 18004, 19241).

Acanthodactylus scutellatus (Audouin, 1829): SW Libya (n = 3): ZCT 2005.41, 2006.55, AIC photo in HUJR*. Sinai, Egypt (n = 7): HUJR 11572, 11575, 11581, 11588, 11592-93, 12636.

Acanthodactylus tristrami (Günther, 1864): Lebanon (n = 9): HUJR 10048-52, 10097, 13560-62.

Lacerta agilis exigua Eichwald, 1831: Turkey (n = 3): HUJR 1738, 6143-44.

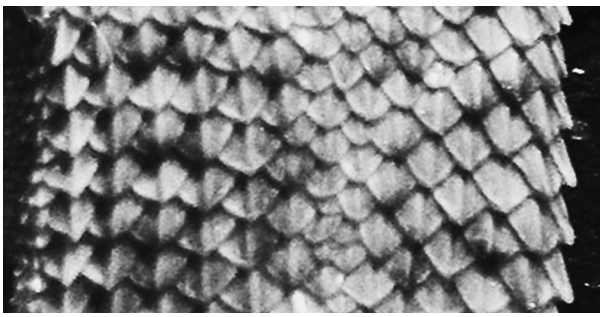

Fig. 1: The scutellation of the middle of the dorsum of *Acanthodactylus b. boskianus* (DAUDIN,1802) includes a vertebral stripe of smaller scales. Adult male from Edku, Mediterranean-coastal Egypt (BMNH 1927.8.13.52, courtesy Patrick CAMPBELL).

Abb. 1: Die Mittelrücken-Beschuppung von *Acanthodactylus b. boskianus* (DAUDIN,1802) enthält einen vertebralen Streifen aus kleineren Schuppen. Erwachsenes Männchen von Edku, küstenmediterranes Ägypten (BMNH 1927.8.13.52, mit freundlicher Genehmigung von Patrick CAMPBELL).

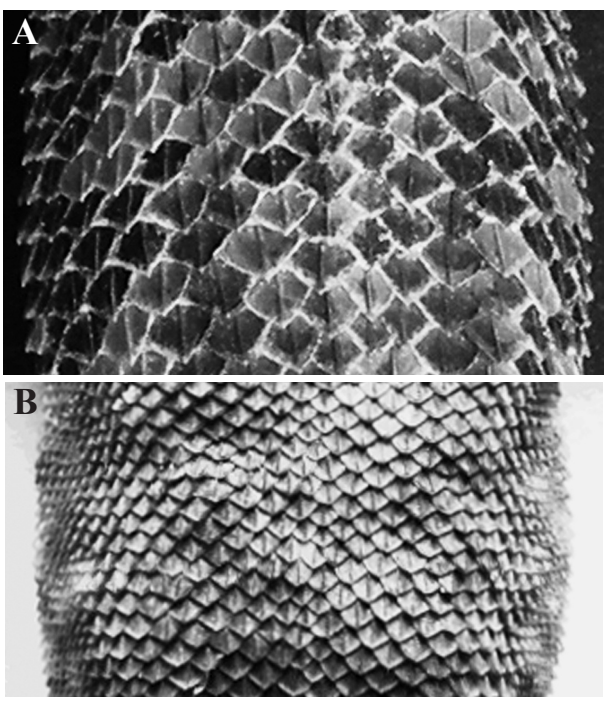

Fig. 2: The scutellation of the middle of the dorsum of *Acanthodactylus b. asper* (AUDOUIN, 1827) includes no vertebral stripe of smaller scales. A - Adult female, from Tamriyat, northern Kingdom of Saudi Arabia (BMNH 1985.524). No smaller vertebral scales present. B - Specimen from Al-Arish, Mediterranean-coastal Sinai, Egypt (AIC 2005.014). Occasional vertebral scales are somewhat smaller but form no distinct stripe.

Abb. 2: Die Mittelrücken-Beschuppung von *Acanthodactylus b. asper* (AUDOUIN, 1827) enthält keinen vertebralen Streifen aus kleineren Schuppen. A – Adultes Weibchen aus Tamriyat, nördliches Königreich Saudiarabien (BMNH 1985.524). Es sind keine verkleinerten vertebralen Schuppen vorhanden. B – Exemplar von Al-Arish, küstenmediterraner Sinai, Ägypten (AIC 2005.014). Gelegentlich finden sich etwas verkleinerte Vertebralschuppen, die aber keinen deutlichen Streifen bilden.

RESULTS

All 11 specimens and photographs listed above as *Acanthodactylus boskianus boskianus* showed within their dorsal scutellation a narrow vertebral (mid-dorsal) stripe of smaller scales (Fig. 1). The regularity of this stripe varied among individuals but it was always distinct, usually 2-3 scale rows wide. In contrast, none of the 571 individuals (specimens or photographs) of 15 congeneric taxa listed above (admittedly almost all from Egypt and eastwards) showed such a distinct vertebral stripe of smaller scales (Fig. 2A). Additional specimens of *Acanthodactylus boskianus asper* lacking such a vertebral stripe of smaller scales are depicted in Gilad et al. (2012). In some few individuals there do occur some single smaller scales in the dorsal midline that, however, are isolated and do not approach a situation of forming a distinct stripe (Fig. 2B).

DISCUSSION

There arises the question whether the small-scaled vertebral stripe occurs in the type specimen of *Acanthodactylus boskianus boskianus*. The fine drawing illustrating the species in the Description de l'Egypte (Gillispie 1994), namely Figure 9 of Plate 1 in the folio volume of illustrations, shows nothing of the sort (Fig. 3). Moreover, in this drawing the coloration stripe pattern, precisely fits that of *A. b. asper* rather than that of *A. b. boskianus* (Werner et al., 2012). However, upon careful examination, the holotype itself, MNHN 2762, despite being a juvenile (Fig. 4A) and in imperfect condition, does show an incipient vertebral stripe of smaller scales (Fig. 4B). Furthermore, its illustration in the original description can be interpreted as showing this (Fig. 5). Thus the discovered qualitative morphological character of a vertebral tract of reduced-size scales is indeed associated with the taxon *A. b. boskianus*.

This character seems to be unique in this taxon, at least among congeners from Egypt and eastwards; it was absent in the representatives of 14 congeners examined herein. Moreover, while specialized vertebral scales – smaller, larger or crest-forming, occur in many agamid, chamaeleonid and iguanid lizards and even in scincids and some gekkonoids, they are absent in most lacertid lizards. There are exceptions though (*Holaspis*, *Philochortus*), the best known being *Lacerta agilis* Linnaeus, 1758, where the mid-dorsal band of narrower scales is usually 8-12 rows wide (Boulenger 1920), creating a different visual image.

The occurrence of isolated small scales in the vertebral zone of some (very few) conspecific individuals (Fig. 2B) may be spurious. It might conceivably represent developmental irregulatity comparable to that resulting from stress and expressed in fluctuating asymmetry (Van Valen 1962; Kark 2001). However, since as a matter of fact this did occur at Al Arish on the Mediterranean coast of Sinai, it could signal a lack of reproductive isolation between the populations, as would indeed befit subspecies. This question deserves thorough investigation.

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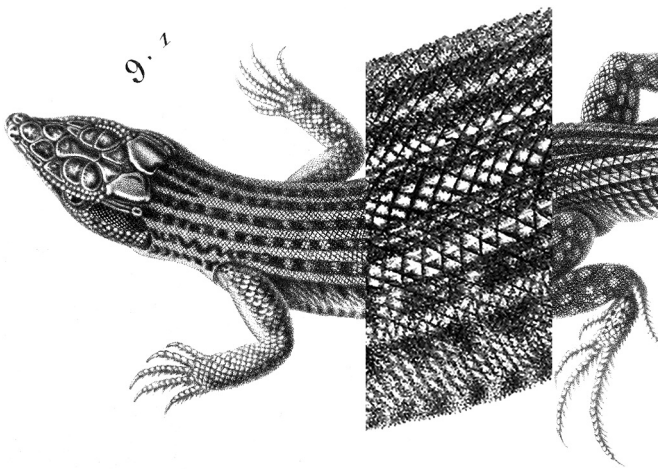

Fig. 3: The drawing attributed to *Acanthodactylus b. boskianus* ("*Lacerta Boskiana*, DAUD.") in AUDOUIN'S contribution to SAVIGNY's "Description de l'Égypte". Note the vertebral black streak behind the end of the pileus, which is common in *A. b. asper*. The mid-trunk area has been enlarged *in situ* (anteriorly aligned according to the vertebral light inter-space between the two branches of the dark vertebral stripe, forking craniad between the thighs) to show the absence of a vertebral stripe of smaller scales.

Abb. 3: Die auf *Acanthodactylus b. boskianus* ("*Lacerta Boskiana*, DAUD.") bezogene Zeichnung in AUDOUINs Beitrag zu SAVIGNYS "Description de l'Égypte". Man beachte die schwarze Vertebrallinie am Hinterende des Pileus, wie sie bei *A. b. asper* häufig ist. Die Rumpfmitte ist *in situ* vergrößert dargestellt (nach vorne zu ausgerichtet nach dem hellen vertebralen Zwischenraum der beiden Äste des dunklen Vertebralstreifens, der sich auf Höhe der Oberschenkel kopfwärts gabelt), um das Fehlen eines vertebralen Streifens verkleinerter Schuppen zu zeigen.

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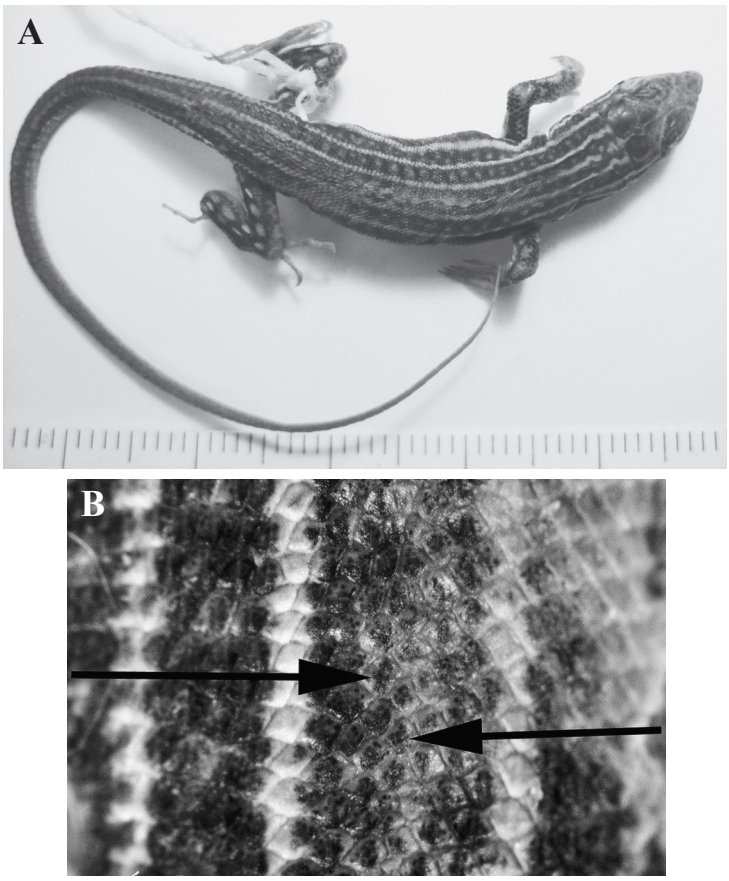

Fig. 4: The holotype of *Acanthodactylus b. boskianus* (Daudin,1802) (MNHN 2762). A - The specimen, dorso-lateral view. Note that the vertebral white line begins at the end of the pileus and peters out in mid-trunk. Ruler – cm and mm. B - Scutellation of the posterior part of the dorsum (where the vertebral white line is absent). The central dark interval between white lines contains an approximately three scales wide vertebral stripe of smaller scales, in which some single larger scales are interspersed.
(The arrows traverse the regular large scales and point to the vertebral track of small scales.)

Abb. 4: Holotypus von *Acanthodactylus b. boskianus* (Daudin,1802) (MNHN 2762). A – Das Exemplar in dorsolateraler Ansicht. Man beachte, daß die weiße Vertebrallinie am Pileusende beginnt und in Rumpfmitte ausläuft. Maßstab – cm und mm. B – Beschuppung des Hinterrückens (auf dem die weiße Vertebrallinie nicht mehr vorhanden ist). Der mittlere dunkle Bereich zwischen den weißen Linien beinhaltet einen etwa drei Schuppen breiten Vertebralstreifen aus verkleinerten Schuppen, in den vereinzelt größere Schuppen eingestreut sind. (Die Pfeile liegen über den regulären, großen Schuppen und zeigen auf den Vertebralstreifen aus verkleinerten Schuppen.)

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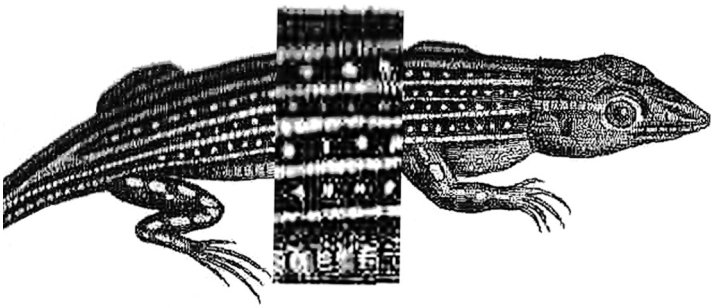

Fig. 5: Drawing of the holotype of *Acanthodactylus b. boskianus* from its description (DAUDIN 1802). Tail cropped from picture. Note that the vertebral white line begins at the end of the pileus and peters out in mid-trunk so that posteriorly it is represented by a row of white dots. The mid-trunk area has been enlarged *in situ* (anteriorly aligned at the vertebral white line). The vertebral white stripe (the second from the top of the enlarged inset) is slightly narrower in comparison with both of the neighboring white stripes, perhaps to reflect an impression of smaller scales in the vertebral position.

Abb. 5: Abbildung des Holotypus von *Acanthodactylus b. boskianus* in seiner Beschreibung (DAUDIN 1802). Der Schwanz ist durch den Bildbeschnitt nicht dargestellt. Man beachte, daß die weiße Vertebrallinie am Pileusende beginnt und nach der Rumpfmitte in einer Reihe weißer Flecken ausläuft. Die Rumpfmitte ist *in situ* vergrößert dargestellt (nach vorne zu ausgerichtet nach der weißen Vertebrallinie). Die weiße Vertebrallinie (im Insert die zweite weiße Linie von oben) ist etwas schmäler als beide weißen Nachbarlinien, vielleicht um den Eindruck verkleinerter Schuppen im Vertebralbereich zu vermitteln.

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