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Hemipenial microornamentation in *Lacerta brandtii* DE FILIPPI, 1863: Falsification of a systematic hypothesis?
(Squamata: Sauria: Lacertidae)

Das Hemipenis-Epithel von *Lacerta brandtii* DE FILIPPI, 1863: Falsifizierung einer systematischen Hypothese?
(Squamata: Sauria: Lacertidae)

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KURZFASSUNG

Seit PETERS (1962) wird *Lacerta brandtii* als nächste Verwandte der *L. parva / L. fraasii* - Gruppe innerhalb der Sammelgattung *Lacerta* angesehen (z. B. ARNOLD 1989; BISCHOFF 1991). Das mehrspitzige Kronenepithel auf der Hemipenisoberfläche von *L. brandtii* scheint diese Hypothese auszuschließen, bietet jedoch keine alternative Lösung an, da es bei *Lacerta* (s. l.) offenbar mehrfach entstanden ist. Mögliche nähere Verwandte von *L. brandtii* sind die Felseidechsen oder die Arten der *L. laevis / L. danfordi* - Gruppe. Neue methodische Ansätze sind zu einer Lösung der Frage erforderlich.

ABSTRACT

Since the work of PETERS (1962) *Lacerta brandtii* DE FILIPPI, 1863 was regarded as the closest relative of the *L. parva / L. fraasii* group within the collective genus *Lacerta* (e. g. ARNOLD 1989; BISCHOFF 1991). The crown-shaped microornamentation on the hemipenial epidermis of *L. brandtii* seems to exclude this hypothesis and does, however, not offer an alternative resolution, due to its obvious multiple origin. Candidates of close relationship to *L. brandtii* are the Rock Lizards or the *L. laevis / L. danfordi* group. Other methodological approaches are required to resolve this question.

KEYWORDS

Lacertidae, *Lacerta, L. brandtii*; systematic position; Iran, Azerbajdzhan

In the mating season the hemipenial surface epithelium in lacertid lizards is covered by minute spines, each of them being a single epithelial cell. The cyclic appearance of these spines is hormonally controlled (see BÖHME 1971). They can end in one pointed tip, they can be bifurcate, or they can bear a multi-spined tip that may be crown-shaped or showing a terminal bulb covered with spinules (BÖHME 1971). Within breeding adult males, there is no intraspecific variation, therefore the spiny epithelium proved to be a useful systematic character. Although it is somewhat problematic to determine the polarity of this character due to lacking outgroup information, it seems less parsimonious to consider the more complicated structure the plesiomorphic one (see ARNOLD 1989).

The Persian Lizard (*Lacerta brandtii* DE FILIPPI, 1863) inhabits a relatively small distribution area which is situated in NW-Iran (Azerbajdzhan Province) and enters the Talysh area near Lenkoran in the former Soviet Republic of Azerbajdzhan (BOULENGER 1920; ANDERSON 1974; BISCHOFF 1991). The lizard's relationship remained uncertain and tentative until today. BOULENGER (1920: 301) regarded it as "one of the most primitive members of the *L. muralis* group" (i. e. *Podarcis* sensu BOULENGER) "which it connects with *L. parva*". WETTSTEIN (1951) linked *L. brandtii* with *L. fraasii* and *L. vivipara*, and therefore placed it in the subgenus *Zootoca*. PETERS (1962: 460), in his monographic treatment of *L. parva*, claimed that *L. brandtii* would have the same type of colour pattern as the for-

mer, and would in this character be closest to *L. parva* - however, after *L. fraasii* - within the entire collective genus *Lacerta*. Two male *L. brandtii* investigated by BÖHME (1971: 208) showed only undifferentiated hemipenial surface epithelium, so that it was impossible to test the hypothesis of a relationship with *L. parva*, which is, along with the small *Psammodromus* species, characterized by an apomorphic bifid, fork-like spiny epithelium (BÖHME 1971: 208, 210). In a recent paper, ARNOLD (1989: 210) states that "*Psammodromus* and *Gallotia* appear to be sister groups and are probably related to *Lacerta parva* and *L. fraasii* and then to *L. brandtii*", thus maintaining the hypothesis of a graduated relationship between these three last-named species. BISCHOFF (1991: 14) stressed that according to the results of LUTZ & al. (1989) *L. parva* would merit generic rank, which should also include *L. brandtii* and *L. fraasii*.

Thanks to the amiable courtesy of Josef EISELT of the Vienna Natural History Museum it was possible to investigate two male *L. brandtii* (NMW 33160) which had been collected in spring (by the end of April), thus being most likely to exhibit a fully differentiated hemipenis epithelium. The microscopic examination (technique employed as described by BÖHME 1971) revealed in fact fully developed cuticular spines, which, however, did not resemble those of *L. parva*, but turned out to be multi-spined, crown-shaped. Furthermore, I had the opportunity also to study the hemipenis epithelium of an adult male of *L. fraasii* (ZFMK 56400), collected by H. A. J. IN DEN BOSCH, likewise in the breeding season. This specimen did not exhibit a fully differentiated cuticular epithelium, but single spines that showed already the bifid condition typical also for *L. parva*. Also ARNOLD (1973) mentioned already a hemipenial microornamentation of this type for *L. fraasii* (see also BISCHOFF 1991). The close relationship between *L. parva* and *L. fraasii*, mainly based on the data and arguments by PETERS (1962) is therefore corroborated by an additional, independent and moreover atelic character (see BÖHME 1971, 1989) in a synapomorphic condition.

L. brandtii, however, because of its crown-shaped spiny epithelium, does not at all take part in this assemblage. Its likewise apomorphic (see above) condition of hemipenial microornamentation links it with the Rock Lizards of the *L. saxicola* complex or with the *L. laevis / L. danfordi* group. The situation here is, however, less conclusive, because it has to be admitted that crown-shaped epithelia have obviously evolved more often than twice within the Lacertidae (if the assumption is correct that the multi-spined condition is derived as compared with simply pointed spines).

LANTZ & CYRÉN (1939: 20) had already stressed the seasonal colour dimorphism in male *L. brandtii*, which can display green throats in the breeding season, thus resembling *L. chlorogaster* from the same geographical area, which likely belongs to the *L. laevis / L. danfordi* group (see BISCHOFF 1991: 14). They mention, however, also an intensive orange colouration of the anal region and the underside of thighs and tail in *L. brandtii*, what can be also found in members of the *L. saxicola* complex (see e. g. the colour plates in DAREVSKY 1967). The systematic and phylogenetic position, respectively, of *L. brandtii* cannot be resolved, however, by discussing such phenetic similarities. Other methods, first of all biochemical procedures, are most-promising to resolve this problem. In any case, the hypothesis of a closer relationship between *L. brandtii* on the one hand and *L. parva* plus *L. fraasii* on the other should not be maintained.

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