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Karyological affinity between *Lacerta fraasii* Lehrs, 1910 and *Lacerta parva* Boulenger, 1887

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The rare lacertid lizard *Lacerta fraasii* occurs in two mountain ranges in Lebanon at altitudes around 2000 m where it is found in open, stony habitats with sparse vegetation that are dry in summer and covered with snow during the long winter period (in den

Bosch, 1993). Boulenger (1920) considered this species to be related to *L. vivipara*. Peters (1962) pointed out a resemblance between *L. fraasii* and *L. parva*. Arnold (1973, 1989) supported the latter affinity, also holding that these species and *L. brandtii* would belong to the same lineage as *Gallotia* and *Psammodromus*.

The *L. parva* karyotype consists of 24 chromosomes with 14 biarmed macrochromosomes (Gorman, 1969; Kupriyanova, 1980; Olmo 1986; Olmo et al. 1993). Similar karyotypes are very rare in Lacertidae, and have recently been found only in some species from the Pyrenees (Odierna et al., submitted). In the current study we investigated the so far unknown karyotype of *L. fraasii* to obtain information on its phylogenetic relationships.

We karyotyped a male specimen captured by one of us (in den Bosch) in Lebanon in the Sannin mountains, near Ayoun Assiman, east of Farai'ya (in den Bosch, 1993). The chromosomes were obtained from intestine, spleen, lung and testis by means the scraping and air drying method as described by Olmo et al. (1986). Besides the conventional chromosome morphology, we also studied NOR localization by the AgNOR method described by Howell and Black (1980).

Our research shows that the chromosome set of *L. fraasii* consists of 24 chromosomes with 14 biarmed and 8 uniarmed macrochromosomes and 2 microchromosomes and is thus very similar to that of *L. parva* (fig. 1). The biarmed chromosomes have the same morphology in *L. fraasii* and *L. parva*, except those of the 7th pair, which are subtelomeric in the former species and metacentric in the latter (fig. 1). The NOR location is also different: in *L. parva* it occurs on the microchromosomes (Olmo et al., 1991), whereas in *L. fraasii* it is located telomerically on the long arm of the 5th pair (fig. 1). This arm has a size similar to that of the L-type NOR-bearing chromosome found in various lacertid species belonging to *Lacerta s. str.*, *Archaeolacerta* and the *L. lepida* group (Odierna et al., 1987; Olmo et al. 1993).

In our opinion, the close karyological resemblance between *L. fraasii* and *L. parva* clearly corroborates the sister-group relationship between them. In fact, in view of the extreme rarity of karyotypes rich in biarmed chromosomes in lacertids (Olmo et al., 1993) it is very improbable that this likeness is only the result of convergence phenomena.

The evolution from *L. parva* or *L. fraasii* karyotype, or vice versa, is likely to have involved only two mutations:

- 1) A pericentric inversion in the chromosomes of the 7th pair. This variation has often been observed in skinks (Olmo et al., 1994), and, in some cases, might have accompanied or followed speciation phenomena (Caputo et al., 1993; Olmo et al. 1994).

- 2) Translocation of the nucleolar organizer. The NOR localization on a microchromosome observed in *L. parva* is considered a plesiomorphic character (Odierna et al. 1987; Olmo et al. 1993). This would suggest that *L. fraasii* karyotype, showing an L NOR-bearing chromosome, is derived. In addition, in view of the proven diagnostic value of NOR localization in indicating relationships (Odierna et al., 1987; Lozano et al., 1993), the resemblance in this character between *L. fraasii* and several species

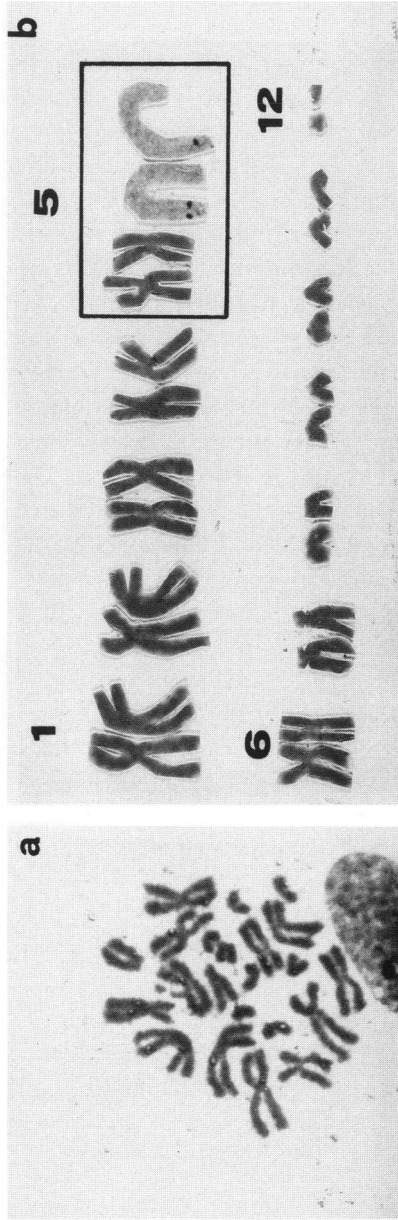


Figure 1. Metaphase plate (a) and karyotype (b) of *Lacerta fraasii*. Note the telomeres of the 5th pair Ag-NOR labelled (pair on the right in the frame).

belonging to *Archaeolacerta* and the *L. lepida* group might be indicative of a phylogenetic relationship among these groups. In this connection, Engelmann and Schaffner (1981), based on electrophoretic studies, suggest that *L. parva* is related to *L. princeps* and *L. lepida*, though morphological (Arnold 1989) and microcomplement fixation (Mayer and Lutz, 1989) studies clearly contrast with this hypothesis. However, the karyological data so far obtained are preliminary, and therefore, the aforementioned resemblance in NOR localization might be either a simple case of evolutionary convergence or a plesiomorphic character, both hypotheses being plausible (Olmo et al. 1991).

Our results help to confirm the relationship between *L. fraasii* and *L. parva*. However, a more detailed study of the karyology of these species is necessary to elucidate the significance of karyological resemblances between these two species and other lacertid taxa. In this connection, it would be interesting to investigate the karyotype of *L. brandtii*, a species which is considered to be related to *L. parva* and *L. fraasii* (Peters 1962; Böhme 1971; Arnold 1973, 1989), although recently Böhme (1993) denied a close relationship of *L. fraasii*, based on examination of hemipenial microornamentation.

Further information will be gained from a comparison of ethological data. The courtship behaviour of *L. parva* was described by in den Bosch (1990), who also observed the sexual behaviour of *L. fraasii*. Observations on behaviour in *L. brandtii* could be revealing in this context.

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A skeletochronological analysis of three syntopic amphibian species from southern Italy

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The skeletochronological method allows a reliable estimation of individual age in amphibians and reptiles. It relies on counts of lines of arrested growth (LAGs) in diaphyseal cross-sections of long bones, which are generally the most informative skeletal elements (Castanet et al., 1993). The method can also provide new information on the populational biology and ecology of the species studied (e.g. Bastien & Leclair, 1992; Denton & Beebe, 1993; Caetano & Castanet, 1993). However, skeletochronology has rarely been used for Italian amphibians (Francillon et al., 1990; Pagano et al., 1990; Rossi et al., 1991; Guarino et al., in press), for most of which growth rates, age at sexual maturity and longevity are poorly known.

This paper reports a skeletochronological study of age structure in adults of three different amphibian species (*Rana dalmatina*, *Rana italica*, *Bombina variegata pachypus*) living