

## MORPHOLOGICAL AND BEHAVIOURAL DIFFERENCES BETWEEN LARVAE OF VARIOUS RACES OF *SALAMANDRA SALAMANDRA*

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### INTRODUCTION

The Fire Salamander *Salamandra salamandra* is a widespread urodele occurring from Western Europe to the Middle East and North Africa. Thirteen races are recognised (Klewen, 1991) based upon variations in body colouration, patterning and proportions, though considerable variation may occur within populations (Thorne, 1968; Klewen, 1991). The current study seeks to identify similar differences between the newly-born larvae of four races of salamander.

### METHODS

Fire Salamanders produce live young in water, generally in the early months of the year. Colonies of four subspecies of Fire Salamander, namely *salamandra*, *terrestris*, *fastuosa* and *gallaica* are maintained in the author's collection and housed separately to prevent hybridisation. Environmental conditions are similar for each population and have been described elsewhere (Wisniewski & Paull, 1986; Wisniewski, 1987). Likewise, all animals receive food of similar quality *ad libitum* (Wisniewski, 1986).

During 1990 and 1991, all young produced were measured and examined for differences in colouration, body proportions and behaviour on the day of birth and further observations were made during development.

### RESULTS

		Mean	Range	Sample
1. Body length (mm)	S.s.s.	34.0	33-36	99
	S.s.t.	30.4	24-34	23
	S.s.g.	31.5	29-35	86

No measures were taken for *fastuosa* as only three juveniles were produced.

- Ratio body length to tail length
  - S.s.s. - Tail 0.5 total length
  - S.s.t. - Tail 0.3-0.5 total length
  - S.s.g. - Tail 0.5 total length
- Proportions
  - S.s.s. - Fairly robust. Tail fin medium wide. Gills medium.
  - S.s.f. - Body massive and bull-necked. Tail fin very narrow. Gills stubby. Well developed at birth and close to metamorphosis.
  - S.s.t. - Often rather thin. Tail stubby and very broad at birth becoming more streamlined later. Gills luxuriant.
  - S.s.g. - Fat and usually robust. Tail fin medium. Head large. Gills luxuriant.
- Colour
  - Determined to some extent by background colouration. However, colour was assessed after the larvae had spent at least two hours in a white container.
  - S.s.s. - Body pale clay. Dark markings on tail only.
  - S.s.f. - Hints of post-metamorphosis colouration present, or yellow and black colouration fully developed.
  - S.s.g. - Dark with lots of speckling on body and tail.

## 5. Behaviour/development

S.s.s.	-	Metamorphosis after three months.
S.s.f.	-	Metamorphosis within one day to three weeks after birth. Very fast and prone to leap from the water.
S.s.t.	-	Slow growing. Metamorphosis up to one year after birth.
S.s.g.	-	Fast growing. Metamorphosis after one to three months.

## DISCUSSION

The results suggest some differences between the larvae of the four races, the most distinctive being *fastuosa* in which the young are born at a point close to metamorphosis, sometimes with full adult colouration. In the other races, colour differences are rather subtle and probably not a reliable distinguishing feature.

Newly-born larvae of *terrestris* are noticeably blunt-tailed with very wide tail fins. The tail is rather short and this contrasts with the adults which are no more or less short-tailed than *salamandra* or *fastuosa*. However, adult *gallaica* do have very short tails, yet the larvae show no sign of this feature.

Larvae of *gallaica* are fat and robust (a feature also characteristic of the adults). Body length is probably an unreliable feature as such a wide range of sizes can be found in one batch of larvae. Mean length may also vary considerably from year to year. Thus, for *terrestris* the mean length of 1990 larvae was 26mm, whilst for 1991 larvae it was 33mm.

Perhaps more subtle differences between larvae of the various races exist, but these have not been identified by the current study.

## REFERENCES

- Klewen, R., (1991). Die Land salamander Europas, Teil 1. *Die Neue Brehm-Bucherei*. 208pp.
- Thorn, R., (1968). *Les Salamandres d'Europe, d'Asie et d'Afrique du Nord*. Paul Lechevalier. 376pp.
- Wisniewski, P.J. & Paull, L.M., (1986). Breeding and rearing the European Fire Salamander *Salamandra s. salamandra*. *Int. Zoo. Yb.* 24/25. 223-226.
- Wisniewski, P.J., (1986). The Fire Salamander: A brief summary of the species and a review of ten years' observation with particular reference to food intake. *The Herptile* 11, 1. 37-41.
- Wisniewski, P.J., (1987). Captive husbandry of the Fire Salamander. *ASRA Monograph* 2, 1. 11-15.