

## Facing a new environment: ability to disperse in the common lizard (*Lacerta vivipara*)

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The decision to disperse is likely to be influenced by numerous factors rather than caused by a single event (DOBSON & JONES 1985). In particular, the ability to disperse may be partly determined by the behaviour of individuals confronted with an unknown environment. In the common lizard, *Lacerta vivipara*, familiarity with its environment reveals a strong interaction between the microhabitat and behaviour, which varies with sex and age (LECOMTE et al. unpublished data). When dispersing, the animals encounter with an unfamiliar environment. In this study, we tried to quantify the capacity to explore, and therefore to disperse in a new environment being empty of conspecifics. In this aim, we compared the behaviour of 47 lizards of different sex and age after their introduction into an enclosure.

### Material and methods

*Lacerta vivipara*, a small lacertid lizard, has been extensively described in previous papers (e.g. PILORGE 1982). The present study took place in the Parc National des Cévennes (France), on Mont Lozère, at an elevation of 1420 m. On June 6th, 15th, 22nd and July 18th 1989, four different samples (4 males, 4 females – all gravid at this date –, 4 yearlings – only 3 on June 6th) were collected in a peatbog (a relatively homogeneous substrate). They were kept indoor one night in individual terraria. The day after their capture, they were introduced into one of 12 experimental units, so that each individual was placed under the same natural conditions. The 12 units were set in two juxtaposed rows on a roughly North-South axis. The habitat in each unit was standardized as much as possible: a small granitic rock and a branch of broom were placed on a natural background of herbaceous plants and heather. The structure of this environment provided the lizards with sites for foraging, thermoregulation, and hiding. In each of the 4 experiments, each category of lizards was equally represented, and placed in the experimental units in such a way that possible differences among categories, induced by the heterogeneity of substrates and sun orientation, could be avoided. After their introduction into the enclosure, the individuals were immediately observed during 15 minutes and their behaviour was carefully described according to a detailed ethogram. Individual behaviours were arranged in 5 categories: thermoregulation (B), foraging (F), locomotor activity (W), alarm and running (A), and hiding (H). The duration of each behaviour is the time an individual spends performing this behaviour during a focus of 15 minutes.

The statistical analyses – test of SCHEFFE, MANOVA, LOG-LINEAR models – were performed using SPSS/PC+.

### Results and interpretation

There is no difference in body size among age and sex classes of the 4 experiments.

Normality and homogeneity of variance were checked for behaviour H and log transformation was used for behaviour B and A. As the distributions of the durations of behaviours F and W departed significantly from normality, we used log linear analysis.

Behaviours B, A, and H were first compared through an analysis of variance with experiments (exp), age, and sex as factors. As far as alarm and running (A) and hiding (H) are concerned, no significant difference was observed between the various groups.

First, adults seem to spend significantly more time thermoregulating than yearlings (effect exp  $\times$  age class:  $\chi^2=9.455$ ,  $df=3$ ,  $P=0.0238$ ). To be more specific, the greater duration devoted to thermoregulation by adult females may be due to their pregnancy (they have to provide an adequate temperature for the embryonic development) rather than to differences of status. The differences between male and female yearlings (effect exp  $\times$  sex:  $\chi^2=10.514$ ,  $df=3$ ,  $P=0.0147$ ) could be attributed to physiological differences or to the fact that yearling males are more outside – and then, in possible interaction with conspecifics.

Individuals moved around significantly more at the beginning of June. This change of activity was especially dramatic in males, and more obvious in yearlings than in adults. This could be related to the fact that mating occurs in May and in early June, so that the activity of adults is greater at that time of the year. Yearlings on the other hand, have not yet acquired a home range and their need to explore the new environment is greater than in adults, particularly in yearling males which are more frequently outside.

Secondly, we made comparisons on the basis of a covariance analysis with body size as a covariate and experiments, age and sex as factors. In this case, a significant effect of body size was shown for behaviours B and H (Behaviour B:  $F_{1,30}=12.934$ ,  $P=0.001$ ; behaviour H:  $F_{1,30}=4.942$ ,  $P=0.034$ ).

Finally, behaviours B, A, and H were analysed within each age class with body size as a covariate and body mass as the depending variable. It appeared that no significant difference was found in males. However, the age of adults was unknown and we can assume that the significant body size effect found in the second analysis was rather due to differences between the two year old individuals and the older ones. In fact, a comparison of duration of behaviours based on 1990's data, within a set of adults of known age (more than two years old) did not reveal any difference of behaviour B, A and H. There was a tendency to have more alarm behaviour in the case of bigger males which are presumed to be dominant ( $F_{1,14}=4.042$ ,  $R^2=0.224$ ,  $P=0.064$ ) but that also may be due to age.

In the case of the adult females, the different stages of gestation among them does not allow to take their body mass into account. Nevertheless, there is a significant relationship between body mass and the duration of thermoregulatory behaviours: larger females thermoregulate more than smaller ones ( $F_{1,14} = 5.18$ ,  $R^2 = 0.270$ ,  $P = 0.0391$ ). As the number of embryos is correlated with body size, larger females carrying more embryos have to thermoregulate longer than smaller ones, in order to reach the optimal temperature for development of the embryos.

In yearlings, bigger individuals thermoregulate more than leaner ones; we found an opposite relationship for the duration of behaviour H (behaviour B:  $F_{1,13} = 12.618$ ,  $R^2 = 0.493$ ,  $P = 0.035$ ; behaviour H:  $F_{1,13} = 11.375$ ,  $R^2 = 0.466$ ,  $P = 0.005$ , Fig. 1).

It reveals that for these known-aged individuals, the corpulence plays an important role when the lizard is faced with a new environment.

### Discussion

The response of individuals facing a new environment is affected by their age and sex, and probably related to physiological and/or dominance aspects.

Adults, in general, thermoregulate longer than yearlings, and yearlings have a greater locomotor activity.

In adult males, no inter-individual obvious difference was observed; they are related to age rather than to intrinsic differences.

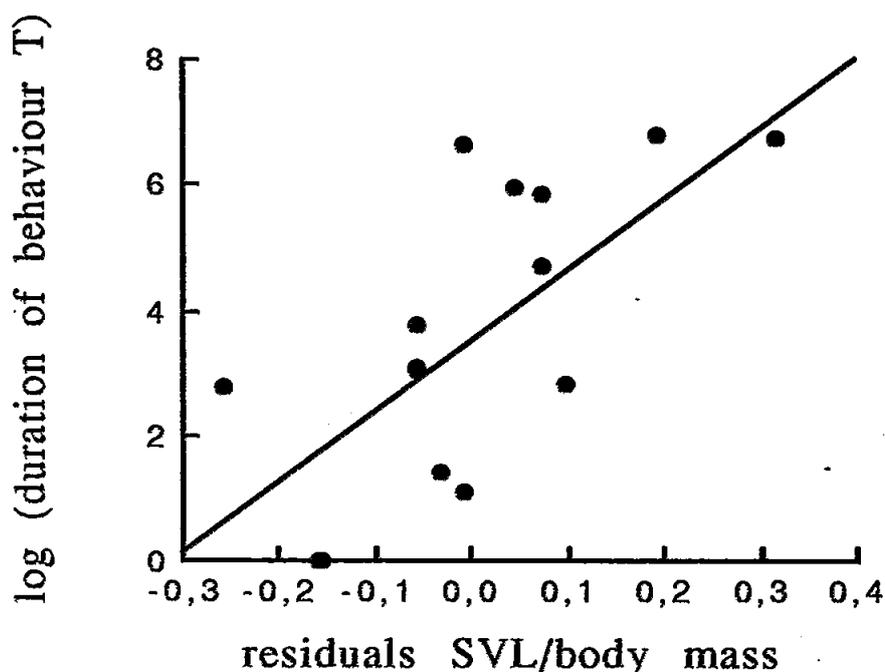


Fig. 1. Relationship between the residuals of the relation between body mass and body size and the duration of thermo-regulatory behaviour in yearlings ( $y = 3.65 + 11.801x$ ;  $R^2 = 0.493$ )

In adult females pregnancy involves physiological constraints, and differences between gravid females are rather related to body size and therefore likely to age.

In yearlings, males show more locomotor activity than females.

Furthermore, bigger yearlings thermoregulate longer than leaner ones. We found an opposite relationship for the time spent hiding. In yearlings, such differences between sex and type of individual could be explained by physiological constraints or interpreted as differences of status between them.

Can this high locomotor activity be related to ability for dispersing, and can yearlings be considered as better colonizers (DANIELSON & GAINES 1987) or just the opposite, should we regard them as poor dispersers, not yet ready to disperse in natural conditions as ANDERSON (1989) suggested? In our experiment, individuals are artificially confronted to a new environment and the fact that yearlings in these conditions spend more time moving around than adults does not directly entail that they should explore and disperse in natural conditions. Nevertheless, a recent study using the same methodology (LECOMTE et al. in prep.) has shown that resident and immigrant yearlings strongly differ in locomotor behaviour. So, we can reasonably relate locomotor behaviour to the ability to disperse without anticipating the issue of their colonization of a strange environment. Further studies on the introduction of juveniles and on the reaction of individuals of different age and sex classes to conspecifics may give more information.

#### References

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