Supplementary Information – Heteroscedasticity modelling

Methods

We used the LME procedure in R software to verify the normality and homogeneous variance of residuals and random effects (Ihaka & Gentleman, 1996; Pinheiro & Bates, 2002). No evidence of heterogeneity in variance of random family effects was found. When heterogeneity in the variance of residuals was detected, we used variance functions to model heteroscedasticity, tested the fit of heteroscedastic models and compared the fit of these models with homoscedastic models using likelihood ratio tests (Pinheiro & Bates, 2002).

Results

EFFECTS OF MATERNAL FOOD AVAILABILITY

We only detected heterogeneity in variance of residuals when modelling the effects of maternal food availability on SVL at hatching. Variance of residuals was heterogeneous between years and sites (respectively, $\chi^2 = 89.94$, df = 9, $P < 0.0001$; $\chi^2 = 22.06$, df = 1, $P < 0.0001$).

EFFECTS OF DENSITY MANIPULATION AND MATERNAL CORTICOSTERONE LEVEL

We only found heterogeneity in variance of residuals between years and between corticosterone treatments when analysing the effects of prenatal population density and maternal corticosterone level on SVL at hatching. Variance of the residuals was lower in 2001 than in 2000 ($\chi^2 = 32.68$, df = 1, $P < 0.0001$, ratio = 0.79 [0.73-0.86] 95%CI) and higher for corticosterone than for placebo treatments ($\chi^2 = 17.09$, df = 1, $P < 0.0001$, ratio = 1.18 [1.09-1.27]).

EFFECTS OF HABITAT HUMIDITY AND MATERNAL GESTATION CONDITIONS

We found that variance of residuals for body size changed significantly with site and year when investigating both prenatal effects of habitat humidity and maternal effects of gestation conditions (basking regime and humidity in the laboratory) on body length at hatching. Variance was lower in humid sites than in dry sites during both study years (1996: ratio to the dry site in 1997 = 0.69 [0.61-0.78] 95%CI, 1997: ratio = 0.74 [0.66-0.84]), and variance in humid sites was lower in 1996 than in 1997 (1996: ratio = 0.65 [0.57-0.73]).

Discussion: variance in body size

Although most studies focus on determining the mean of phenotypic traits, a change in variance around the mean may be just as important, as it can strongly influence ecological and evolutionary trajectories (Merilä & Sheldon, 2000). For example, genetic and non-genetic variation in life history traits can change in direct response to the environment (Hoffmann & Merilä, 1999), leading to different heritabilities for the same trait in different environments (Merilä, 1997). Using statistical tools to model a heterogeneity of variance (Pinheiro & Bates, 2002), we investigated determinants of body size variance in juvenile common lizards.

In our analyses, changes in the variance within and between families can be interpreted in the following way (Hoffmann & Merilä, 1999): (1) a high variance within families (a high variance of the residuals) suggests a high "non-genetic" variability that will reduce the heritability of body size, while (2) a high variance among families (a high variance of the random family effect) suggests on the contrary a stronger influence of "genetic" factors (or uncontrolled prenatal factors). We found no significant change in the interfamilial variation in body size between the various environmental conditions examined in our study, suggesting that genetic factors (or uncontrolled prenatal factors) are similarly expressed over a broad range of environments. However, we found that both high maternal corticosterone level and prenatal habitat dryness increased intrafamilial variance in offspring body size. These factors might act as environmental stressors that increase development instability of body size in the common lizard. No similar change in the variance of growth rate was detected, suggesting that variance of body size at hatching and variance of growth rate are under different mechanisms of control.

References

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