

Testing the interplay between physiological and life-history traits: an experimental study in *Drosophila*

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ABSTRACT

Question: Developmental time and metabolic rate are correlated at higher levels of organization. Does this allometric relationship scale down to the intraspecific level?

Methods: We exposed flies of three species of *Drosophila* collected at contrasting altitudes and similar latitudes to varying experimental thermal regimes. Metabolic rate was measured as CO₂ production using a ‘closed system’. Developmental time was estimated as the time elapsed from the first instar larval stage until adult emergence.

Results: We observed a positive correlation between metabolic rate and developmental time among species. However, such allometry was not detected within species. Interestingly, both variables presented different patterns of interactions with sex and thermal treatment.

Conclusions: It may not be possible to extrapolate allometric rules of macroecology to within-species variation. Indeed, the factors that affect variation in physiological variables at the intraspecific and interspecific levels should be different.

Keywords: developmental time, *Drosophila*, metabolic rate, thermal adaptation.

INTRODUCTION

Life-history traits such as survival, growth rate, fecundity, and age at maturity are considered indirect measures of an organism’s fitness in nature (Stearns, 1992). The expression of these phenotypic traits, as for all traits, is mediated by environmental influences; nevertheless, life-history traits have a particularly strong influence on an organism’s fitness. In addition, physiological variation within the life history of an individual may influence fitness. Moreover, the connections between genotype and phenotype have traditionally been the subject of physiology and developmental biology. However, such studies do not inform us about how the phenotype is designed for reproduction and survival, an issue traditionally addressed by evolutionary biologists (Stearns, 1992).

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