Relationship between the thermal variation, its predictability and the upper thermal limits of anuran larvae: An integrative approach.

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BACKGROUND

RESEARCH QUESTIONS

1) How much the thermal variation and its predictability differ between local (i.e. the macroclimate) and organismic scales (i.e. the micrometeorology)?
2) In what extent spatiotemporal variation among microclimates correlates with organismic thermal tolerance?
3) Is there any trade-off betweenbaseline and ecological thermal tolerance of species? If so, how this correlates with the temporal variation in environmental temperature experienced within microclimates?
4) How the predictability of intragenerational thermal variation (i.e. during development) affects the thermal tolerance and its underlying mechanisms?

HYPOTHESIS

1) Organism’s thermal tolerance is positively correlated with spatiotemporal variation in microclimate (i.e. high and fast daily thermal variation select for high thermal tolerance).
2) Baseline thermal tolerance would be enhanced in species that undergo fast thermal changes in the field, whereas ecological thermal tolerance would be favored in species experiencing slower thermal changes.
3) Higher unpredictability of intergenerational thermal variation increases overall thermal tolerance. Yet, the predictability of intergenerational thermal variation favors greater phenotypic plasticity of thermal tolerance.
4) Phenotypic plasticity of thermal tolerance is accomplished via “enhanced cellular stress response (enhanced response), constitutively elevated expression of protective genes (genetic assimilation) or a shift from damage resistance to passive mechanisms of thermal stability (tolerance)” (Stebbins-Gould et al. BMC Genomics 17:111, 2016).

MATERIALS AND METHODS

- Model system
- Climatic data
- Upper thermal tolerance tests
- Phenotypic plasticity
- Data analysis

PREDICTIONS

- CT max
- T max
- SD

GLOSSARY

Adaptation: The dynamic evolutionary process that fits a population of organisms to their environment.
Anurans: The most species, diverse, and widespread of the three extant amphibian orders (i.e. frogs and toads).
Bioinformatics: The collection, classification, storage, and analysis of biochemical and biological information using computers especially as applied to molecular genetics and genomics.
Critical Thermal Maximum: Temperature at which animal motion becomes disorganized and the organism can not escape from conditions that will promptly lead to its death.
Ectothermic animal: An organism in which internal physiological sources of heat are of relatively small or quite negligible importance in controlling body temperature, and therefore must rely mainly on environmental heat sources.
Performance: Any mean of an organism’s capacity to function (e.g. locomotion, growth, survivorship, etc.).
Phenotypic plasticity: The property of a given genotype to produce different phenotypes in response to distinct environmental conditions.
Proteome: The entire set of proteins expressed by a genome, cell, tissue, or organism at a certain time under defined conditions.
Reaction norm: The function that describes the pattern of phenotypic expression of a single genotype across a range of environments.
Transcripts: The full range of messenger RNA, or mRNA, molecules expressed by an organism.

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