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Commentary Article

# Beneficial Acclimation Hypothesis: A Commentary

**Divya Singh**[1], **Seema Ramniwas**[1*]

*1University Center for Research and Development, Chandigarh University, Gharuan, Mohali-140413, India*

## INTRODUCTION

Evolutionary adaptation to climate change by an individual within its lifespan gave rise to a trait known as phenotypic plasticity which allows phenotype of individuals to 'fit' in changing environments. Phenotypic plasticity is a type of developmental plasticity because an organism during its life span when anticipated by external environmental or internal physiological factors, adopts a permanent physiological, morphological, or behavioral change in the developmental trajectory through gene–environment interactions. [1] Plasticity and acclimation is the most common response which becomes evident at physiological level as well as at the morphological level to environmental change. To describe the assumption that all acclimation changes enhance the physiological performance of an individual, the beneficial acclimation hypothesis (BAH) was proposed. [2, 3] BAH especially in response to environmental variation have focused on plasticity. BAH is contentious with robust criticism and multiple hypothesis assessed it. Following assessments were drawn:

- Individuals reared at an optimal developmental temperature compete better in all environments. [4,3]
- Cold environment reared ectotherms develop larger body with fitness advantage. [5]
- Cold inverse i.e. warmer is better for smaller individuals. [6]
- Developmental temperature has zero effect on adult fitness.

Continuous rejections of BAH lead to developed criticisms and new support from adult acclimation with decrease in fitness of an individual at stressful temperatures. Alternate hypotheses should be tested to infer BAH as wrong with avoidance of difficulties like trade-offs in field environments [7] and behavioural versus life history traits interactions.[8, 9] with resumption of developmental and phenotypic plasticity we tested BAH in a cold-adapted, limited ranged fly species endemic to the Himalayas and the Indian subcontinent. A robust experiment was set up to measure a number of thermal hardiness phenotypes (melanization, chill coma recovery, heat knockdown, and survival) on individuals of the Dipteran species, Drosophila nepalensis, reared in different thermal environments, (14, 17, 21, and 25 °C) and from different life cycle stages. We found that rearing at higher temperatures reduces melanization and cold hardiness, but improves heat knockdown times. There is a beneficial plastic response to higher temperatures in this species. An addition experiment was performed to determine if short-term acclimation to a higher temperature (26.2°C), compared to some control temperature which is not reported, will result in increases in thermal hardiness. We discovered beneficial long-term developmental acclimation responses for both cold and heat. The results, lead to conclusions:

- There exists long-term developmental acclimation to both heat and cold in the species that may become extremely beneficial as temperatures and climates alter in the region.
- There exists a lack of short-term heat acclimation in the species which mean that rapid shifts in thermal extreme could be detrimental to the species.
- There exists evidence for life stage-specific thermal acclimation responses with Pupae being more heat resistance in response to higher temperatures.

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*Correspondence to: Seema Ramniwas, University Center for Research and Development. Chandigarh University, Gharuan, Mohali-140413, India; E-mail: seema.ramniwas@gmail.com

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