Author's Accepted Manuscript

www.elsevier.com/locate/jtherbio

Physical mechanism or evolutionary trade-off? Factors dictating the relationship between metabolic rate and ambient temperature in carabid beetles

Agnieszka Gudowska, Bartosz W. Schramm, Marcin Czarnoleski, Jan Kozłowski, Ulf Bauchinger

PII: S0306-4565(16)30217-0
DOI: http://dx.doi.org/10.1016/j.jtherbio.2016.11.009
Reference: TB1845

To appear in: *Journal of Thermal Biology*

Received date: 19 July 2016
Revised date: 5 October 2016
Accepted date: 11 November 2016

Cite this article as: Agnieszka Gudowska, Bartosz W. Schramm, Marcin Czarnoleski, Jan Kozłowski and Ulf Bauchinger, Physical mechanism or evolutionary trade-off? Factors dictating the relationship between metabolic rate and ambient temperature in carabid beetles, *Journal of Thermal Biology* http://dx.doi.org/10.1016/j.jtherbio.2016.11.009

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Physical mechanism or evolutionary trade-off? Factors dictating the relationship between metabolic rate and ambient temperature in carabid beetles

Agnieszka Gudowska[a*], Bartosz W. Schramm[a,b], Marcin Czarnoleski[a], Jan Kozłowski[a], Ulf Bauchinger[a]

[a]Institute of Environmental Sciences, Jagiellonian University, Gronostajowa 7, 30-387 Krakow, Poland

[b]Sable Systems Europe GmbH, Ostendstraße 25, 12459 Berlin, Germany

[*]Corresponding author: agnieszka.gudowska@uj.edu.pl

Accepted manuscript

Abstract

The tight association between ambient temperature (T) and metabolic rate (MR) is a common occurrence in ectotherms, but the determinants of this association are not fully understood. This study examined whether the relationship between MR and T is the same among individuals, as predicted by the Universal Temperature Dependence hypothesis, or whether this relationship differs between them. We used flow-through respirometry to measure standard MR and to determine gas exchange patterns for 111 individuals of three Carabidae species which differ in size (*Abax ovalis, Carabus linnei* and *C. coriaceus*), exposed to four different temperatures (ten individuals of each species measured at 6, 11, 16 and 21°C). We found a significant interaction between ln body mass and the inverse of temperature, indicating that in a given species, the effect of temperature on MR was weaker in larger individuals than in smaller individuals. Overall, this finding shows that the thermal dependence of MR is not body mass invariant. We observed three types of gas exchange patterns among beetles: discontinuous, cyclic and continuous. Additionally, the appearance of these patterns was associated with MR and T. Evolution in diverse terrestrial environments could affect diverse ventilation patterns, which accommodate changes in metabolism in response to temperature variation. In conclusion, explaining the variance in metabolism only through fundamental physical laws of thermodynamics, as predicted by the Universal Temperature Dependence hypothesis, appears to oversimplify the complexity of nature, ignoring evolutionary trade-offs that should be taken into account in the temperature – metabolism relationship.

Keywords

energy expenditure, breathing patterns, ectotherms, Metabolic Theory of Ecology

Download English Version:

https://daneshyari.com/en/article/5593459

Download Persian Version:

https://daneshyari.com/article/5593459

Daneshyari.com