Is metabolic rate compensation reflecting a thermal stress rather than acclimation?

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Résumé

Most studies exploring ectotherms metabolic response to warming focus on respirometric approaches, thus only reflecting individual aerobic metabolism. Here, we measured the metabolic response and lactate body content of *Gammarus pulex* after a shift from low (12∘C) to high (22∘C) temperature by coupled oxygen consumption measurements (microrespirometry) and heat production (direct microcalorimetry). Following the shift to high temperature and after an initial increase, oxygen consumption gradually decreases, getting back to the value reported at low temperature. Such phenotypic plasticity may compensate for the temperature-induced increase of metabolic rate, commonly considered as an acclimation process in ectotherms. However, the simultaneous measurements of *Gammarus pulex* metabolic rate by direct microcalorimetry remained stable, highlighting an uncoupling between organism heat production, reflecting total metabolic rate, and oxygen consumption. This mismatch suggests an oxygen-disconnected metabolic process, concomitant with an increase in individual lactate body content at high temperature, suggesting a shift from aerobic to anaerobic metabolism. Seven days after the shift to high temperature, the estimated proportion of anaerobic metabolic rate represents up to 50% of total metabolism. Our results indicate that the decrease in aerobic metabolism does not reflect a decrease in total metabolic rate, assimilated to metabolic acclimation, but rather a shift to anaerobic processes to sustain the temperature-induced increased in organism energetic requirements.

Mots-Clés: Global warmimg, Ectotherms, Metabolism, Acclimation

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