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ORIGINAL PAPER

Heat shock response and metabolic stress in the tropical estuarine copepod *Pseudodiaptomus annandalei* converge at its upper thermal optimum

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Abstract

Heat shock response (HSR), in terms of transcription regulation of two heat shock proteins genes (*hsp70* and *hsp90*), was analysed in a widespread tropical copepod *Pseudodiaptomus annandalei*. The mRNA transcripts of both genes were quantified after copepods at a salinity of 20 underwent an acclimation process involving an initial acclimation temperature of 29°C, followed by gradual thermal ramping to the target exposure temperature range of 24°C to 36°C. The respective cellular HSR and organismal metabolism, measured by respiratory activity at exposure temperatures, were compared. The fold change in mRNA expression for both *hsp70* and *hsp90* (8-9 fold) peaks at 32°C, which is very close to 32.4°C, the upper thermal optimum for respiration in the species. Unexpectedly, the modelled HSR curves peak at only 3°C (*hsp90*) and 3.5°C (*hsp70*) above the mean water temperature (29.32°C) of the copepod in the field. We propose that copepods in tropical waters adopt a preparative HSR strategy, early at the upper limit of its thermal optimum, due to the narrow thermal range of its habitat thus precluding substantial energy demand at higher temperatures. However, the model suggests that the species could survive to at least 36°C with short acclimation time. Nevertheless, the