Thermal limits of survival and reproduction depend on stress duration: a case study of *Drosophila suzukii*

Michael Ørsted[1], Quenin Willot[2], Andreas Olsen[2], Viktor Kongsgaard[2], and Johannes Overgaard[2]

[1]Aalborg University
[2]Aarhus Universitet

September 13, 2023

Abstract

Studies of ectotherm responses to heat extremes often rely on assessing absolute critical limits for heat coma or death (CT_{max}), however, such single parameter metrics ignores the importance of stress exposure duration. Furthermore, population persistence may be affected at temperatures considerably below CT_{max} through decreased reproductive output. Here we investigate the relationship between tolerance duration and severity of heat stress across four ecologically relevant life-history traits (productivity, sterility, coma, and mortality) using the global agricultural pest *Drosophila suzukii*. For the first time, we show that for sublethal reproductive traits, tolerance duration decreases rapidly and exponentially with increasing temperature (R^2>0.97), thereby extending the Thermal Death Time framework recently developed for mortality and coma. Using field micro-environmental temperatures, we show how thermal stress can lead to considerable reproductive loss at temperatures with limited heat mortality highlighting the importance of including limits to reproductive performance in ecological studies of heat stress vulnerability.

Hosted file

\selectlanguage{ngerman}Ørsted_et_al_ELE_main_manuscript.docx available at https://authorea.com/users/664372/articles/666101-thermal-limits-of-survival-and-reproduction-depend-on-stress-duration-a-case-study-of-drosophila-suzukii