How vulnerable are populations of semi-aquatic insects (Odonata) to global temperature increases?

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Abstract

The thermal tolerance of a species may be exceeded by the predicted temperature increases and thus contribute to population extinctions. However, the impact of temperature increases is thought to vary between climate regions, with latitude and by local climate, life history traits and inter- and intraspecies interactions. Here, we aim to establish the vulnerability of ectothermic insects to a warming climate by estimating the thermal buffer, the difference between critical thermal maximum (CTmax) and the maximum temperature of the warmest month in Ischnura heterosticta damselflies across a 2700 km cline. We measured CTmax along a latitudinal gradient of seventeen degrees from twenty-one populations along the eastern coast of Australia. Our results showed that damselflies inhabiting in tropical regions had higher CTmax than temperate damselflies and CTmax increased with increasing temperatures but not with decreasing latitudes as predicted. We further found that individuals with high parasite numbers had higher CTmax, while body size, body condition and sex had no impact on CTmax. Our projections showed that damselfly thermal buffer will be narrower in the tropics compared to temperate regions under a predicted 2.6°C degree annual mean temperature increase. Therefore, damselflies in the tropics are likely to be more vulnerable to climate change driven extinction even though they have a relatively higher CTmax.

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