Evolutionary potential of thermal preference and heat tolerance in Drosophila subobscura

Castañeda, Luis E.

Romero-Soriano, Valèria

Mesas, Andrés

Roff, Derek A.

Santos, Mauro

Evolutionary change of thermal traits (i.e., heat tolerance and behavioural thermoregulation) is one of the most important mechanisms exhibited by organisms to respond to global warming. However, the evolutionary potential of heat tolerance, estimated as narrow-sense heritability, depends on the methodology employed. An alternative adaptive mechanism to buffer extreme temperatures is behavioural thermoregulation, although the association between heat tolerance and thermal preference is not clearly understood. We suspect that methodological effects associated with the duration of heat stress during thermal tolerance assays are responsible for missing this genetic association. To test this hypothesis, we estimated the heritabilities and genetic correlations for thermal traits in Drosophila subobscura, using high-temperature static and slow ramping assays. We found that heritability for heat tolerance was higher in static assays ($h^2 = 0.134$) than in slow ramping assays ($h^2 = 0.084$), suggesting that fast assays may provide a more precise estimation of the genetic variation of heat tolerance. In addition, thermal preference exhibited a low heritability ($h^2 = 0.066$), suggesting a reduced evolutionary response for this trait. We also found that the different estimates of heat tolerance and thermal preference were not genetically correlated, regardless of how heat tolerance was estimated. In conclusion, our data suggest that these thermal traits can evolve independently in this species. In agreement with previous evidence, these results indicate that methodology may have an important impact on genetic estimates of heat tolerance and that fast assays are more likely to detect the genetic component of heat tolerance.