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► To cite this version:

Marion Javal, D Renault, Hervé Colinet. Thermal variability and insects ecology : effects of fluctuating thermal regimes on *Drosophila melanogaste*. 12. Meeting Ecology and Behaviour, Jun 2016, Villeurbanne, France. , 2016. hal-01603661

HAL Id: hal-01603661

<https://hal.science/hal-01603661>

Submitted on 3 Jun 2020

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Thermal variability and insects ecology : effects of fluctuating thermal regimes on *Drosophila melanogaster*.

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Résumé

Temperature is a structuring parameter of ecosystems that affects almost all the aspects of biology. This is particularly true for ectotherms that cannot regulate their inner body temperature and are thus subjected to the thermal regime of their environment. Yet the temperature fluctuates naturally at different time-scales and insects are able to face those changes thanks to tolerance or avoidance mechanisms coupled with physiological adjustments. However, changes in the climate are expected in the years to come, marked with an increase of the average temperature but also more frequent extreme events and an increase of the thermic fluctuations.

Effects of constant temperatures on insects are already well studied, but less is known about fluctuating temperatures, yet more ecologically relevant. Taking into account those thermal regimes is crucial to fully understand the ectotherm's responses to climate change, and to predict its effect on insects' populations.

We tested the plasticity of cold tolerance of the model organism *Drosophila melanogaster* taking into consideration the effects of intrinsic (dose-response relationship, acclimation) and extrinsic (sex, gravity, developmental stage) parameters on the temperature resistance under constant versus fluctuant conditions. Fluctuating temperatures globally enhance *D. melanogaster*'s resistance to cold stress, especially by providing recovery periods used to fix stress-induced prejudices, but parameters can interact and alter the general pattern. For instance, we showed that if males were more resistant to cold, females benefited more from fluctuations. Similarly, acclimation to cold was beneficial if the stress was constant, but reduced survival under fluctuation conditions.

Our experimentations have refined the understanding of *D. melanogaster*'s responses to cold stress, and the results could be generalized to other groups of insects. Characterizing the responses to thermic stresses for insects is the first step toward predictive models that could anticipate the potential distribution of insects' populations under a changing climate.

Mots-Clés: cold stress, fluctuating thermal regimes, recovery, *Drosophila*, acclimation

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