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# Effects of environmental constraints on the fitness and physiology of a tenebrionid beetle, *Alphitobius diaperinus*

Julie Bjorge<sup>\*1</sup>, Martin Holmstrup<sup>2</sup>, Claudia Wiegand<sup>1</sup>, and David Renault<sup>1</sup>

<sup>1</sup>Rennes University 1 – Université de Rennes 1, UMR Ecobio – France

<sup>2</sup>Aarhus University – Denmark

## Abstract

Insects must cope with a combination of naturally and anthropogenically changing conditions in their environments. To successfully maintain fitness and performance throughout their life, they have developed behavioral and physiological responses that allow them to try to maintain their performance when the conditions are largely suboptimal. Nowadays, however, insects are increasingly exposed to stressful conditions, and new environmental stressors, including pollutants. Investigations of the effects of environmental variations, and combination of environmental stressors, on the physiological responses of insects are rare. In particular, the long term consequences of physiological adjustments and energetic costs developed during stress exposure on the subsequent fitness are understudied. Here, we investigated the effects of environmental variations (daily heat periods), and anthropogenic pollution (exposure to the insecticide Cyfluthrin), and the combination of these two stressors, on the survival, physiology (antioxidant capacity and metabolite composition), and reproduction (number of offspring per female) of *Alphitobius diaperinus*. We hypothesized that repeated heat or insecticide exposures would cause body reserves to decline with increased number of stress exposure events, as body reserves should be used for fueling the repair of injuries. These costs are expected to have a negative effect on the number of offspring, but as stressful environments can result in an increased reproduction response, the outcome can be driven by the nature of the counteracting effects at play. This study therefore shows not only the physiological response to environmental changes in these insects, but increases much needed knowledge of the fitness effects of such changes.

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\*Speaker