Institute: Institute of Environmental Science

Topic: Oxidative stress effects on life history traits in insects

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Background information:

In the light of global climate change and its link to the loss of biodiversity, the profound understanding of the evolution of life histories is gaining further attention. Knowledge of what influences life history traits like mass, growth rate, life span, mortality and fecundity is increasingly built on understanding physiology in general, and oxidative stress in particular. Oxidative stress results from an imbalance between (pro-) oxidants and antioxidants and is the most likely driver of aging, being thus highly relevant for fitness. Over the last decade, oxidative stress biology made great advances in understanding life history trade-offs in mammals and birds (Monaghan et al. 2009). However, our understanding of how oxidative stress is driving such trade-offs in insects is still minute, particularly in the light of insects as a species rich taxonomic group with an important role in the ecosystem.

Compensatory growth is a known evolutionary mechanism in insects and findings in some few insect species clearly promote compensatory growth to cause oxidative stress, caused by resource allocation away from the maintenance of antioxidant capacity rather than by increased production of oxidants (De Block and Stoks 2008, Tüzün et al. 2020). How such oxidative stress-driven trade-offs affect the life cycle stages (egg, instars, pupa or adult stages) in insects, and may even carry-over to subsequent life cycle stages is only marginal understood.
In our pilot studies on antlion (*Myrmeleon formicarius*) larvae we could show compensatory growth as a result of experimental neonicotinoid exposure and confirmed the general potential of successful measurements of oxidative stress metabolites in antlion larvae.

The main question to be addressed in the project:

1) Does compensatory growth in antlions result in oxidative stress?
2) Does manipulated growth and compensatory growth affect the quality and quantity of development within the same life cycle stage?
3) Does manipulated growth and compensatory growth affect the quality and quantity of development in a subsequent life cycle stage (=carry-over effect)?

Information on the methods/description of work:

Investigations of life cycle phenology and potential carry-over effects in response to experimental manipulations and the associated oxidative stress levels are laboratory-based (Figure)t:

- Experimental manipulation of antlion larvae workload, feeding rhythm, and neonicotinoid exposure
- Documentation and measurement of growth, performance, moult, transition between instars, and life cycle stages.
- Measurements of oxidative stress markers (for antlion individuals) in response to experimental manipulation and compensatory growth.

Additional information:

Good communication and English language skills.

Place/name of potential foreign collaborator:

- Robby Stoks, Division Ecology, Evolution and Conservation Biology, KU Leuven, Belgium
- Stefania Casagrande, Max-Planck Institute for Biological Intelligence, Seewiesen, Germany.

References:

[1] De Block, M., and R. Stoks. 2008. Compensatory growth and oxidative stress in a damselfly. Proc Biol Sci **275**:781-785.
[2] Monaghan, P., N. B. Metcalfe, and R. Torres. 2009. Oxidative stress as a mediator of life history trade-offs: mechanisms, measurements and interpretation. Ecol Lett **12**:75-92.
[3] Tüzün, N., M. De Block, and R. Stoks. 2020. Live fast, die old: oxidative stress as a potential mediator of an unexpected life-history evolution. Oikos **129**:1330-1340.