Developmental heaven, purgatory and hell: how do they shape cognition? Studying the effects of the thermal environment on cognitive abilities of insects

The aim of this project is to investigate how temperature during development affects cognitive abilities. Phenotypic plasticity, the term describing the effect that environmental factors (such as temperature) have on various aspects of the phenotype of organisms (such as their cognition), is at the centre of this research proposal. To address the aim, I will conduct a study using predatory antlions (Neuroptera: Myrmeleontidae). These insects spend majority of their life as larvae and go through three instar stage development. I will collect antlions in the field at their first instar stage, develop them under different incubation groups during their entire second instar stage, and then compare their cognitive abilities after they reach third instar stage. I will expose larvae to different conditions in each incubation group: mild, moderate or extreme temperature and poor or good resource availability. One can imagine this experimental setup as a simulation of prolonged locally occurring weather events, such as normal, unusually warm and extremely hot summer time, each with either not much or a lot of food, occurring during a period of development. Is this something that will have an effect on cognitive abilities? Which will be better for cognition: heavenly conditions of normal summer with plenty of resources or hellish conditions of extremely hot summer with little resources? These are the questions which I will address here.

Why focus on temperature and cognition? All organisms interact with their environment and change as a result of this interaction. The most basic factor being responsible for such environmental molding of organisms is temperature. Coping with temperature is costly and probably drains an organism from resources otherwise usable for different investments. It is possible that one of such investments is cognition, or more specifically costly neuronal tissue, which is necessary for cognition but energetically demanding in formation, maintenance and functioning. Conditions which favour cognitive impairment and cognitive enhancement are still poorly studied. Thus, here I will determine whether temperature affects the level of cognitive abilities in all three basic aspects: perception, learning and memory. Antlions *perceive* vibrations which they can *learn* to associate with prey and *remember* for as long as the association is valid. I will measure how well do they perceive, learn and remember after developing in different environmental conditions.

The proposed study is unique is several ways. Here, I will concentrate on cognitive abilities, and these are an important but overlooked issue in the context of phenotypic plasticity. Furthermore, both perception as well as memory are neglected relative to learning in terms of devoted research, but they are no less important. Here, I will study all these three mentioned aspects of cognitive functioning. Also, majority of studies investigate phenotypic plasticity of adult organisms, but I will use animals at their juvenile stage.

I expect that the obtained results will be novel and thus published in leading journals and presented on international conferences. As such, they will gain considerable interest from specialists of various fields such as entomology, thermal biology and cognition ecology.