Disentangling information (predator cues)- and stated-based transgenerational plasticity in the freshwater snail Physa acuta

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Résumé

Phenotypic plasticity is the ability of a genotype to produce alternative phenotypes in different environmental conditions. It classically refers to within-generational plasticity (WGP), in contrast to transgenerational plasticity (TGP) where the phenotype of an organism was influenced by the environment experienced by the previous generations. However, the studies that have examined how organisms integrate information from their parents often found very variable patterns of TGP. They may result from nonadditive responses to multiple cues (parental and personal information) but may also depend on whether the environment simply acts as a cues versus the environment also influences organism's state. Two types of TGP may interact: information-based TGP - cues from parental environment influence offspring- and state-based TGP - carry-over effect of parental environment on state-. A challenge for the theory is to incorporate environmental conditions that non only act as cues but also can affect state.

Predation act as a major driver in the emergence and evolution of plasticity of defences in prey. While some defences against predators are constitutive and permanent, others are induced when the preys detect some predator cues. The expression of these defences (predator-induced WGP) that are often considered as costly should depend on the amount of energy the organisms may invest in. At the generational level, one might extrapolate that the predator-induced TGP may be influenced by the parental state: (i) the transmission of information across generation may be costly and then may be reduced by a low parental state or (ii) the carry-over effect from parental state to offspring state may influence the offspring ability to respond to parental cues. We carried out an experiment to test these hypotheses in a predator-prey system: the freshwater snail *Physa acuta* exposed to crayfish cues. *P. acuta* is a classic example of phenotypic plasticity in response to predator cues with modifications in shell morphology (thicker and rounder), behaviour (escape behaviour), and life-history traits (e.g. accelerated growth rate).

We raised a first generation of snails with four treatments (presence/absence of predator cues and low/high food levels) and their offspring (second generation) were raised in control condition (no predator cues, high food level). Morphological, behavioural, and life-history traits were measured in both parents and offspring. We will present how predator cues and organism state influence the WGP and TGP patterns. Preliminary results show that 1/ individual state influences the ability to produce antipredator defences (WGP), 2/ parental state

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influences the offspring state constraining the antipredator defences of offspring (information-based TGP).

Mots-Clés: phenotypic plasticity, transgenerational plasticity, physa acuta, carry, over effect, predation