Intergenerational metabolic memory and transgenerational plasticity in aquatic clonal plants under heat stress

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Résumé

Plant past experience can influence plant phenotype, especially when recurrent stresses occur, to cope with new environmental conditions. Plants have then developed molecular mechanisms to store information about past stresses, indicating a plant memory. This memory can be transmitted within the individual during mitosis (somatic memory). In clonal plants, mitosis contributes to the production of new daughter individuals. Parental memory can then propagate to daughters, leading to transgenerational memory between clonal generations.

Plant memory can be stored at multi-omic levels, i.e. epigenetic, transcriptomic, proteomic and metabolomic. Plant response to novel environmental conditions through morphological changes is likely to be based on plant metabolome rearrangements. However, metabolites are not only the end-products of genetic networks, as they actively participate in many aspects of cellular signalisation. Plant metabolism is modulated by several environmental factors including past stress, but few studies tested whether the metabolism itself can participate to plant memory.

In this context, we study metabolic changes of daughter plants of a sub-Antarctic aquatic species (*Limosella australis*) under recurrent heat stress, using an untargeted metabolomic approach. Metabolic features were identified based on a single plant database. Indeed, to uncover and identify metabolites involved in transgenerational memory, untargeted metabolomic tools are optimal approaches. We compared metabolomes of daughters from parents which have or have not grown under heat stress, and additionally investigated granddaughters metabolic rearrangements after a second heat stress. This approach will allow us to characterise plant response under recurrent stresses, highlighting a transgenerational plasticity, and to understand which metabolic pathways are involved in stress mitigation.

Mots-Clés: Clonal plants, metabolism, plant memory, Iles Kerguelen, HPLC, MS/MS

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