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# Metabolites relating to phenotypes and environments: between-population differentiation within species

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## Abstract

The metabolome is known to be shaped by both phylogeny and environment. Besides, the metabolome both acts on and is influenced by the phenotype. While macroevolution of genes is more and more being deciphered, very little is known about microevolution of the metabolome, for instance the intraspecific variation of the metabolome in nature within and among populations and regions. Microevolution may affect the relation between metabolites and environments or phenotypes.

We studied populations of three *Ranunculus* species distributed across two regions and across environments in Iles Kerguelen. We used two metabolite classes, flavonoids and amines, both known to respond to stresses and the latter being growth regulators. Flavonoids were quantified by UPLC TQD and amines by HPLC.

We showed that both environment and affiliation to a population influence metabolites of both classes. There is little relationship between metabolome and environment or phenotype in populations across regions, but strong within regions. Among regions, the response to a given environmental factor may be achieved by different compounds. Likewise, among regions a given trait may be influenced by different metabolites.

Our results suggest microevolutionary differentiation of the metabolome in populations among regions, including how metabolites respond to the environment and how they relate to the phenotype. For two metabolite classes, we show that metabolites may be functionally redundant within species. These findings open new perspectives for understanding evolutionary responses of plants to environmental changes.

**Keywords:** metabolites, flavonoids, amines, functional redundancy, phenotype, environment, between population differentiation, microevolution, plants, subantarctic, Kerguelen, *Ranunculus*

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