Metabolic profiling reveals a metabolic shift in Arabidopsis plants grown under different light conditions

Yogesh Mishra¹,², Hanna Johansson Jänkänpää¹, Christiane Funk², Wolfgang Peter Schröder¹,² and Stefan Jansson¹*

¹. Umeå Plant Science Centre, Department of Plant Physiology, Umeå University, SE-901 87 Umeå, Sweden
². Umeå Plant Science Centre, Department of Chemistry, Umeå University, Umeå, Sweden

*Author for correspondence: Stefan Jansson, Tel: +46-90 786 53 54; Fax: +46-90 786 66 76; Email: stefan.jansson@plantphys.umu.se

ABSTRACT:

Plants have a tremendous capacity to adjust their morphology, physiology and metabolism depending on variation in growing conditions, this is called phenotypic plasticity. Therefore, it is utmost important to understand study their metabolism and adaptation capacity also natural condition (where they actually developed), not just in growth chambers. In previous study (Mishra et al, submitted) we have studied and quantified how that Arabidopsis grown in field differ from those grown in growth chamber in terms of, for example, leaf morphology, photosystem components and photosynthetic regulatory processes. The metabolome provides another tool for understanding the function and plasticity of plants. Therefore, to achieve insights in above differences into the metabolic level, we compare the metabolite profiles of leaves of wild type Arabidopsis thaliana (Col) growing under constant laboratory conditions and field. Using GC-MS. The data are confounded by the within- and between-day variation in weather the field, but still many metabolites accumulate to very different levels. In particular many sugar and sugar derivatives (fructose, sucrose, glucose, galactose and rafinose) showed very large differences. Also, the levels of aminoacides were in general much higher in field grown plants. Several intermediates of TCA cycle including succinate, fumarate and malate three fold higher in growth chamber compared to field grown plants. Apparently, large metabolic shifts are induced in different growing conditions and our study provides new insight into the mechanism of plant adaptation at metabolomic level, and highlights the role of known protectants under natural conditions.