

# **Metabolomics: A Robust Bioanalytical Tool for the Dissection of Plant Metabolism and Prediction of Complex Traits**

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Being closer to the phenome compared to other “omics”, metabolomics can be applied for the study of the metabolism of organisms and the discovery of the missing links between genotypes and phenotypes. Focusing on plants, it can be employed for the dissection of their responses to biotic and/or abiotic stimuli and the corresponding metabolism regulation. The in-depth understanding of the undergoing biochemical changes in such interactions could lead to the discovery of reliable plant metabolites-biomarkers. The latter could be further exploited in biomarker-assisted selection programs of cultivars and species based on desired traits or genetic engineering of highlighted biosynthetic pathways. Here, the “proof-of-concept” of the use of metabolomics for the discovery of validated biomarkers of plants’ resistance to biotic and abiotic stimuli is presented in detail for certain species. The content of plants in various metabolites and the up- or down-regulation of key-pathways could be used as reliable indicators of their physiological state and the *in silico* projection of traits. Among others, phytoalexins, signaling molecules, and other metabolites with biological roles, as well as biosynthetic pathways such as, the phenylpropanoid, isoflavonoid, and alkaloid could serve as such. Upon the development of validated metabolomics models, the approach can be adapted in the high-throughput study of traits of concern, contributing towards the reduction of the required time and costs.