4.4 Natural genetic variation in growth and metabolite regulatory roles of Allyl glucosinolate in Arabidopsis thaliana

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Glucosinolates (GSLs) play an important role in plant as biotic and abiotic stress response mediators inducing complex defense strategies networks [1-2]. However, the physiological significance of GSL sensing in plants is not completely understood. Thus, we initiated an investigation of the effects of exogenous Allyl GSL on plant development. To identify suitable genetic screening conditions we initially tested seven *A. thaliana* accessions with different GSL profile. Plants were feed with 50 μM Allyl GSL in MS media with different sucrose concentrations. Results showed that the inclusion of Allyl GLS within the media lead to increased biomass of most accessions with increasing effects as sucrose increased. HPLC verified that all the accessions were able to take up the Allyl GSL from the media and this transport was also dependent upon the sucrose concentration. To elucidate the potential mechanism by which Allyl GSL can affect biomass changes in Arabidopsis we increased the study to a survey of a 96 *A. thaliana* natural accessions [3-5]. Results showed that growth was highly heritable and that natural Arabidopsis accessions have significant variation for the effect of Allyl GSL upon seedling growth. The accessions displayed both positive and negative response in growth. In addition to growth, the exogenous Allyl also altered endogenous GSL accumulation with different effects across the Arabidopsis accessions. There was also an interaction of GSL profile and growth with the Allyl treatment having stronger effects on growth for the genotypes which predominantly display C3 GSL than those with C4 GSL. To better understand how the different GSL may combine to relate with growth responses, we performed regression analysis with all individual GSL traits. This resulted in a model where variation in the response of eight GSL traits, seven aliphatics and one indolic, explained 43% of the variability plant growth response to exogenous Allyl GSL. 8-methylsulfinyloctyl GSL responses to Allyl were the most strongly correlated with growth responses. In conclusion, it appears that Allyl GSL has the capacity to differentially affect plant growth and metabolite content of Arabidopsis accessions dependent upon the environment and endogenous GSL genetic variation. Further Genome-wide association studies will help to elucidate the regulatory network and candidate genes controlling growth response variation to exogenous Allyl GSL.

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