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PROJECT TITLE

Effects of single and combined environmental stressors on the phenotypic plasticity of the ruderal plant Tanacetum vulgare

CONSORTIUM

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SUMMARY OF THE REPORT

Phenotypic plasticity is a crucial prerequisite allowing plants to cope with stresses. However, stress responses have often been evaluated individually. Moreover, phenotypic plasticity may greatly vary within species. Thus, we performed an experiment at the ExpoSCREEN facility in Helmholtz Munich to evaluate variation in responses to single and combined stresses. We used the widespread species *Tanacetum vulgare*, which expresses intraspecific diversity in terpenoid profiles, building so-called chemotypes.

Phenotypic plasticity was determined using clones of four chemotypes belonging to different maternal genotypes. Plants were clonally propagated in Bielefeld and plantlings sent to Munich. After acclimatisation, plants were exposed in four walk-in chambers of ExpoSCREEN, where they grew under controlled light and climatic conditions.

After initial growth under well-watered conditions, clones were exposed to one of the four treatments: control, drought (abiotic stress), insect herbivory (biotic stress) and drought plus insect herbivory. Plants assigned to the drought treatments received only half the amount of water. For herbivory, larvae of a generalist insect were placed on the respective plants. After the stress onset, volatile emission was measured in each sub-chamber with PTR-MS.

Before onset of the drought treatment, as well as before and at the end of the 5-day herbivory treatment, plants were phenotyped using a photostation to estimate the plant biomass and their responses to the individual and combined stress treatments. Finally, plants were harvested and leaf and root samples shock-frozen. The leaves and roots are currently analysed for their terpenoid profiles by GC-MS. Leaves are also analysed for metabolic fingerprints using LC-MS. Changes in the different plant traits will be statistically tested in dependence of plant treatment, plant chemotype and plant maternal genotype.

We expect that some of the metabolic plant responses should be stress-specific, while others overlap between plant stresses; a combined stress likely leads to a stronger stress response than individually applied stresses; the extents of these responses may differ across chemotypes and maternal genotypes, potentially revealing highly individual-specific patterns. We plan to publish the data in a high-ranking open access journal, making data available following FAIR principles.

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