

Wanted: Master student

The genomic basis of heavy-metal adaptation in plants

Background

Knowledge of the genes involved in adaptation of plants to metal-enriched soils are of great importance to understand the evolution of metal-tolerant and -hyperaccumulating plant species. The Brassicaceae *Arabidopsis halleri* (right, photo by Martin C. Fischer) is a perennial plant that can tolerate and hyperaccumulate heavy metals. In the ongoing project AriaDNA, a collaborative effort between the Swiss Federal



Research Institute WSL and the W. Szafer Institute of Botany from Krakow (Poland), we reciprocally planted cloned plants from two metal-rich and two non-metal sites in their home and away habitats. We assessed various fitness traits related to growth, photosynthetic capacity, and reproduction. Moreover, we sequenced the whole genomes of the different clones used in the experiment.

Objectives

Based on an established set of around 2.5 million single-nucleotide polymorphisms (SNPs) and the phenotypic traits assessed in the reciprocal transplant experiment, we will perform genotype \times phenotype association analyses to identify the genetic basis of these fitness-relevant traits in relation to heavy-metal enriched soils. We will compare the outcome to a recently published study (Sailer et al. 2018, Scientific Reports 8, 16085) that looked at environment \times genotype associations in the same four populations. The work will yield important insights into the genomic basis of fitness-relevant traits in respect to heavy-metal adaptation.

Methods

The thesis will focus on statistics and analysis. Based on genomic resources (SNPs) and phenotypic data (experiment) already available, the student will perform different genotype \times phenotype associations and add additional evidence by analyzing gene pathways, gene diversity, and functional gene characterization. Consequently, no field and lab work is planned. The results will be reported in scientific paper format and are planned to be published if successful.

Please contact the supervisors if you are interested:

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Project AriaDNA: <https://info.botany.pl/ariadna/>

Working place: WSL, Birmensdorf