University of Warsaw, Faculty of Biology, Institute of Experimental Plant Biology and

Biotechnology

Department of Plant Molecular Ecophysiology

Project Title: Identification loci responsible for maize adaptation to cold condition at early

stages of development

Competition type: NCN OPUS 25

Project leader: dr Marcin Grzybowski

Position in the project: PhD Student

Number of job offers: 1

Stipend amount/month: 4200 PLN gross

Position starts on: 01.10.2024

Maximum period of contract/stipend agreement: 36 months

Profile of candidates/requirements:
 Formal requirements:
- Msc degree in biology or related discipline. The Msc degree should be be obtained before the date of starting work in the project
- The successful candidate is expected to enroll in the Doctroal School of the University of Warsaw (https://szkolydoktorskie.uw.edu.pl/en/sdnsip-2/)
 Practical requirements:
- Basic knowledge of Linux operating system and scripting language such as R, Python
- Good knowledge of English
- Experience in conducting plant experiments and familiarity with high-performance computing systems is encouraged, but not mandatory.
- Knowledge of plant biology, including genetics and physiology, will be considered an additional advantage.

Project description:

Maize, originally domesticated in the warm climate of southwestern Mexico, is now cultivated worldwide, including temperate regions of North America and Europe. In temperate climates, maize faces cold stress during early growth stages. Significant natural variation in response to cold stress exists in maize, evident both morpho-physiologically and transcriptomically. Many modern inbred lines demonstrate resilience to cold stress. However, the precise mechanisms driving this adaptation remain elusive. To investigate and identify the genetic loci and associated genes responsible for maize adaptation to cold spring condition, three approaches will employed: automated plant phenotyping, quantitative genetics, and population genetics.

In the initial phase of the project, analyses will be conducted on the response of maize to cold stress using a diverse association panel. This panel will encompass tropical genotypes, temperate-adapted historical breeding material, and recently developed lines. The analyses will span both morpho-physiological and

transcriptomic levels. Subsequently, genome- and transcriptome-wide association studies (GWAS/TWAS) will be carried out for all morpho-physiological traits to identify quantitative trait loci (QTLs) responsible for regulating these traits and their alterations under cold conditions. Simultaneously, expression GWAS (eGWAS) will be performed for all genes to uncover expression quantitative trait loci (eQTLs).

Many loci targeted by selection during adaptation and modern breeding may not directly contribute to an obvious phenotype. Therefore, population genetic methods will be utilized to detect putative selected regions of the genome between different maize groups: tropical versus old breeding material, and old breeding material versus recently released lines. Finally, overlaps between differently expressed genes, eQTL, QTL, and selected regions will be examined to identify genes responsible for maize adaptation to cold conditions. The project's results are expected to significantly enhance our understanding of maize response to low temperatures and its adaptation to temperate climates.

Key responsibilities include:
- Conducing plant experiments, including: maintaining plant growth, performing scoring plant traits (phenotyping), collecting material for RNA sequencing
- RNA isolation
- Conducting gene expression analysis (using RNA-seq data) and quantitative phenotypic data analysis
- Preparing scientific presentations and manuscript drafts
- Participating in seminars and conferences

Required documents:
- Cover letter, including short description of master thesis
- Curriculum vitae with the list of scientific activities
- Address details of at least one direct supervisor/scientist who may recommend the given candidate
- Copy of MSc certificate (or, if the MSc certificate has not been obtained yet, a certificate/document about the date of MSc defense)
- Document confirming the status of PhD Student (to be provided before starting work in the project) For the purpose of the recruitment process, please attach a scan of signed, written permission for recruitment-related personal data processing, which states: „I give permission to the University of Warsaw, registered at the address of ul. Krakowskie Przedmieście 26/28, 00-927 Warszawa, to process my personal data for the purposes of carrying out the recruitment procedure, choosing the employee, and entering into an employment contract with the University of Warsaw, if applicable. I have been informed about my legal rights and obligations in relation to these actions. I acknowledge that providing the aforementioned personal data is done by me on a voluntary basis."

Please submit the following documents to: marcin.grzybowski@uw.edu.pl

Application deadline: 31.05.2024

Date of announcing the results: 17.06.2024

Additinal information can be obtained from project leader: marcin.grzybowski@uw.edu.pl

The scholarship recipient will be selected based on a competition conducted in accordance with the Regulations for Awarding Scholarships in Research Projects Financed by the National Science Centre, as specified in Resolution No. 124/2022 of the NCN Council dated December 1, 2022.