Ph.D. projects in progress

1.

Mentors: Dénes Dudits, Ferhan Ayaydin

Doctoral School: University of Szeged, Faculty of Science and Informatics, Doctoral School of Biology

Ph.D. student: Feríz Rádi

Title of the research topic: Expansion of genetic resources of the Hungarian maize breeding materials with innovative methods

Description of the research topic: Methods supporting precision breeding of maize were developed. Dihaploid (DH) technology using the R1-navajo (R1-nj) gene encoding a phenotypic marker was combined with genome size determination using flow cytometry. Genome editing methods for targeted nucleotide exchange with synthetic oligonucleotides in plants depend on in vitro tissue culture systems. In this study, we presented an alternative using in planta technology based on the injection of oligonucleotide solution into the apical meristem region of haploid maize seedlings. Induction of a specific mutation in the phytoene desaturase gene of chlorophyll biosynthesis served as a phenotypic marker. Sequencing confirmed the presence of mutant and wild-type cell populations in leaf tissues. This procedure can reduce off-target mutations generated by in vitro methods.

2.

Mentors: Györgyi Ferenc, Antal Kiss

Doctoral School: University of Szeged, Faculty of Science and Informatics, Doctoral School of Biology

Ph.D. student: Bence Varga

Title of the research topic: Targeted alteration of plant gene expression with chemically modified oligonucleotides

Description of the research topic: Recombinant DNA technology opened new possibilities in plant breeding. At the beginning, alterations of the plant genome and acquisition of new traits were achieved by the introduction of transgenes. A drawback of this method is the random integration of the transgenes into the genome. Thus, the development of techniques allowing targeted modification of the function of selected genes became necessary. The goal of our research is the development of methods using chemically modified oligonucleotides to achieve the desired genetic or epigenetic changes. The purpose of chemical modifications is to increase binding specificity and *in vivo* stability of the

oligonucleotide.

A growing body of data suggest that the expression of genes can be influenced by changing their epigenetic characteristics such as the pattern of DNA methylation. One of our research goals is to explore the possibilities of using modified oligonucleotides to increase the specificity of targeted DNA methylation.