Institute: Institute of Botany

Topic: Hybridization and introgression processes within populations of *feather grasses* in lowland and mountain steppes

Name of supervisor: prof. dr hab. Marcin Nobis
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Background information:
The evolutionary significance of hybridization in speciation has been a very interesting question for decades. Nowadays new genomic data are increasing research attention to this topic. Studying natural hybridization provide opportunities to gain data that are not easy to obtain from laboratory crosses because they usually involve relatively few generations of recombination. Generally, approximately 25% of plant species are able to hybridization in the wild and up to 11% of flowering plants may be the results of hybridization events. We presume that natural hybridization also represents an important factor influencing the high diversity of *Stipa,* and we predict that around 30% of the genus species could have a hybrid origin (Nobis et al. 2020). Our research concerning the hybridization within *Stipa caucasica – S. kirghisorum – S. richteriana* complex will provide novel insights into empirical studies of natural hybridization. New evidence about the hybrid origin of selected *Stipa* species will help to clarify genetic processes within the populations and the genus and complement knowledge about hybrid speciation in plants.

The main question to be addressed in the project:
Are there genotypes adapted to different environmental conditions within the particular species range? Is the ability to hybridization and introgression equal within a different part of the species distribution range? Will climate change lead to the overlap of ranges between species (that show hybridization ability) in areas where so far their ranges have not overlapped?

Information on the methods/description of work:
Field research will be conducted in the lowland and mountain feathergrass steppes of Middle Asia (Kazakhstan, Kyrgyzstan, Tajikistan). We aim to assess the genetic structure of parental-hybrid populations, check the frequency of hybridization and introgression within the climatic gradient and due to climate change (under different climate models and scenarios), and whether climate change will increase the likelihood of hybridization in populations that have currently not been in contact with other species. For each species, we will select localities from different parts of the geographical range where the species coexist with other related species. From such a population, we will collect 20 individuals for each of co-occurring taxa and individuals that will exhibit hybrid characteristics. During the fieldwork environmental data as well as plant materials for morphological, molecular, and syntaxonomic examinations will be collected. SNP genotyping by high-density sequencing will be done by using the DArT method, which represents a combination of complexity reduction method and next-generation sequencing, optimized for each organism to select the most appropriate complexity reduction method (Baiakhmetov et al. 2020).

Additional information
A potential candidate should possess knowledge and experience in designing and conducting interdisciplinary research. The candidate needs to have the ability to work in the research team. Excellent written and oral skills in English language are required.

Name of potential foreign collaborator:
Prof. Georgy Lazkov, Kyrgyz Academy of Sciences

References:
1. Baiakhmetov, E., Ryzhakova, D., Gudkova, P.D., Nobis M. 2021. Evidence for extensive hybridisation and past introgression events in feather grasses using genome-wide SNP genotyping. BMC Plant Biology 21, 505

2. Nobis M., Gudkova P.D., Nowak A., Sawicki J., Nobis A. 2020. A synopsis of the genus Stipa (Poaceae) in Middle Asia, including a key to species identification, an annotated checklist, and phytogeographic analyses. Annals of the Missouri Botanical Garden105: 1-63