

Report on the outcomes of a Short-Term Scientific Mission¹

Action number: CA18201

Grantee name: Bojana Stojanova

Details of the STSM

Title: Contemporary evolution of floral traits in arable weeds revealed by the resurrection method

Start and end date: 16/10/2023 to 31/10/2023

Description of the work carried out during the STSM

Description of the activities carried out during the STSM. Any deviations from the initial working plan shall also be described in this section.

(max. 500 words)

The applicant learned how to dissect, mount and photograph preserved flowers to measure floral morphometric characters through training through research provided by Peter Glasnovic. The applicant was then trained to use the software ImageJ to measure floral characteristics related to pollinator attractivity (petal length and width, corolla tube length, anther and stigma size), as well as to selfing ability (anther-stigma distance). The applicant mounted and photographed over 400 flowers of two entomophilous, self-compatible, short-lived species, *Centaurium erythraea* and *Matthiola tricuspidata* for which samples were collected from ancestral genotypes (grown from 30-years old seeds) and contemporary genotypes (grown from seeds harvested within the past 5 years from the exact same location). During the STSM priority was given to determining the most relevant morphometric traits, and dissecting and photographing all available samples in order to make sure that they were obtained and photographed in standardized conditions (same camera set up, same experimenter), and thus the resulting images will have less variation due to random, non—biological factors. About 30% of the photographed flowers were also analysed in ImageJ, which is a highly time-consuming task. The applicant also discussed possible results treatment after all the data has been gathered.

The applicant organized a seminar for the students of the Nature Conservation programme where she presented the current work of the STSM, as well some of her previous work related to the study of contemporary plant adjustment to environmental change.

The workshop titled 'Estimates of outcrossing rates in natural populations' could not be organized because of incompatibilities with the schedule of interested participants. Instead, the applicant

¹ This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

acted as a supervisor for a week for a BSc student that was realizing her practical work at the University of Primorska, providing training for practical work, detailed information about the work carried out in the scope of STSM, and general information about plant biodiversity conservation, which is the thesis topic of the BSc student.

Two short videos are planned to showcase the results of the STSM – one general promotional about the STSM and its unfolding over the course of 2 weeks (available [here](https://youtu.be/ohq1DSdPC9k) <https://youtu.be/ohq1DSdPC9k>), and one scientific video about the main research results, planned for December 2024.

Description of the STSM main achievements and planned follow-up activities

Description and assessment of whether the STSM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the STSM. Agreed plans for future follow-up collaborations shall also be described in this section.

(max. 500 words)

The STSM produced an impressive amount of raw input regarding floral morphometric traits in two arable species, which will be statistically analysed by the end of 2023. The results of the analyses will be included in **two manuscripts planned for the spring of 2024** – one assessing the shift of floral attractivity and selfing ability of *C. erythraea* over the past 30 years in a common garden, and one manuscript estimating the adaptive character of putative floral trait shifts in *M. tricuspidata* that have occurred over 24 years in simulated past and present-day environment. Both manuscripts aim to contribute to the understanding of how floral traits and mating systems in arable weeds have evolved in response to climate change and pollinator decline over contemporary timescales. The choice to insert these results in larger publications instead of producing a standalone short communication was made with the goal to increase their impact and visibility, as manuscripts compiling various phenotypic and genetic data (in addition to the floral morphometric data) have higher probability of being accepted in well-known botanical and conservation journals. The results will also be disseminated through invited seminar presentation, two of which are already programmed (14th of December at the University of Grenoble, France, and the spring semester and the Masaryk University in Brno, Czech Republic), as well as international scientific conferences (PopBio 2024 in Frankfurt, Germany).

The combined results will help disentangle between two possible scenarios in response to pollinator decline:

- Arable weeds have evolved to maintain their outcrossing rates despite pollinator decline, resulting in larger, more attractive flowers in contemporary genotypes compared to their ancestors
- Arable weeds have evolved towards increase selfing ability (reduced anther-stigma distance, reduced anther size), which can be accompanied by reduced pollinator attractivity (smaller flowers). **This latter scenario can lead to short-term increase of arable weeds fitness, but a long-term decoupling of plant-pollinator interactions in agroecosystems.**

Disentangling between these two scenarios is key to understand the eco-evolutionary dynamic between arable weeds and their pollinators, the ecosystem services they provide, and how will the organisms and their services be affected by anthropogenic environmental change. Despite the currently non-endangered status of many arable weeds, **conservation actions need to be undertaken before the genetic diversity of extant arable weed populations is irreparably lost, and before the plant-pollinator trophic interactions are decoupled**. Additionally, the trends observed with arable weeds likely occur in other threatened plant species, having major implications for the design of their conservation plans. The results of this STSM will therefore directly contribute to the Tasks 1.1 (Recognition of the importance of mutualists (including pollinators) for plant conservation) and 1.2 (Identification of the potential uses of population biology, conservation genetics and genomics) of the WG1. Moreover, the results of the STSM will

underline the importance of appropriate ex-situ seed conservation which beyond preservation of diversity, is key for producing high-quality resurrection studies, in line with the objectives of WG2.