AGENT Project – Genebank Review

Place: Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben

Date: July 19-20, 2022

Participants IPK: Ulrike Lohwasser, Nils Stein, Stephan Weise, Dörte Harpke, further staff members

Reviewers: Dagmar Janovská (CRI Prague), Ludmila Papoušková (CRI Prague), Pavol Hauptvogel (NPPC Piešťany), Iveta Čičová (NPPC Piešťany)

Background

Within the AGENT project a new approach is tested to review the operations of European genebanks (GB) and guide their improvement through a system of reciprocal visits and support. The blueprint of a GB monitoring system, as adopted by the European Genebank Integrated System (AEGIS), will be tested by focusing on the European collection holders of wheat and barley cooperating within AGENT. This will serve as an example for wider use within the European network. Curators of 11 GBs will visit each other's facilities and evaluate the efficiency of operations based on jointly prepared protocols. Reports will offer recommendations for improvement and will be used to approach suitable funding agencies for targeted capacity building. In the first cycle the genebanks of CRI (Czech Republic), NPPC (Slovakia) and IPK (Germany) are involved.

Visit/Organization

Ulrike Lohwasser (IPK) organized the visit of IPK Genebank and meeting with reviewers Dagmar Janovská (CRI Prague), Ludmila Papoušková (CRI Prague), Pavol Hauptvogel (NPPC Piešťany), Iveta Čičová (NPPC Piešťany). The detailed programme as well as the most important documents supporting the conservation of PGRFA (e.g. https://genres.de/fileadmin/SITE_MASTER/content/Publikationen/Plant_Genetic_Resources_NationF_en.pdf) was provided before the visit to IPK. Nils Stein (head of Genomics of Genetic Resources Research group) from the Genebank Department introduced the Institute. The scientific focus of the Institute is on the development of new insights into the structure, function, and evolution of plant genetic material, on the conservation, research, and development of the hereditary diversity of important cultivated plants, their ancestors, and wild relatives.

The Federal Ex situ Genebank is deeply integrated into the research structure of the IPK. It is an integral part of the research department Genebank, research groups Resources Genetics and Reproduction, Genebank Documentation, Cryo and Stress Biology and the satellite collections North. The core responsibilities of the Federal Ex situ Genebank are to collect, conserve and characterise plant genetic resources and to conduct research and development relevant to plant genetic resources conservation.

Ulrike Lohwasser presented the activities of all research groups in detail, which are part of the Genebank Department.

The reviewers visited laboratory facilities, herbarium, isolation cabins, tents, bags, glasshouses, *in vitro* laboratory and cryopreservation facilities, microphenomics, macrophenomics, phytochamber, greenhouse and storage of plant genetic resource samples. Stephan Weise (head of Genebank Documentation research group) explained in detail the PGRFA documentation of the information system - The IPK Genebank Information System (GBIS) https://gbis.ipk-gatersleben.de/gbis_i.

The reviewers had the opportunity to see field experiments for multiplication and evaluation of PGRFA, further greenhouse and isolation cages with pollinators for legumes, medicinal plants as well as oil plants and vegetables on the second day.

Outcome of the Review

Management/Funding

The Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) was founded as Kaiser Wilhelm Institute for Crop Plant Research in 1943, incorporated into the GDR Academy of Sciences in 1948 and re-established as IPK in 1992. Over the course of the Institute's 75 years of existence, it has developed into a world-leading plant research centre. Its current staff of 120 scientists and 60 PhD students come from more than 30 countries, and it is supported by 265 technicians and 31 administrative workers. The state of the staff is well above average and very positive in supporting research and conservation of plant genetic resources. The certified quality management system (ISO 9001:2015), valid until 30 March 2025, provides the necessary level of quality control. The material of Genebank is provided under the regulations of the SMTA.
Funding of IPK including the Genebank is sufficiently secured in two ways: 1. Institute's core funding: 36.9 Mio€ 2. Third-party-funding in 2021: 11.5 Mio€.
The seeds from the Genebank are available on the basis of international conventions and treaties: Convention of Biological Diversity (CBD) with its Nagoya Protocol, International Treaty for Plant Genetic Resources of Food and Agriculture (ITPGRFA), by Standard Material Transfer Agreement (SMTA), Breeders rights and any other special agreements. All Genebank material is available on the base of SMTA, not only the species under Annex 1 of the ITPGRFA.

Recommendation 1

There are no recommendations in terms of management and funding for the IPK Genebank. The Genebank has a high level in all activities and procedures, and it is recommended to continue the existing trend.

Germplasm Management

The Federal Ex situ Genebank is one of the world's largest plant germplasm collections, both in terms of the botanical diversity represented and the number of accessions held: currently its holding comprises 152,014 accessions, spanning 92 families, 758 genera and 3,095 species. The bulk of the collection is stored as seed, housed in 5 cold rooms maintained at -18°C, under which conditions seed viability typically lasts several decades. The seeds are stored in sealed

glass containers, which are stored on shelves behind each other. Reference collections include: 449,767 herbarium sheets, 109,990 seeds and fruits, 57,062 cereal spikes.

Accessions are stored in base and active collections, there are no maximum limits of seeds. For the base collection, stored in aluminum bags under vacuum conditions, there is a minimum number of stored seeds twice as much as the number of seeds needed for sowing of particular crop.

The seed germination test is done only once out of 50 seeds. In order to determine germination objectively, it would be necessary to do germination in two repetitions.

Recommendation 2

According to the ISTA rules and recommendation of FAO, 200 seeds for the initial germination test is usually used. However, in IPK only 50 seeds are used for the test. Therefore, to objectively determine germination, we recommend that at least two replicates be performed.

Fields experiments

Field evaluation of plant genetic resources is carried out on a huge area where standard conditions for plant growth and multiplication are ensured. The 18 ha experimental field "Selkenbreite", which is mostly dedicated to the regeneration of Genebank materials, is managed using a five-field rotation system. Perennial crops are maintained as permanent plantings (comprising of 3 ha), while bulb-forming crops as onion and garlic are cultivated in a separate 2 ha field, which is relocated every 4-5 years for phytosanitary reasons. Around 100 plots of cross-pollinating species are distributed across the site, in order to achieve their reproductive isolation.

In Vitro/Cryo Preservation

Vegetatively propagated materials are maintained as permanent crops in the field and/or subjected to *in vitro* culture or cryopreservation. The latter procedure, which involves storage under liquid nitrogen at -196°C, is applied to over 2,000 accessions, including 1,730 potatoes. There are *in vitro* collections containing 236 samples and cryo collection which includes 2,397 samples.

Safety duplicates

Safety duplicates of the seed of 64,233 of the accessions have been deposited at the Global Seed Vault in Svalbard, Norway. All fresh regenerated material will be duplicated in the Seed Vault until all accession have a safety duplicate.

Information system

The IPK Genebank Information System (GBIS) offers the possibility to obtain information about the holdings of the Federal Ex situ Collection by specifying free or scientific search criteria. After creating a user account, it is possible to access to the integrated ordering system. The utility of any genetic resource is heavily dependent on the body of metadata associated with it, including its passport (geographic origin and taxonomic classification), its agronomic performance, its biochemical characteristics, and - increasingly - its genotype in the form of

DNA sequence. The marriage of biological resources with digital information is in line with the Federal Ex situ Genebank's mission to become a bio digital Resource Centre.

Final conclusion

The IPK Genebank Gatersleben is a technical facility that holds the largest collection of plant genetic resources in the EU. It operates in a certified quality management system. Extensive research is carried out in the areas of the genetic architecture of seed longevity, seed viability, vigour and longevity, mapping and identifying genes for drought tolerance, genomes, and phenotypes of Solanaceous crops, edaphic adaptation in barley wild relatives, crops for increased diversity in agriculture. The researchers have many scientific publications in peer-reviewed journals and are also successful in obtaining many national and international projects.

Final remarks

The reviewers have agreed that all the activities in the Genebank are of a very high level. Ulrike Lohwasser answered all questions and provided all requested information with maximum dedication during both days. The evaluators appreciated the pleasant working atmosphere, the work rate, and the top professionalism.

September 30th, 2022

Dagmar Janovská, Ludmila Papoušková, Iveta Čičová, Pavol Hauptvogel