Reinforcement of the AEGIS Quality System and EURISCO data coverage

Short title: **New AEGIS**

Proposal submitted for funding to the German Federal Office for Agriculture and Food

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Submitted by the Secretariat of the European Cooperative Programme for Plant Genetic Resources (ECPGR) - June 2024

Timeframe: 1 September 2024 – 28 February 2025

Budget: € 153,640

1. Background

At its 17th meeting in Oeiras, Portugal (May 2023), the ECPGR Steering Committee approved the objectives of ECPGR for Phase XI (2024-2028), which are aligned with priority actions identified in the Plant Genetic Resources Strategy for Europe (PGR Strategy), developed by ECPGR in the frame of the GenRes Bridge project (ECPGR, 2021)[1].

Among its priorities for the next phase, ECPGR includes the consolidation and sustenance of *ex situ* conservation, specifically by strengthening the AEGIS (A European Genebank Integrated System) initiative, and strengthening PGR information systems, through compilation and transfer of existing characterization and evaluation data to EURISCO. These specific priorities aim to contribute to the following 2030 objective of the PGR Strategy:

- By 2030, the PGR diversity in European genebanks is conserved reliably and made accessible for sustainable use, by improving the efficiency and efficacy of the European genebank infrastructure. Thus, the European *ex situ* conservation system will be raised to a level of excellence in terms of i) long-term quality (conservation management, viability, genetic integrity and phytosanitary protection) and ii) accessibility of conserved material to users, thereby positioning Europe as a primary contributor to the global PGR conservation and use effort.

The approach of the PGR Strategy to reach this objective foresees:

1. Establishing a certification system, that is economically sustainable and accessible to genebanks and collection holders, based on a quality management system (AQUAS) with standards and a (external) monitoring system, via a) consolidating AQUAS using generic FAO genebank conservation standards and agreed crop-specific adaptations when appropriate, along with simple and inexpensive performance indicators and a reporting system and b) establishing and running a monitoring system, based on both internal and independent peer reviews and a certification mechanism.
2. Creating capacity building and facility improvement mechanisms that support genebank managers to achieve the standards needed for AEGIS certification, as follows: …*inter alia* via

[1] https://www.ecpgr.org/resources/ecpgr-publications/publication/plant-genetic-resources-strategy-for-europe-2021

> a monitoring system for identifying needs for capacity and facility improvement, creating capacity building activities, raising knowledge at all levels…supporting exchange of knowledge and experiences via websites, publications and social media, as well as staff exchanges and conferences, … training material at all levels, … supporting facility improvements, etc.

The ECPGR SC in the 17th meeting also reiterated the need to coordinate activities to strengthen AEGIS.

The AEGIS initiative aims to conserve unique European germplasm efficiently and perpetually, as part of a decentralized European Collection, according to agreed quality standards implemented by developing the AEGIS Quality System (AQUAS).
Benefits of the overall AEGIS initative relate to the improvement of the quality, safety and sustainability of conservation through a supportive management on a regional basis and ultimately lead to better coverage of the genepool, better quality of materials conserved, secured availability of materials and information, reduced redundancy of the collections and increase of knowledge transfer, integration and participation. These benefits apply to several stakeholders, i.e. the genebanks that operate in a mutually supportive network, the policy-makers and administrators who can rely on a more efficient use of resources, breeders and other users who have transparent access to data and high quality material under well defined standard conditions, the general public who can rely on long-term conservation of *ex situ* agro-biodiversity, an insurance to address future climate change and food security scenarios.
The European Collection material is made available to users under the terms of the ITPGRFA, even for non-Annex 1 crops. AEGIS was started in 2009 and currently has 35 member countries and 63 Associate Member (AM) institutions. The EURISCO database has ~122k accessions flagged as AEGIS, i.e. that are part of the European collection of unique materials.
The AQUAS quality system, agreed by ECPGR in 2009[2], outlines policies, processes and procedures that AEGIS members shall follow to ensure an appropriate quality in their genebank activities. A well functioning AQUAS is the key element of a successful AEGIS, since it enables to increase the quality of the conservation throughout the region, based on standards to be achieved and peer reviews for reciprocal monitoring and support.
Even though partially successful, as indicated by its large membership and increasing inclusion of accessions in the European Collection, the AEGIS system has not been able to express its full potential, with its main limitation identified in the difficulty of establishing a fully operational quality system, with increased transparency of operations and monitoring mechanisms[3].
Transparency of operations is expected to start with the preparation by each AM of an operational genebank manual describing the current mode of operation across all their genebank management activities. Only a limited number (13) of AMs have so far prepared and made this document publicly available[4]. Its compilation has often been completed within the context of trilateral reciprocal reviews of genebank curators in the frame of European projects[5]. A deeper level of transparency is the publication of

[2] https://www.ecpgr.cgiar.org/aegis/aquas/overview
[3] Hintum, T.; Engels, J.M.M.; Maggioni, L. (2021). AEGIS, the Virtual European Genebank: Why It Is Such a Good Idea, Why It Is Not Working and How It Could Be Improved. Plants 2021, 10, 2165. https://doi.org/10.3390/plants 10102165
[4] https://www.ecpgr.org/aegis/aquas/genebank-manuals
[5] Horizon projects GenResBridge and AGENT, https://www.ecpgr.org/aegis/aquas/peer-visits

Standard Operation Procedures (SOPs), which describe in great detail every single step of the genebank operations. Only one genebank (CGN, the Netherlands) has so far made these procedures publicly accessible[6]. In preparation for a systematic monitoring mechanism of genebank activities, a tool called 'Genebank Metrics' has been developed in prototype form by CGN. This is a list of parameters related to genebank activities, which enables real-time monitoring of all aspects of genebank management. By filling in a template with genebank operation data, a script enables an easy calculation of all the relevant parameters to understand the status of the genebank at a certain moment or during a certain period (i.e. size and composition of the collection, data and documentation, conservation, availability, distribution, etc.). Involvement of various AMs in developing and testing (eventually adopting) this tool would create common terminology, increase transparency and enable harmonized and comparable monitoring across the region. This could also be the basis for prioritization of capacity building activities, reporting in a certification system and to funding agencies and the wider public.

So far, ten ECPGR Working Groups have developed **crop-specific genebank standards**, providing additional guidance and procedures for conservation activities[7]. Other Working Groups have not yet reviewed the FAO Genebank Standards in view of adapting them with crop-specific guidelines. Working Group Chairs can be incentivized to prepare these standards in collaboration with their WG members.

Many past or ongoing international projects funded by ECPGR or the European Commission have generated valuable **characterization and evaluation data** on European PGR accessions, but these data are typically dispersed in project-specific databases, associated with publications or stored on local computers. To make these data reusable by researchers and allow further exploitation, they should be accessible and directly linked with passport data of the evaluated accessions. EURISCO is the centralized European catalogue of PGR and provides a repository for C&E data, adding value to European PGR, which is also a priority for ECPGR. Making these phenotypic data centrally available in the European database is a key step to add value to the material that is either already part of AEGIS or can be designated to enter AEGIS in the future. The more information is made available for the material in EURISCO, the better this can be investigated and selected by breeders or other users for introduction into breeding programmes or suitable growing conditions in farmers fields.

2. Project description

Within the context described in the background, a project is proposed with activities strengthening AEGIS and EURISCO. This project proposal outlines activities directly related to the above-mentioned ECPGR priorities and will specifically address some of the obstacles that have made the AEGIS initiative only partially successful so far, as well as improving phenotypic data coverage in EURISCO.

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[6] https://www.ecpgr.org/aegis/aegis-membership/associate-members/Netherlands/NLD037; https://www.ecpgr.org/resources/latest-news/news-detail/cgn-the-netherlands-sets-precedent-with-public-access-to-standard-operating-procedures

[7] https://www.ecpgr.org/aegis/aquas/genebank-standards/agreed-standards

The aim is to support the AEGIS Associate Member (AM) institutions to honour their commitment to operate according to quality principles, starting with transparency of their operations. Capacities of the AMs will be built through direct and indirect support, ensuring the preparation of operational genebank manuals, encouraging the publication in English of Standard Operating Procedures (SOPs), promoting a methodology to increase transparency of operations through the development of a list of agreed genebank metrics and organizing reciprocal peer visits across genebanks. A helpdesk at the ECPGR Secretariat will ensure support to the AMs throughout the project and will organize meetings to facilitate implementation of tasks and finalize documents and agreements.

Working Group Chairs will be incentivized to complete crop-specific genebank standards, in collaboration with their WG members, also relying on the Secretariat helpdesk support.

Furthermore, the project will collect existing characterization and evaluation data from previous ECPGR and EC projects and prepare them for inclusion in EURISCO using the standard template. This will allow centralization of dispersed phenotypic data on EURISCO accessions. Examples of projects for which data will be compiled and curated are CarrotDiverse, SMARTLEG, EUGrainLeg, Eurolegume and BrasExplor, among others.
Overall, these measures will facilitate access to crop accessions and associated phenotypic data of underused European germplasm collections for use in research and breeding, contributing to adaptation measures to climate change and ensuring food security.

Finally, public awareness products will be prepared to communicate the importance and impact of the project's achievements: creating transparency and improve quality of genebank activities and sharing data.

The main impact that this project is expected to reach is to improve transparency of operations of the AEGIS Associate Member genebanks, and their capacity to increase their quality, through a coordinated and centrally-supported commitment, preparation of monitoring tools and enhancement of peer support. Furthermore, the project will promote efficient sharing of genebank data, including phenotypic information.

3. Objectives of the project

1. Strengthening of AEGIS by supporting the AEGIS Associate Members towards the implementation of their commitments
    - Facilitate preparation of missing operational genebank manuals
    - Analyze genebank manuals and provide observation/recommendations for action
    - Develop agreed genebank metrics documents by pilot genebanks
    - Translate and publish Standard Operating Procedures of pilot genebanks
2. Strengthening of AEGIS by completing the definition of AQUAS standards

- Provide preparation of crop-specific standards as part of the AEGIS Quality System (AQUAS)

3. Improving C&E data coverage in EURISCO
    - Include into EURISCO existing characterization and evaluation data from at least 100 accessions each of different legume and vegetable crops phenotyped in previous projects.

4. Activities

AEGIS-related activities (these activities will ensure a reactivation of all the AEGIS Associate members towards the implementation of the AEGIS commitments at institutional, national and regional levels. Transparency of procedures through the publication of genebank manuals and translated operating procedures will enhance reciprocal trust and collaboration among the members, triggering a series of mutually supportive actions, including emulation to improve the effectiveness of all procedures. Self-monitoring and peer-monitoring systems will be tested and finetuned. Overall, the quality of operation of the AEGIS genebanks will increase and become more visible and recognizable. This step-change should have an impact, accelerating integration and mutual support of the AEGIS genebanks, as well as incentivizing the size increase of the Europen Collection. Ultimately, a well-functioning AEGIS system will guarantee proper and more efficient conservation of PGR in Europe and better serve the needs of breeders and other users):

i. Kick-off online meeting with AEGIS Associate members to explain the project, discuss items for the implementation of AEGIS (genebank manuals, designation of AEGIS accessions, safety-duplication, distribution policy, quality system with peer reviews, Standard Operating Procedures, genebank metrics); seek volunteers for pilot activities (analysis of genebank manuals, contribution to genebank metrics agreement, peer reviews).
ii. Provision of ‘seed-money’ contributions to max. 20 Associate Members to incentivize preparation of genebank manuals.
iii. Analysis of genebank manuals by peer experts with the objective of identifying strengths and weaknesses and elaborating a summary of the current mode of operation in the region, with annotations and recommendations.
iv. Translation into English of Standard Operating Procedures by those AMs in agreement with making the SOPs public.
v. Based on the CGN draft list of genebank metrics, a few pilot genebanks will discuss reaching an agreed list and provide examples of its implementation. A resulting document will be prepared in draft form, intended for further finalization and publication.
vi. Preparation of at least two crop-specific standards under the coordination of the respective WG Chair or WG member(s).
vii. Establishment of a helpdesk at the ECPGR Secretariat to provide advice on the implementation of activities agreed during the online meeting, in particular preparation of genebank manuals, crop-specific standards, organization of peer reviews, development of genebank metrics agreement.
viii. Organization of reciprocal peer visits of tentatively six AM genebanks to improve reciprocal knowledge and standards.

ix. An in-person final project meeting of ca. 30 AMs will be organized to present and finalize all the project outputs, discuss recommendations regarding operational manuals, genebank metrics agreement and implementation, safety duplication and distribution policies, publication of SOPs and peer review experiences. Perspectives for a increased coverage of the European Collections with multiplications and safety-duplications will also be discussed, and opportunities and solutions proposed.

Activities to strengthen EURISCO (these activities will enable inclusion in EURISCO of phenotypic data that were generated by past ECPGR or EC projects and were not linked to the publicly available centralized database. These data will thus become comparable with other existing published data and will enable more knowledgeable selection of the material in EURISCO, and possibly in AEGIS. This action will add value to the work carried out by previous publicly funded projects and ultimately improve the mass of data that are so useful for bredeers and other users of plant genetic resources)**:**

x. Use the EURISCO templates to transfer to EURISCO existing characterization and evaluation data of European plant genetic resources accessions generated in previous projects

Public awareness activities (these activities will enable widespread visibility of the results obtained through this project and thus inform users, policy makers and the general public about improvements and impact achieved)**:**

xi. Update the AEGIS website with information on the project and publication of all the documents/products developed.
xii. Brochure explaining what has been done, why it's important, and future steps and social media posts featuring short videos/animations showcasing key project results.

5. Expected outcomes

a) AMs participating in the project increase their awareness of the AEGIS principles and contribute to increasing quality of operations and accessibility of the European Collection
b) At least 20 new operational genebank manuals developed
c) All prepared genebank manuals are analyzed and compared. This analysis generates an overview of current practices, and general and specific recommendations for improvement
d) Three sets of tcrop-specific genebank standards are developed
e) Between five and ten AMs agree to make their Standard Operating Procedures public and provide their translations in English
f) A genebank metrics list is agreed by a group of pilot genebanks and a document is ready in advanced draft for publication
g) Existing characterization/evaluation data for as many as possible accessions of grain legumes, vegetables and other PGR accessions made available via integration in the EURISCO catalogue.

h) Six reciprocal review visits of genebanks are completed, with the respective reports compiled and published online.
i) A kick-off online meeting and a final physical meeting of AMs are organized and held. A report of the final meeting is published online.

6. Chronogram of activities.

	2024		2025
Activity	Q3	Q4	January
Kick-off online meeting with AEGIS Associate members			
Preparation of genebank manuals			
Analysis of genebank manuals			
Translation of SOPs into English			
Discuss agreement on genebank metrics			
AEGIS helpdesk at Secretariat			
Genebank reciprocal visits			
Facilitate preparation and approval of crop-specific standards as part of AQUAS by the Grain Legumes WG			
Prepare existing characterization and evaluation data of European legume, vegetable and other accessions for transfer to EURISCO (partners to be identified)			
Preparation of public awareness products to publicize the project's outputs			
Final in person project meeting			