

BETA WG REPORT FOR PHASE IX (2014-2018)

Submitted to the 15th Steering Committee Meeting, Thessaloniki, Greece, May 2018
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1. CONTRIBUTION TO ECPGR OBJECTIVES

1.1. Achievements and success stories

Outcome 1. AEGIS is operational. Accessions in AEGIS are characterized and evaluated.

- In the framework of the different research projects the group contributed to the objectives of the ECPGR and AEGIS.
In particular, during the “Genetic diversity of *Patellifolia* species (GeDiPa)” project geographic gaps in the European Collection of *Patellifolia* accessions were identified and collection trips took place to close gaps. The action aimed at a better understanding of the spatial distribution of genetic diversity within the genus *Patellifolia*, the establishment of taxonomic standard accessions as well as the identification of Most Appropriate Accessions (MAAs) for AEGIS. A set of polymorphic SSR markers was developed suited to characterize genetic diversity of *Patellifolia* species and allow the rationale selection of MAAs for AEGIS, and recommendations of Most Appropriate Wild Populations (MAWPs) were given.
- The Crop-specific genebank standards for orthodox seeds for *Beta* and *Patellifolia* species were prepared according to modifications and additions indicated by the WG to meet the crop specificities, and the FAO Genebank Standards for PGRFA were accepted.
The AQUAS quality system was adopted and implemented by the WG through the approval in March 2016 of the *Beta*-specific genebank standards for orthodox seeds.

Outcome 2. Quantity and quality of data in EURISCO, including in situ and on-farm data, have been increased. Functionality of EURISCO meets users' expectations.

- The members of the WG are searching ways to include in EURISCO the data that are registered in the International Data Base for Beet (IDBB), including passport data and characterization and evaluation data. The IDBB is an inventory of *ex situ* accessions maintained in an international, decentralized network of genebanks undertaken jointly by an international group of curators, researchers and users of beet germplasm. This internet site provides access to information systems suited to support the development of a complementary conservation programme for *Beta* and *Patellifolia*, allows the search for passport, characterization and evaluation data on genebank accessions and promotes the management and sustainable use of plant genetic resources of beets (*Beta* and *Patellifolia* species).
The Julius Kühn-Institut (JKI) is still operating the IDBB.
- The crop-specific Population Level Information System (CWRIS-AEGRO-PLIS) and Genetic Reserve Information System (GenResIS) provide access to information on plant occurrences observed in the ecosystems and natural habitats where they have developed their distinctive properties.

- EURISCO is not yet ready to host *in situ* and on-farm data.

Outcome 3. In situ and on-farm conservation and management of priority crop wild relative (CWR) and landrace (LR) populations are implemented throughout Europe. Mechanisms are in place for more effective utilization of the conserved germplasm.

- **GeDiPa project**

The project on “Genetic diversity of *Patellifolia* species ([GeDiPa](#))” was submitted by the *Beta* and Wild Species Conservation in Genetic Reserves Working Groups for funding under the ECPGR Activity Grant Scheme (Phase IX). The project was selected by the Executive Committee for funding in 2014, started in February 2015 and was completed in December 2016.

Partners in Spain, Portugal and Germany jointly analysed the patterns of genetic diversity of the genus *Patellifolia*, a crop wild relative of cultivated beets. The action aimed at the identification of collecting gaps and the identification of MAAs and MAWPs on an informed basis. To this end, a set of polymorphic SSR markers for *Patellifolia* was developed and used to study the geographic distribution of genetic diversity within the species as well as the genetic differentiation between occurrences sampled in the distribution area on site. The results were published online in the final Activity report as well as in two open access papers available from the Activity webpage.

- ***Beta nana* project**

Beta nana, a Greek endemic wild relative of beet, was on the agenda of the WG since 1999. The WG recommended organizing an *in situ* conservation project. In 2005, a joint (USA, GRC, DEU) plant exploration mission was conducted and afterwards more missions took place from the Greek Genebank. The investigation of the genetic population structure in this alpine species has been completed by scientists of the USDA-ARS in 2017. Results allowed to identify the most suitable area for the establishment of a genetic reserve. Model-based assignment analysis found three main genetic lineages that may reflect biogeographical processes known to occur in the flora of the Balkan peninsula. These genetic clusters all overlap to some degree in an area in the centre of the species distribution. It is also in this region that most of the observed multilocus genotypes occur and where the set of most diverse individuals is located. This area may be suited for the establishment of a genetic reserve.

The project contributed to the ECPGR objectives and helped promoting the cooperation with non-European partners.

- **BETANET project**

The project on “Improving a cooperation network between actors involved in conservation and utilization of *Beta* genetic resources ([BETANET](#))” was submitted by the *Beta* WG for funding under the ECPGR Activity Grant Scheme (Phase IX) in 2016 and re-submitted in 2017. The project was selected for funding by the Executive Committee in October 2017, started in December 2017 and will be completed in November 2018.

Partners from Italy, Greece, Germany, Portugal, UK, Ireland and Serbia participate in the project. The action will offer the opportunity to different stakeholders to collaborate and exchange opinions regarding the conservation, evaluation and utilization of *Beta* and *Patellifolia* germplasm. The project will strengthen networking, facilitate the dissemination of knowledge and enhance the relationship among the participants as well as establish relationships between the PGR conservation and user community and the nature / species conservation community.

The project will contribute to establish a complementary conservation action plan, to organize research project proposals focused on diversity studies and conservation

planning and to improve links between all stakeholder groups involved in beet genetic resources conservation and utilization programmes.

Outcome 5. Relations with users of germplasm are strengthened.

- **BETANET project**

The BETANET activity will strengthen networking, facilitate the dissemination of knowledge and enhance the relationship among the participants as well as establish relationships between the PGR conservation and user community and the nature / species conservation community. It will contribute to new and / or improved links between all stakeholder groups involved in beet genetic resources programmes at national, regional and international level.

1.2. Gaps or constraints identified

The projects and the actions listed above show the continued, engaged and trusting cooperation between members of the network of *Beta* and have positive results on the fulfilment of the objectives of ECPGR.

Although there are some major constraints identified:

- Decreasing opportunities for participation in the ECPGR Activity Grant Scheme projects because members might be interested to participate but their countries might not be eligible for funding or might not have available quota.
- Considering time and money investment, other funding opportunities seem more tempting than the ECPGR Activity Grant Scheme projects.
- Increasing institutional and national tasks and various priorities of the WG members might not allow them extra time to dedicate to the ECPGR obligations.
- Difficulties to organize meetings during Phase IX that could help to keep the WG united.
- Slow rate in the inclusion of accessions in the European Collection.
- Under-representation of vegetable breeders / breeding researchers (cultivar group Leaf Beet, cultivar group Garden Beet).
- CWRIS PLIS as well as the IDBB are hosted by JKI and kept operative. Means for updating are not available and the information is getting outdated.
- From mid-2019 onwards, the IDBB website will no longer be updated.

2. GRANT SCHEME ACTIVITIES

- **Grant Scheme proposals (submitted: 2; approved: 2)**

1. [Genetic diversity of *Patellifolia* species \(GeDiPa\)](#) – First Call (2014)

The purpose of this project was the improved service for research and breeding through the selection of MAWPs as components of a network of genetic reserves and the selection of MAAs for AEGIS.

Recommendations were given for further collecting to close geographic gaps in the European *Patellifolia ex situ* holding and selection of MAWPs and MAAs.

2. [Improving a cooperation network between actors involved in conservation and utilization of *Beta* genetic resources \(BETANET\)](#) – Fourth / Fifth Calls (2016/2017)

The purpose of this proposal is to offer the opportunity to different stakeholders to collaborate and exchange opinions regarding the conservation, evaluation and utilization of *Beta* and *Patellifolia* germplasm. The project will strengthen networking, facilitate the dissemination of knowledge and enhance the relationship among the participants as well as establish relationships between the PGR conservation and user community and the nature / species conservation community.

- **Total number of partners involved: 30 from 10 countries**

- ECPGR-funded: 14 from 8 countries
- Self-funded: 16 from 8 countries

- **Meetings held**

1. GeDiPa coordination meeting, Madrid, Spain, 17 February 2015

- **Reports and related data**

- GeDiPa Project**

- [Genetic diversity of *Patellifolia* species \(GeDiPa\) – Interim Activity Report](#)

- [Genetic diversity of *Patellifolia* species \(GeDiPa\) – Final Activity Report](#)

- **Funds mobilized**

- ECPGR granted funds: € 29.300
- Inputs in-kind declared in Grant activities: € 38.000

3. OTHER ACTIVITIES (CROSS-WORKING GROUP ACTIVITIES, LINKS WITH OTHER NETWORKS, PROJECTS AND INITIATIVES)

- **Cross-Working Group activities**

- The GeDiPa activity (above) was submitted jointly with the Wild Species Conservation in Genetic Reserves WG.
- The “Networking among Working Groups for discussing and coordinating the implementation of ECPGR objectives ([ECPGR Networking](#))” activity was submitted jointly with all WGs under the Fourth call of the ECPGR Activity Grant Scheme. The main aim of this project was to increase cooperation between the WGs’ Chairs with the support of the ECPGR ExCo and ECPGR Secretariat. Based on the results achieved, recommendations were given to the ExCo for planning the objectives for Phase X. On behalf of the *Beta* WG the Chairs P. Ralli and L. Frese participated in the meeting in Ljubljana, Slovenia, 17-18 October 2017. Their presentation for the activities carried out in view to synergistically implement the ECPGR objectives for Phase IX in the WG is available online [Beta](#).

- **Links with other projects**

- **CWRIS-AEGRO-PLIS / GenResIS**

The Crop Specific Population Level Information System (CWRIS AEGRO-PLIS) and the Genetic Reserve Information System (GenResIS) provide access to information on plant occurrences observed in the ecosystems and natural habitats where they had developed their distinctive properties.

- **AKER project**

The eight-year AKER programme launched in September 2012 and was supported by 11 partners, government agencies and private operators in the French sugar beet sector dealing with the management of genetic resources in the Genus *Beta*. The AKER project proposed to identify accessions that would contain rare alleles of interest to broaden the genetic diversity in elite germplasm. For this purpose a set of *Beta* section *Beta* accessions of diverse geographic origin was ordered from genebanks around the world. Dense molecular mapping and sequencing were carried out to help core collection selection and monitor diversity in order to estimate and exploit the available genetic diversity better.

- **PGR Secure project (EC FP7)**

During this project an analysis of CWR genetic diversity across the UK was undertaken and highlighted *in situ* and *ex situ* conservation priorities. This included working with Natural England (English national conservation agency) to establish the first UK genetic reserve for CWR taxa on the Lizard peninsula in the extreme Southwest of England. A priority taxon within the genetic analysis and conservation action was *Beta vulgaris* subsp. *maritima*, which is now actively conserved on the Lizard and seed samples deposited in the Millennium Seed Bank.

- **LIFE Recover Natura project**

This project started in 2014 and aimed to establish a genetic reserve for *Beta patula* and increase the protection and conservation status of the Nature Reserve areas of the Ponta de São Lourenço Peninsula and the Desertas islands in the Madeira Archipelago.

To implement the species genetic reserve it is essential to confirm the population size and evaluate its structure and dynamics, identify the dispersive strategies and the magnitude of the soil seed bank, as well as the spatial distribution of plant genetic variability. In the framework of this project many actions were taken that had to do with the evaluation of distribution and occurrence areas and population size of *Beta patula*, the implementation of measures promoting *in situ* and *ex situ* conservation of this species and the establishment of a monitoring line to assess the impact of implement action on *Beta patula* population.

- **CWR conservation in Portugal project**

In the framework of the ongoing project - Portuguese Red List of Vascular Plants – mainland populations of *Beta macrocarpa* and *Patellifolia procumbens* are being assessed according to IUCN criteria. It is expected to improve *in situ* conservation and management of these priority crop wild relative populations.

- **Farmer's Pride project (H2020 – SFS-04-2017)**

The project “Networking, partnerships and tools to enhance *in situ* conservation of European plant genetic resources” started in 2017 and will last three years. The main objective of Farmer's Pride is to establish a network of stakeholders and conservation sites that effectively coordinates conservation actions to safeguard the wealth of Europe's *in situ* PGR and integrates the user community to maximize their sustainable use.

Members of the *Beta* WG coordinate or participate in the above projects. This fortunate situation establishes close collaborations between the WG on *Beta* and other teams and allows for tuning the crop-specific activities and the ECPGR objectives with the overarching activities of these projects.

4. WORKING GROUP DOCUMENTS AND PUBLICATIONS

- Documents / Crop-specific standards

- [Seed increase protocol for *Beta* and *Patellifolia* species \(updated version, November 2014\)](#)
- [Crop-specific genebank standards for orthodox seeds \(agreed by the *Beta* WG, March 2016\)](#)

- Publications

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- Stevanato, P., Trebbi, D., Panella, L., Richardson, K., Broccanello, C., Pakish, L., Fenwick, A.L. and Saccomani, M. 2014. Identification and Validation of a SNP Marker Linked to the Gene HsBvm-1 for Nematode Resistance in Sugar Beet. *Plant Mol Biol Rep*, DOI 10.1007/s11105-014-0763-8.
- Andrello, M., Henry, K., Devaux, P., Desprez, B. and Manel, S. 2015. Taxonomic, spatial and adaptive genetic variation of *Beta* section *Beta*. *Theor Appl Genet*, DOI 10.1007/s00122-015-2625-7.
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- Maxted, N., Avagyan, A., Frese, L., Iriondo, J.M., Magos Brehm, J., Singer, A. and Kell, S.P. 2015. [ECPGR Concept for *in situ* conservation of crop wild relatives in Europe](#). Wild Species Conservation in Genetic Reserves Working Group. European Cooperative Programme for Plant Genetic Resources, Rome, Italy.
- Borisev, M., Borisev, I., Zupunski, M., Arsenov, D., Pajević, S., Curčić, Z., Vasin, J. and Djordjević, A. 2016. Drought Impact Is Alleviated in Sugar Beets (*Beta vulgaris* L.) by Foliar Application of Fullerene Nanoparticles. *PloS One*, 11 (11), [DOI 10.1371/journal.pone.0166248](#).
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- Romeiras, M.M., Vieira, A., Silva, D., Moura, M., Santos-Guerra, A., Batista, D., Duarte, M.C. and Paulo, O.S. 2016. Evolutionary and biogeographic insights on the Macaronesian *Beta-Patellifolia* species (Amaranthaceae) from a Time-Scaled Molecular Phylogeny. *PloS One*, DOI 10.1371/journal.pone.0152456.
- Capistrano-Gossmann, G.G., Ries, D., Holtgrawe, D., Minoche, A., Kraft, T., Frerichmann, S.L.M., Rosleff Soerensen, T., Dohm, J.C., Gonzalez, I., Schilhabel, M., Varrelmann, M., Tschöep, H., Uphoff, H., Schütze, K., Borchardt, D., Toerjek, O., Mechelke, W., Lein, J.C., Schechert, A.W., Frese, L., Himmelbauer, H., Weisshaar, B. and Kopisch-Obuch, F.J. 2017. [Crop wild relative populations of *Beta vulgaris* allow direct mapping of agronomically important genes](#). *Nature Communications* 8:15708, DOI 10.1038/ncomms15708.
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5. EXPECTED ADDITIONAL ACHIEVEMENTS AND FUTURE ACTIVITIES

- The BETANET activity will contribute to the improved long-term *in situ* and *ex situ* conservation of beet genetic resources in Europe with a specific focus on complementary conservation action planning. A list of MAWPs will be available at the end of the action. The respective sites can be used to establish a European multi-species genetic reserve network. It will also help the development of research project proposals required for *in situ* conservation planning and the establishment of new and / or improved links between all stakeholder groups involved in beet genetic resources programmes worldwide.
- In the framework of the BETANET activity a meeting will be held in San Servolo, Venice, Italy from the 19th till the 20th of June 2018.