European Cooperative Programme for Plant Genetic Resources
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Activity Report

Exploitation of *Cucurbita* local germplasm for sustainable agriculture (Cucurbitlocal)

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INTRODUCTION

Conservation of local germplasm is crucial to maintain the extant natural genetic diversity of the *Cucurbita* species and to provide novel traits for the cultivation of crops in sustainable agri-food systems. This project aimed to rationalize the conservation of *Cucurbita* local landraces stored in major European genebanks (IPK, UPV, SvG), and/or in regional communities in Italy and Tunisia to make them available for growers through the AEGIS network or other European Initiatives. The Cucurbitlocal project aimed to increase the collaboration among project partners – including the University of Naples Federico II (UNINA-Italy), the Leibniz-Institute of Plant Genetics and Crop Plant Research (IPK-Germany), the Suceava Genebank (Romania), the Polytechnic University of Valencia (UPV-Spain) and the Regional Research Centre on Horticulture and Organic Agriculture (CRRHAB-Tunisia) – involved in the collection, maintenance and characterization of cucurbit species in the respective countries. In addition, we aimed to strengthen the collaboration of the ECPGR Cucurbits Working Group members and to improve European and regional genetic resources conservation and use. The rational and effective conservation and management of plant genetic resources (PGR) in European collections as well as the addition of passport and phenotypic information through the EURISCO catalogue can provide access to unique germplasm. Therefore, the revision and the valorization of *Cucurbita* local genetic germplasm conducted through this project will facilitate the sustainable use of the *Cucurbita* resources, an important goal for ECPGR's Phase X programme. Moreover, this pilot project can be extended overall in Europe and North Africa, as well as to other cucurbit crops.

The specific goals of the project were:

- Monitor primary traits of *Cucurbita* local accessions both available at national genebanks (Germany, Spain, Romania) and in regional collections (Italy and Tunisia)
- Promote regeneration of accessions and exchange among partners
- Perform an agronomic evaluation of selected accessions tolerant to drought (Italy, Spain and Tunisia)
- Select *Cucurbita* local accessions for inclusion in AEGIS and/or for promoting their use (all partners)
- Organize virtual meetings to define the project workflow (kick-off meeting), check the status of research activity and better focus future activities (all partners), and discuss results obtained (final meeting)
- Construct an inventory of local *Cucurbita* accessions (all partners)

MATERIALS AND METHODS

Phenotypic characterization was conducted in five countries based on consensus in morphological/physiological primary descriptors defined by the ECPGR Cucurbits Working Group. Morphological characterization was performed based on a standardized descriptor list developed in 2021 by IPK, Suceava genebank and CRRHAB and in 2022 by IPK, UNINA and

UPV. In both years, a taxonomical determination was done according to the described cultivar groups in Mansfeld's Encyclopedia of Agricultural and Horticultural Crops. Field trials in low-watering regimes on a subset of accessions have been conducted in Italy, Spain and Tunisia to identify varieties and landraces suitable for the environmental conditions of areas tested. In 2023, an additional agronomic trial under low-watering conditions was conducted in Italy and Spain. Data will be shared in databases and catalogues with farmers and other end-users to enhance their use or made available in the EURISCO repository.

RESULTS

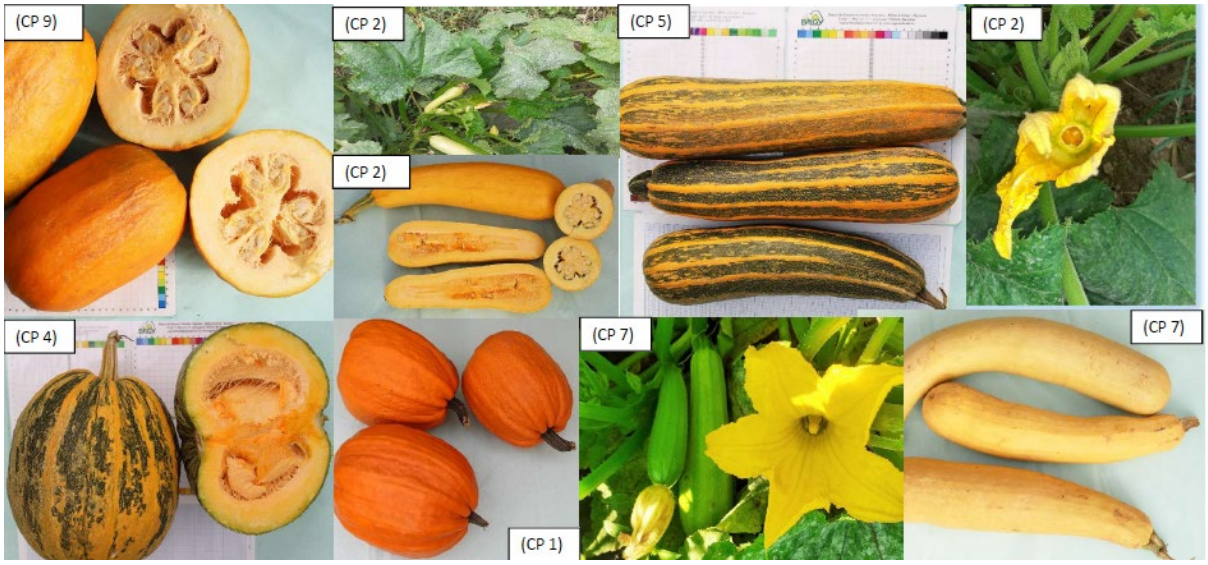
A kick-off virtual meeting was organized on 26 February 2021 using the Skype platform to discuss the Executive Committee (ExCo) recommendations and planned activities. Each country selected the number of accessions on which to perform morphological evaluation based on a list of common descriptors. After the kick-off meeting, material was selected for regeneration and germination rate as well as available seed amount.
Due to the COVID-19 pandemic, a virtual meeting (Google Meet platform), open to all Cucurbits Working Group members was organized on 28 October 2021, 9:30-10:30 (CET), to present project activities. The discussion focused on the activities carried out by participating partners and on the soundness of descriptors used to capture diversity. Moreover, the seed exchange among partners for the next year's activity was organized. In 2021 and 2022, IPK (Germany), based on standardized descriptors related to 44 morphological and agronomical traits, assessed the diversity for fruit and seed traits of respectively 39 and 36 *Cucurbita* landraces selected from the full collection (Table 1) including *C. maxima*, *C. pepo*, *C. argyrosperma*, *C. moschata* and *C. melanosperma*. In addition, two Italian zucchinis (Zucchini Tondo di Piacenza and Zucchini Alberello di Sarzana), provided by M. Ercolano, were grown and compared with the genebank material. All accessions were also taxonomically characterized and successfully regenerated. The data were prepared to be made available online in the local Genebank Information System (GBIS) and later on in EURISCO. In EURISCO, 870 cucurbit accessions from IPK are flagged as part of AEGIS and this list was revised.

Table 1 *Cucurbita* accessions available at IPK (Germany)

Species	Total number of acc.	Landraces
Cucurbita pepo	539	124
Cucurbita maxima	352	139
Cucurbita moschata	109	37
Cucurbita argyrosperma	19	-
Cucurbita sp.	13	-
Cucurbita melanosperma	10	-
Cucurbita lundelliana	5	-
Cucurbita palmata	2	-
Cucurbita foetidissima	1	-
Cucurbita okeechobeensis	1	-

Suceava Genebank assessed the diversity of five plant traits of ten local landraces of *C. pepo* (Figure 1) and 10 of *C. maxima.* These accessions were successfully regenerated. The data were prepared to be made publicly available in the Suceava Genebank Information System (BIOGEN) and EURISCO. In EURISCO, 23 cucurbit accessions from Suceava are flagged as part of AEGIS and this list was revised.

Figure 1 Examples of *C. pepo* and *C. maxima* local landraces assessed at Suceava Genebank, Romania



The University of Naples Federico II (UNINA, Italy) regenerated and evaluated 12 Italian *Cucurbita pepo* landraces (Table2) for morphological plant and fruit traits. In addition, an open field trial, under water deficit was conducted using the same genotypes. Potential drought-tolerant genotypes such as Romanesco, San Pasquale and Bianco di Sicilia were identified. These accessions are stored in the genebank of UNINA and are available for users on request. They were not included in the EURISCO database because the UNINA Department did not sign the agreement with the Italian focal point.

Table 2 Morphological plant and fruit traits evaluated on 12 *Cucurbita pepo* landraces at UNINA, Italy

Genotype	Growth habit	Branching	Steam color	Tendrils	Leaf blade size	Leaf blade incisions
Romanesco	Bush	Present	Completely green	absent to rudimentary	Large	Shallow
Zucchino di Piacenza	Bush	Present	Completely green	absent to rudimentary	Medium	Medium
Bianco di Sicilia	Semi-trailing	Present	Completely green	absent to rudimentary	Very large	Medium
Valery	Trailing	Present	Completely green	Very developed	Medium	Medium
Zucchino di Faenza	Bush	Present	Completely green	absent to rudimentary	Small	Deep
Nano verde di Milano	Semi-trailing	Present	Completely green	absent to rudimentary	Medium	Medium
PEP250	Semi-trailing	Present	Completely green	absent to rudimentary	Small	Medium
PEP503	Trailing	Present	Completely green	Very developed	Very small	Absent or very shallow
Bianco di Trieste	Bush	Present	Completely green	absent to rudimentary	Small	Medium
San Pasquale	Bush	Absent	Completely green	absent to rudimentary	Large	Medium
Alberello di Sarzana	Bush	Present	Completely green	absent to rudimentary	Large	Very deep
Rampicante	Trailing	Present	Completely green	Very developed	Medium	Medium

At CRRHAB (Tunisia), ten landraces belonging to *C. maxima*, *C. pepo* and *C. moschata* were characterized for their agro-morphological traits under open field conditions. These landraces were previously collected from local farmers in the centre-east of the country (especially Sahline, Wardanine, M'Saken and Chott-Mariem). A preliminary evaluation for low-watering regime and powdery mildew scoring tolerance was also performed. Notably, certain landraces exhibited tolerance to powdery mildew in the field. These accessions will be conserved soon in the genebank of Tunisia (BNG) for their long-term conservation, ensuring their ongoing preservation and accessibility.

At UPV (Polytechnic University of Valencia, Spain) 13 accessions were screened for morphological traits. All except one are in the COMAV genebank. The one that is not yet in the bank is because it was donated by a farmer and has not been multiplied yet. Seven are

already in EURISCO. UPV is managing the inclusion of the rest in the EURICO database through their National Focal Point.

In addition, an evaluation for low-watering regime as well as powdery mildew scoring tolerance was done.

An online meeting (using Google Meet) to discuss the results obtained was organized on 19 December 2022. UNINA and UPV decided to exchange some material to perform a low-watering trial in two locations. An extension of the project was obtained by UNINA team to test ten *Cucurbita* accessions for drought tolerance in collaboration with UPV. A trial with two different irrigation treatments – Treatment 1 (using 100% H2O) and Treatment 2 (using 50% H2O) – was set up. Agronomic traits analysis was conducted in the field to evaluate the performance of each variety in both conditions. Four varieties, namely Bianco di Sicilia, Romanesco, San Pasquale and Valery, proved to be more productive under drought conditions.

Figure 2 Examples of *Cucurbita* local landraces evaluated at UPV, Spain

Recommendations

The Cucurbitlocal project (https://www.ecpgr.cgiar.org/working-groups/cucurbits) strengthened the collaboration among researchers with different scientific expertise for improving the conservation and the valorization of *Cucurbita* local genetic germplasm diversity and richness (Chikh-Rouhou et al. 2023). This pilot project contributed to the sustainable use of the *Cucurbita* resources and could be extended overall in Europe or other continents also to other cucurbit crops. It could be interesting to promote an initiative between European and African countries.

References

Chikh-Rouhou H, Lohwasser U, Pico-Sirvent B, León AF, García-Martínez S, Guadagno A, Amoroso C, Ercolano M. **2023**. Cucurbitlocal – A collaborative initiative to strengthen valorization of *Cucurbita* local germplasm for sustainable agriculture. Cucurbit Genetics Cooperative Report 46: 33-34