Global strategy for the conservation and use of *Capsicum* genetic resources: summary for ITPGRFA stakeholders

This document is a concise summary of the Global Strategy for the Conservation and Use of *Capsicum* Genetic Resources (Barchenger and Khoury 2022). This summary supports decision making by the stakeholders of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) by providing evidence-based information in an accessible format.

Non-Annex I crops: *Capsicum annuum* L. var. *annuum* L., *Capsicum baccatum* L. var. *pendulum* (Willd.) Eshbaugh, *Capsicum chinense* Jacq., *Capsicum frutescens* L., *Capsicum pubescens* Ruiz & Pav.
International collections: World Vegetable Center (WorldVeg), Centro Agronómico Tropical de Investigación y enseñanza (CATIE), International Center for Biosaline Agriculture (ICBA)

Composition and gaps in *ex situ* collections

More than 50,000 accessions of *Capsicum* genetic resources are conserved *ex situ* in international, national and subnational genebanks, universities, botanic gardens, seed conservation organizations, and other institutions worldwide. It is not clear what proportion of these represent distinct and unique accessions. Stakeholder surveys conducted during the development of this strategy indicate that many collections are considered to be highly distinct and unique. Regarding taxonomic representation of *Capsicum* in *ex situ* conservation, the cultivated taxa are clearly much better represented than the wild species and likely comprise around 97–99% of all *Capsicum* accessions worldwide. Existing gaps in collections have been identified at species/taxa, genetic, ecogeographic, varietal, trait and other levels.

Routine operations and quality management system

The great majority of collections have long-term storage infrastructure for their accessions, which is supplemented by medium- and short-term facilities. Further efforts should be made to enhance long-term conservation for all distinct accessions, either at their current sites or through duplication at institutions already having long-term storage infrastructure. Likewise, further efforts to improve storage materials and processes (i.e. temperature and humidity standards) should be made for collections not currently following optimum practices. For many collections, pests and diseases present challenges to storage and maintenance. Further efforts to limit their negative impacts are important. Almost 40% of *Capsicum* accessions on average worldwide presently

Key metrics	Data source	Value	%
Estimated global number of accessions ***ex situ***	FAO-WIEWS (2021)	47,503	
Estimated global number of accessions ***ex situ***	Survey[1] (2021)	50,132	
Estimated global number of accessions notified as available in the MLS	GLIS portal (2023)	10,193	20%
Accessions with DOI	GLIS portal (2023)	14,832	30%
Estimated number of accessions safety duplicated at a different genebank[2]	Survey (2021)	13,654	27%
Number of accessions safety duplicated at Svalbard Global Seed Vault	SGSV web portal (2023)	9,812	20%
Number of samples distributed per year nationally	Survey (2021)	1948	
Number of samples distributed per year internationally	Survey (2021)	1440	
Passport data completeness index: median value in Genesys (Range 0-10)	Genesys (2023)	5.7	

[1]Responses to the online survey conducted in 2021 were received from 40 genebanks.

[2]This figure does not include safety duplicates at Svalbard Global Seed Vault.

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Federal Ministry of Food and Agriculture

require urgent regeneration according to stakeholder survey respondents, with some institutions reporting up to 100% of accessions requiring urgent regeneration.

More than half (56%) of the institutions responding to the surveys use the Genebank Standards developed by FAO/IPGRI (1994) to manage their collection and to minimize the loss of genetic integrity in *Capsicum* accessions during storage and regeneration. In addition, 44% of respondents follow the guidelines established by Rao et al. (2006) for seed conservation, while 22% use the earlier version developed by Hanson (1985). More than 36% of respondents use their organization's own operational manual and 27% have developed standard operating procedures (SOP) for key processes in their institution. Approximately 17% of respondents use a quality management system (QMS) for day-to-day operations. More than 7% of respondents report having no written procedure or protocol in place for managing their *Capsicum* collection.

Safety duplication

The stakeholder surveys indicate that about 41% of accessions on average are already safety duplicated, although considerable variation exists across institutions. More than one-quarter of institutions have no safety duplications of their collection. Global genetic resources databases indicate that about 18% to 37% of *Capsicum* accessions globally are currently safety duplicated. In 2023, the Svalbard Global Seed Vault held over 9,000 *Capsicum* accessions; this may represent about 20% of the total worldwide.

Documentation and information systems

60% of survey respondents reported they did not have an adequate computerized database to manage the collection and share accession data. They also reported that their current system did not meet the needs of the institution or of the users of the collection. Passport data is present within an accession-level database for 83% of institutions responding to the survey. Characterization data and associated images exist in the accession level database for the *Capsicum* collections in 59% and 51% of the institutions, respectively. Nearly 60% of the respondents make accession-level data publicly available, while 27% reported that this information is private.

Human and financial resources

Approximately 23% of respondents cited that a lack of funding and human resources, or capacity, significantly threaten the global *Capsicum* collection.

Distribution and obstacles to use

Capsicum genetic resources are not in Annex 1 but are largely accessible under the SMTA of the International Treaty on Plant Genetic Resources for Food and Agriculture. Information reported through FAO WIEWS about the number of accessions and the number of samples distributed from 2012 to 2019 by national genebanks indicates that *Capsicum* is among the most distributed of vegetable crops. Among the institutions that returned the stakeholder surveys, 61% distribute their *Capsicum* accessions in addition to conserving them. The USDA-ARS Plant Genetic Resources Conservation Unit was the largest distributor of *Capsicum* among the respondents both nationally and internationally for both wild and domesticated species. In terms of biotic constraints to distributing *Capsicum* samples, approximately 43% of stakeholder survey respondents reported viruses as major limiting challenges.

Partnerships and networks

The following relevant past and current networks were identified:

- G2P-SOL phenotypic and genotypic network
- European Cooperative Programme for Plant Genetic Resources and its European Evaluation network
- Simposio de Recursos Genéticos para América Latina y el Caribe
- Plant Genetic Resources Management Working Group of the African Union
- Taiwan Seed Industry Exchange Platform
- The Association of Southeast Asian Nations and WorldVeg have a long-standing network, AARNET, to coordinate development and implementation of projects on vegetables.

Recommendations and priorities

- Further collecting of wild species to improve their representation in *ex situ* conservation. Further collecting within taxonomic hotspots, namely Brazil, Andean countries and parts of Mesoamerica are of particular importance.
- Enhance long-term conservation for all distinct accessions, either at their current sites or through duplication at institutions with the appropriate infrastructure.
- Study the multitude of factors contributing to loss of viability for the *Capsicum* species in storage and develop a set of standards to ensure best practices.
- Reduce the proportion of accessions urgently needing regeneration.
- Collaborations to characterize and evaluate *Capsicum* collections.
- Safety duplication of *Capsicum* accessions.
- Further efforts are needed to provide up-to-date information regarding *Capsicum* collections through global databases. Fundamental data on collections can be made more complete. Enhancing the availability of passport and characterization information will also make the collection of greater potential value.

Bibliography

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Acknowledgements

The development of this document was funded by the German Federal Ministry of Food and Agriculture (BMEL) as part of the project "Mainstreaming the Global Crop Conservation Strategies in Plant Treaty Processes".