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Pillar 1

Services to support the *ex situ* PGR community

Jaime Prohens (UPV)
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Introduction

EURISCO database:

- $>2 \cdot 10^6$ accessions
- >400 Institutes
- 43 member countries

(a) Accession list: A table showing a list of accessions. The columns include C&E data, Holding institute, Accession number, Taxon, Accession name, Acquisition date, and Details. The table shows 1-50 accessions, with the first few rows being:

C&E data	Holding institute	Accession number	Taxon	Accession name	Acquisition date	Details
✓	DEU146	HOR 22215	Hordeum vulgare L. convar. distichon var. nutans (Röde) Alef.	BACCARA	2010-12-07	View
✓	DEU146	HOR 22216	Hordeum vulgare L. convar. distichon (L) Alef.	Maresi	2010-12-07	View
✓	DEU146	HOR 22219	Hordeum vulgare L. convar. deficiens var. deficiens (Steud.) Körn.	Agneta	2010-12-07	View
✓	DEU146	HOR 22217	Hordeum vulgare L.		2010-12-07	View
✓	DEU146	HOR 22220	Hordeum vulgare L.		2010-12-07	View
✓	DEU146	HOR 22266	Hordeum vulgare L. convar. distichon var. nutans (Röde) Alef.		2010-12-07	View
✓	DEU146	HOR 22265	Hordeum vulgare L. convar. distichon var. nutans (Röde) Alef.		2010-12-07	View
✓	DEU146	HOR 22261	Hordeum vulgare L. convar. distichon var. nutans (Röde) Alef.		2010-12-07	View
✓	DEU146	HOR 22264	Hordeum vulgare L. convar. vulgare var. hybernum Viborg		2010-12-07	View
✓	DEU146	HOR 22260	Hordeum vulgare L. convar. distichon var. nutans (Röde) Alef.		2010-12-07	View
✓	DEU146	HOR 22259	Hordeum vulgare L. convar. distichon var. nutans (Röde) Alef.		2010-12-07	View
✓	DEU146	HOR 22258	Hordeum vulgare L. convar. distichon var. nutans (Röde) Alef.		2010-12-07	View
✓	DEU146	HOR 22263	Hordeum vulgare L. convar. distichon var. nutans (Röde) Alef.		2010-12-07	View
✓	DEU146	HOR 22205	Hordeum vulgare L. convar. vulgare var. hybernum Viborg		2010-12-07	View
✓	DEU146	HOR 22207	Hordeum vulgare L. convar. vulgare var. hybernum Viborg		2010-12-07	View
✓	DEU146	HOR 22208	Hordeum vulgare L. convar. vulgare var. hybernum Viborg		2010-12-07	View
✓	DEU146	HOR 22206	Hordeum vulgare L. convar. distichon var. nutans (Röde) Alef.		2010-12-07	View
✓	DEU146	HOR 22202	Hordeum vulgare L. convar. distichon var. erectum (Röde) Alef.		2010-12-07	View
✓	DEU146	HOR 22201	Hordeum vulgare L. convar. distichon var. nutans (Röde) Alef.		2010-12-07	View

(b) Map: A map of Europe showing the distribution of accessions. Red dots represent collection locations across various countries, with a high density in Central Europe and the Balkans.

(c) Accession details: A detailed view of a specific accession. The page includes sections for Passport data details, Characterisation and evaluation data, and Experiment details. Key details include:

- PUID/DOI: 10.25642/IPK/GBIS/258776
- National Inventory code: DEU
- Institute name: EURISCO (Contact details on FAO-WIEWS website)
- Institute code: Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research, Gatersleben, Germany
- Accession number: HOR 18009
- Accession names: JIMMA VI
- Assigned crop name: BARLEYWILDBARLEY
- Country of origin: ETH (Ethiopia)
- MLS status: part of the MLS
- AEGIS status: part of the AEGIS
- Accession date: 1980
- Species: Hordeum vulgare
- Subtaxa: convar. distichon var. nigrinudum
- Subtaxa authority: (Wavlov) Mansf.
- Biological status: 300 (Traditional cultivar/landrace)
- Acquisition source: 99 (Other)
- Acquisition date: 2001-05-13
- Germplasm storage: 13 (Long term)
- Donor institute code: DEU001
- Donor institute name: Plant Genetic Resource Collection, Braunschweig, Germany
- Donor accession number: 39115
- Accession URL: <https://gloria.ipk-gatersleben.de/gbis2/faces/pages/detail.jsf?accessionId=258776>

Download: Last update of accession record: 2022-03-24

Trait table:

Experiment description	Trait name	Trait method	Score	Score link
Scoring of barley access... 1	powdery mildew (Srysphe graminis)	TraitScore2 very little to...	1	View
Scoring of barley access... 1	dear leaf rust (Puccinia hordei)	TraitScore2 very little to...	1	View
Scoring of barley access... 1	yellow rust (Puccinia striiformis)	TraitScore2 very little to...	1	View

From Kotni et al. (2023)

Introduction

EURISCO database:

- $>2 \cdot 10^6$ accessions
- >400 Institutes
- 43 member countries

Ex situ community:

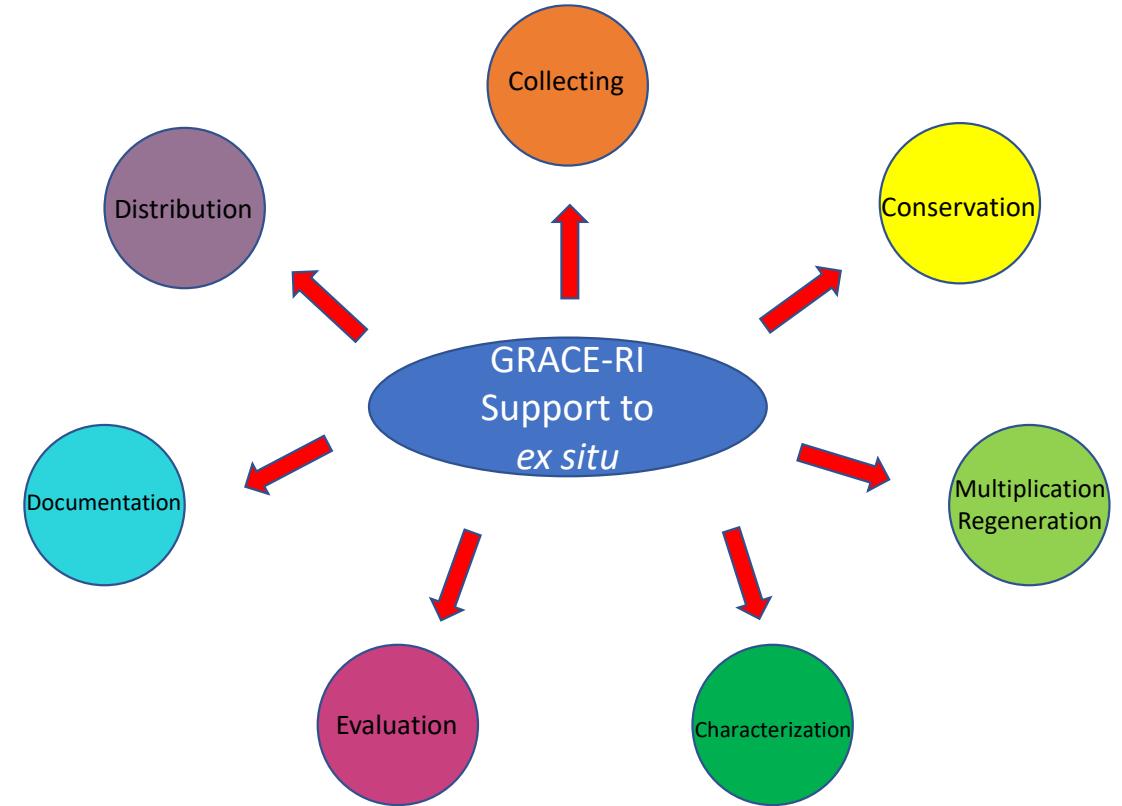
- Seed banks
- Field collections
- *In vitro* collections
- Cryo facilities
- Botanic gardens



Introduction

Challenges:

- Fragmentation
- Unequal quality
- Limited resources
- Gaps in data and services



Pillar I aims to address these challenges through (D2.5):

- A QMS system
- Improved conservation protocols
- Integration of omics
- Core collections
- Safety duplication



GRACE-RI and the *ex situ* conservation cycle

Collecting germplasm

Actors:

- Genebanks
- Botanic gardens
- Field expeditions

Needs:

- Gap analysis
- Legal clarity (ABS, Nagoya)
- National permits

GRACE-RI Support:

- Gap analysis to prioritize taxa/sites (D3.5)
- Central service for permits & compliance
- Shared protocols for ethical & scientific collecting

Pillar V



Conservation

Actors:

- Seed banks
- In vitro collections
- Cryopreserved collections
- Field collections

Needs:

- Reliability of conservation
- Increased viability of germplasm
- Fast & non-destructive viability evaluation
- Cost efficiency

GRACE-RI Support:

- Quality management systems (QMS), certification and SOP repository (D2.1., D2.2, D5.2 & D5.5)
- Shared *in vitro* & cryo hubs for recalcitrant & vegetatively propagated species
- Services for non-destructive viability testing
- Specialized crop genebanks to concentrate expertise



Multiplication & regeneration

Actors:

- Seed genebanks
- *In vitro* & cryo collections
- Field collections

Needs:

- Maintain viability & integrity
- Reduce risks
- Avoid genetic drift & genetic contamination
- Produce high quality propagation material

GRACE-RI Support:

- Standards and protocols to ensure genetic fidelity (D3.2) and phytosanitary safety
- Coordination of multiplication and regeneration through specialized genebanks
- Seed cleaning and quality services
- Backup services (cryo & *in vitro* conservation)



Characterization

Actors:

- Seed genebanks
- Field & *in vitro* collections

Needs:

- Reliable identification
- Standardized descriptors (minor species)
- High-throughput characterization tools
- Tools to manage and analyse large volume of data

Pillar III

GRACE-RI Support:

- Network of taxonomy experts
- Genotyping and cytogenomics services
- Development of core collections (CC)
- Image storage and analysis (D1.1)
- Analysis tools of characterization data

Pillar III



Evaluation

Actors:

- Seed genebanks
- Field & *in vitro* collections
- Research institutes
- ECPGR's EVA network

Needs:

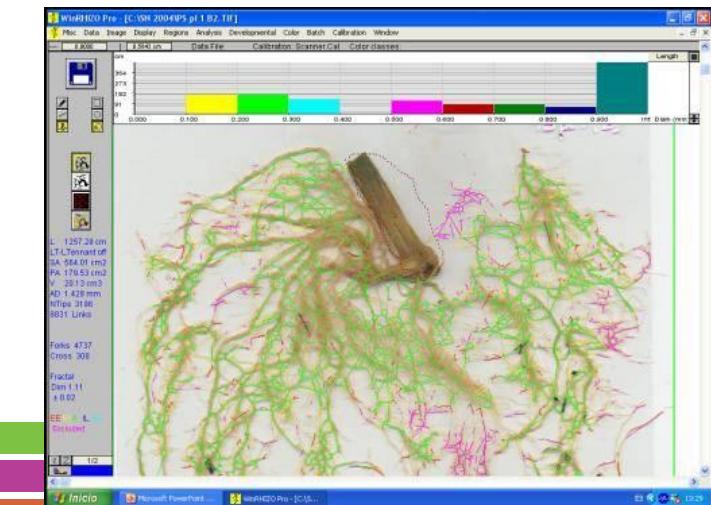
- Trait screening for stresses & quality
- Multi-environment testing
- Standardized protocols & data
- Predictive tools for trait discovery

Pillar III

GRACE-RI Support:

- CC high-throughput phenotyping (EMPHASIS)
- CC multi-site trials (EVA/ECPGR)
- Unified standards and protocols (D4.1 & D4.3)
- Advanced tools for integrative data analysis

Pillar III



Documentation

Actors:

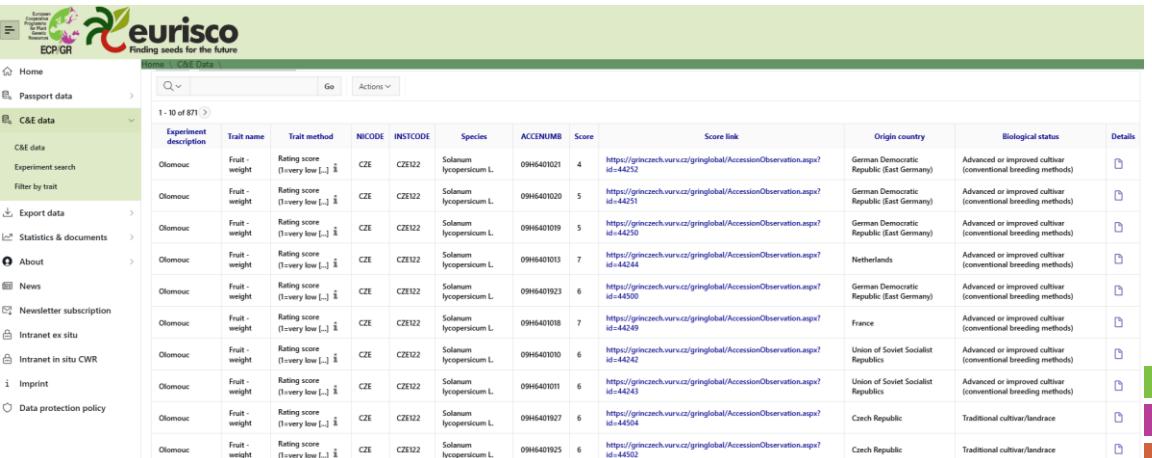
- Genebanks & other *ex situ* collections
- EURISCO
- ECPGR National Focal Points
- Research institutes

Needs:

- Integration of diverse databases
- Standardized descriptors & metadata (D1.1)
Pillar III
- Detection of duplicates & gaps
- Storage of large amounts of data

GRACE-RI Support:

- EURISCO 2.0: integrate passport, omics & phenomics data
- FAIR-compliant data curation & stewardship
- AI tools for duplicate/gap detection
- Long-term repositories for large-scale datasets, linked to EURISCO



Experiment description	Trait name	Trait method	NICODE	INSTCODE	Species	ACCESSIONID	Score	Score link	Origin country	Biological status	Details
Olomouc	Fruit - weight	Rating score (1=very low ... 5)	CZE	CZE122	Solanum lycopersicum L.	09H6401021	4	https://grinzech.vurv.cz/gringlobal/AccessionObservation.aspx?id=44252	German Democratic Republic (East Germany)	Advanced or improved cultur (conventional breeding methods)	View
Olomouc	Fruit - weight	Rating score (1=very low ... 5)	CZE	CZE122	Solanum lycopersicum L.	09H6401020	5	https://grinzech.vurv.cz/gringlobal/AccessionObservation.aspx?id=44251	German Democratic Republic (East Germany)	Advanced or improved cultur (conventional breeding methods)	View
Olomouc	Fruit - weight	Rating score (1=very low ... 5)	CZE	CZE122	Solanum lycopersicum L.	09H6401019	5	https://grinzech.vurv.cz/gringlobal/AccessionObservation.aspx?id=44250	German Democratic Republic (East Germany)	Advanced or improved cultur (conventional breeding methods)	View
Olomouc	Fruit - weight	Rating score (1=very low ... 5)	CZE	CZE122	Solanum lycopersicum L.	09H6401013	7	https://grinzech.vurv.cz/gringlobal/AccessionObservation.aspx?id=44244	Netherlands	Advanced or improved cultur (conventional breeding methods)	View
Olomouc	Fruit - weight	Rating score (1=very low ... 5)	CZE	CZE122	Solanum lycopersicum L.	09H6401023	6	https://grinzech.vurv.cz/gringlobal/AccessionObservation.aspx?id=44250	German Democratic Republic (East Germany)	Advanced or improved cultur (conventional breeding methods)	View
Olomouc	Fruit - weight	Rating score (1=very low ... 5)	CZE	CZE122	Solanum lycopersicum L.	09H6401018	7	https://grinzech.vurv.cz/gringlobal/AccessionObservation.aspx?id=44249	France	Advanced or improved cultur (conventional breeding methods)	View
Olomouc	Fruit - weight	Rating score (1=very low ... 5)	CZE	CZE122	Solanum lycopersicum L.	09H6401010	6	https://grinzech.vurv.cz/gringlobal/AccessionObservation.aspx?id=44242	Union of Soviet Socialist Republics	Advanced or improved cultur (conventional breeding methods)	View
Olomouc	Fruit - weight	Rating score (1=very low ... 5)	CZE	CZE122	Solanum lycopersicum L.	09H6401011	6	https://grinzech.vurv.cz/gringlobal/AccessionObservation.aspx?id=44243	Union of Soviet Socialist Republics	Advanced or improved cultur (conventional breeding methods)	View
Olomouc	Fruit - weight	Rating score (1=very low ... 5)	CZE	CZE122	Solanum lycopersicum L.	09H6401027	6	https://grinzech.vurv.cz/gringlobal/AccessionObservation.aspx?id=44504	Czech Republic	Traditional cultiva/landrace	View
Olomouc	Fruit - weight	Rating score (1=very low ... 5)	CZE	CZE122	Solanum lycopersicum L.	09H6401025	6	https://grinzech.vurv.cz/gringlobal/AccessionObservation.aspx?id=44502	Czech Republic	Traditional cultiva/landrace	View

Distribution

Actors:

- Genebanks
- Phytosanitary authorities
- Researchers, breeders, farmers
- Seed exchange networks

Needs:

- Safe movement of material
- Compliance with ABS, SMTA, and seed & germplasm legislation
- Efficient user access
- Traceability of distributed material

Pillar ✓

GRACE-RI Support:

- Phytosanitary hubs for testing, sanitation, certification
- Legal helpdesk on ABS, SMTA, and seed laws
- Integrated ordering platform connected to EURISCO
- Digital traceability tools for monitoring exchanges

Pillar ✓



CERTIFICADO FITOSANITARIO
PHYTOSANITARY CERTIFICATE
Nº CE / ES / 0392716 2B



Expanding the concept of *ex situ*

Field Collections & Botanic Gardens

Actors:

- Field collections (clonal crops)
- Botanic gardens
- Tree collections & arboreta

Needs:

- Long-term security for unique living collections
- Back up strategies to reduce vulnerability
- Phytosanitary management of vegetative material *Pillar V*
- Integration of data into European catalogues *Pillar III*

GRACE-RI Support:

- Specialized genebanks for clonal crops
- Safety duplication in secure facilities
- Phytosanitary services for vegetative materials *Pillar V*
- Linkage with EURISOL for data visibility and access *Pillar III*



***In vitro* & Cryo Collections**

Actors:

- *In vitro* collections
- Cryo facilities
- Research labs developing new preservation protocols

Needs:

- Reliable long-term conservaton methods
- Protection from contamination and loss
- Harmonized protocols
- Sharing of specialized expertise and facilities

GRACE-RI Support:

- Standardized protocols & certification for *in vitro* and cryo practices
- Shared cryo hubs for storage
- Capacity building and training
- R&D platform to develop new technologies for difficult species



Herbaria & Digital Vouchers

Actors:

- Herbaria linked to genebanks
- Botanic gardens with vouchers
- DiSSCo and natural history collections

Needs:

- Secure storage of vouchers
- Integration of herbarium data with accession records
- Tools for digital imaging and analysis
- Use of specimens for DNA, trait and reference studies

GRACE-RI Support:

- Linked voucher system connecting herbaria to genebank accessions
- Integration with DiSSCo for biodiversity data standards (D5.1)
- AI-assisted image & spectral analysis for traits without cultivation
- Digital repositories for specimen data and images

Pillar III



Duplication & Specialized Genebanks

Actors:

- National and regional genebanks
- International back-up facilities
- ECPRG networks
- Specialized genebanks

Needs:

- Ensure safety back-up of unique accessions
- Minimize unnecessary duplications
- Rationalize conservation by crop or species groups
- Strengthen coordination between institutions

GRACE-RI Support:

- Strategy for coordinated duplication
- Safety back-up mechanisms including Svalbard and regional vaults
- Promotion of specialized genebanks
- Integration with ECPGR & AEGIS to align responsibilities





Cross-cutting Services

Bioinformatics Services

Actors:

- Genebanks & other GRCs
- Research institutes analyzing omics
- ELIXIR & bioinformatics structures
- Breeders using integrated datasets

Needs:

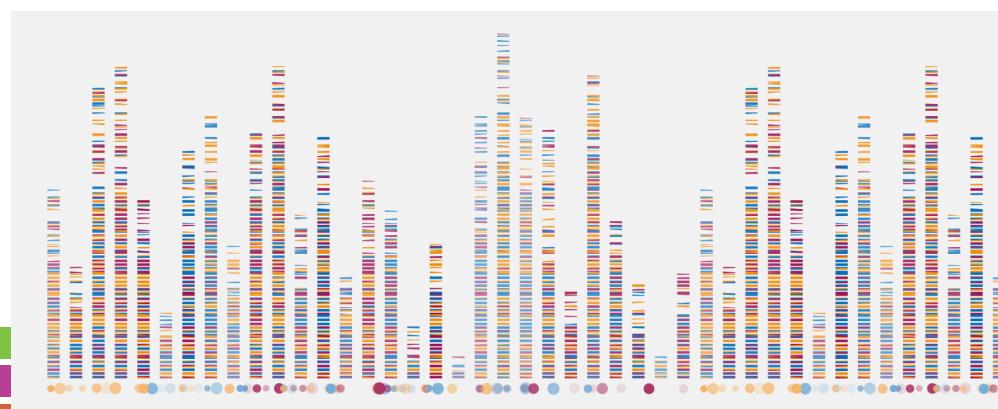
- Tools to process large-scale omics and phenomics data
- Integration of heterogeneous datasets (passport, phenotypic, omics, environment)
- User-friendly pipelines for non-experts
- Standards to ensure interoperability across Europe

Pillar III

GRACE-RI Support:

- Shared analysis pipelines for genomics, phenomics, metabolomics
- Virtual research environments for integrative analyses
- Training and support in bioinformatics tools
- Coordination with ELIXIR for standards and interoperability

Pillar III



Training & Capacity Building

Actors:

- Genebank and other GRC staff
- ECPGR training and networking initiatives
- Universities and research institutes

Needs:

- Professional training in QMS, conservation, and phytosanitary practices
- Skills in omics, phenotyping, and bioinformatics
- Staff exchanges and mentoring
- Building capacity in smaller or underfunded collections

GRACE-RI Support:

- Structured training programmes across key technical areas
- E-learning modules & workshops accessible to all institutions
- Staff exchanges & mobility schemes within the RI network
- Peer-review audits as a learning and mentoring tool



Coordination in the European Landscape

Key roles:

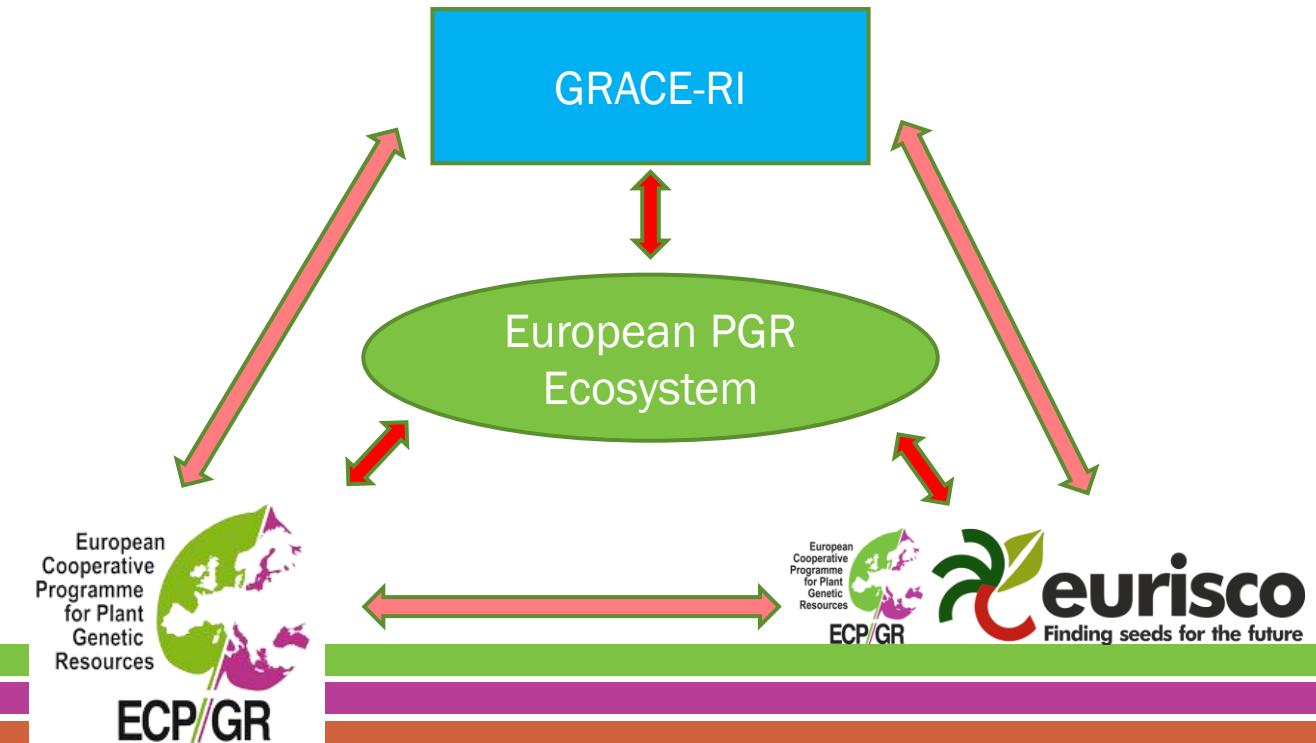
- EURISCO → European catalogue of accessions (accession data backbone).
- ECPGR → Policy & coordination network (countries, crop groups, AEGIS, EVA).
- GRACE-RI → Service provider (advanced scientific, technical, legal, training support).

Integration:

- EURISCO remains the data hub
- ECPGR remains the governance & coordination platform
- GRACE-RI provides infrastructure services to strengthen both

GRACE-RI Support:

- Complementarity
- Robust European system for *ex situ* conservation and use of PGR



Synergies with other ESFRIs & Conclusion

Potential synergies:

- EMPHASIS → Plant phenotyping
- ELIXIR → Life Science data and bioinformatics
- LifeWatch ERIC → Biodiversity and ecosystem data integration
- DiSSCo → Distributed system of scientific collections
- In-Sylva ERIC → Forest and tree genetic resources, linking *in situ* and *ex situ* networks
- BBMRI – ERIC → Biobanking and biomolecular resources
- METROFOOD → Metrology for Food & Nutrition

Conclusion:

GRACE-RI will support the *ex situ* conservation community with services that secure, connect, and enable use of PGR





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THANK YOU

Jaime Prohens
Universitat Politècnica de València
jprohens@btc.upv.es