

EXPLORING OF GRAIN LEGUMES DIVERSITY FOR SUSTAINABLE EUROPEAN AGRI-FOOD SYSTEMS (EXPLODIV): THE CONTRIBUTION OF IBBR

Dr. Wilma SABETTA

CNR – Institute of Bioscience and BioResources (IBBR)

*ForEVA – Fostering the need of implementation of the ECPGR's
European Evaluation Network (EVA) on Grain legumes*

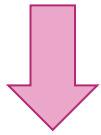
10-11 October 2023, Bucharest, Romania



Institute of Biosciences and BioResources (IBBR): a short presentation



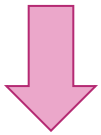
1969 – Germplasm Laboratory



1970 – Institute of Plant Germplasm



2002 - Institute of Plant Genetics (IGV)



2013 - Institute of Biosciences and BioResources (IBBR)



Integration of the Institute of Genetics and Biophysics (IGB) and the Institute of Protein Biochemistry (IBP)

Headquarter in Bari + 5 divisions spread over national territory



c/o Campus Universitario
Via Amendola n.165/a, cap 70124, Bari (BA),
ITALY



Main objectives/activities:

- safeguard and management of plant biodiversity: exploration, collection, multiplication, evaluation, characterization and documentation of plant genetic resources (PGR)
- research lines:
 - 1) management, sustainable use and evolution of natural, agricultural and forest PGR
 - 2) traditional and biotechnological plant breeding
 - 3) nutraceuticals, functional food and their role for human health
- synergism and collaborations with numerous public and private Italian (several University, CNR Institutes, Ministries, CREA, ENEA, etc.) and International (EU, FAO, IPGRI, IITA, ICARDA, IPK, etc.) Institutions
- training activities for undergraduate and graduate students, post-docs and contractors



**EURISCO (European Search Catalogue
for Plant Genetic Resources)**
Network of 400 Institutes

EVA (European Evaluation Network)
Networks for plant species
characterization

**AEGIS (An European Genebank
Integrated System)**
Network of several Institutes
(including CNR) from 68 Nations



MISSIONS AND HISTORICAL COLLECTION OF PGR MOSTLY IN THE MEDITERRANEAN BASIN (1973-2018)

Immagini da archivio storico

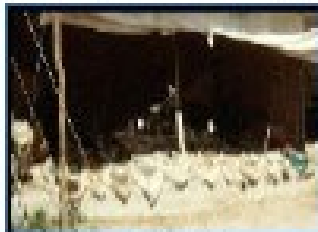
Spighe dall'Algeria



Spighe dall'Etiopia



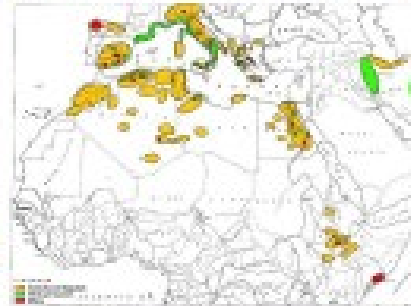
Spighe dalla Libia



Marocco



Etiopia



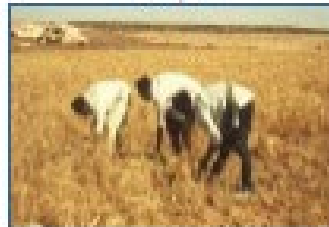
Etiopia



Etiopia



Iran



Tunisia



Oasi nel deserto



Etiopia



Egitto

IBBR Projects on legumes:

1) **AGRITECH**: Centro Nazionale per le Tecnologie dell'Agricoltura

(budget: 1.980.000,00 €; period 2022-2025)

European Union Next Generation EU within the Agritech National Research Center (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR)-MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.4-D.D. 1032 17/06/2022, CN00000022).

Task: Resilience to drought stress of Italian legume germplasm by genetic and biochemical approaches (Spoke 1 Leader)

Ongoing activities: HT-phenotyping of an already GBS-genotyped lentil collection, GWAS analysis, biochemical and genetic characterization of the most promising genotypes.

2) **PRO-GRACE**: Promoting a Plant Genetic Resource Community for Europe

(budget IBBR: 81.250,00 €; period 2023-2024)

HORIZON-INFRA-2022-DEV-01-01, TOPIC: Research infrastructure concept development.

Task: Gap analysis of the present European RI ecosystem, including an analysis of the possible synergies with existing RIs (WP5 Leader)

Ongoing activities: PGR proper conservation and access (quality-assured *ex situ* and *in situ* management), integrated European PGR information system, scientific services, and proposal of the future GRACE-RI.



IBBR Projects on legumes:

3) LEGU-MED: Legumes in biodiversity-based systems in Mediterranean basin (budget: 1.240.190,00 €; period 2020-2024)
MUR (decreto n. 1963 del 30/07/2021). *PRIMA* Section 2 – Multi-topic 2019 (Partnership for Research and Innovation in the Mediterranean Area) Call 2019.

Task: Recovery, selection and collection of germplasm (WP1 Leader)

Ongoing activities: Supply project partners with samples and genetic/biochemical characterization of chickpea and lentil genotypes.



Review

Ex Situ Conservation of Plant Genetic Resources: An Overview of Chickpea (*Cicer arietinum* L.) and Lentil (*Lens culinaris* Medik.) Worldwide Collections

Angela Rosa Piergiovanni 



IBBR Projects on legumes:

4) SaVeGrainPugliaLEG: Salvaguardia delle leguminose da Granella di Puglia

(budget IBBR: 1.200.000,00 €; period 2023-2025)

PSR Puglia 2014-2020. Misura 10 - Pagamenti agro-climatico-ambientali. Sottomisura 10.2 -Sostegno per la conservazione, l'uso e lo sviluppo sostenibili delle risorse genetiche in agricoltura. Operazione 10.2.1 - Progetti per la conservazione e valorizzazione delle risorse genetiche in agricoltura

Task: **Collection, multiplication, fine characterization of Apulian legume species (Partner)**

Ongoing activities: Implementation of the results from the previous project, in particular for the most deserving genotypes.

5) SaVeGrainPuglia: Recupero, caratterizzazione, salvaguardia e valorizzazione di leguminose, cereali da granella e foraggio in Puglia

(budget: 4.000.000,00 €; period 2013-2018)

PSR Puglia 2014-2020. Misura 10 - Pagamenti agro-climatico-ambientali. Sottomisura 10.2

Task: **Collection, multiplication, multidisciplinary characterization and documentation of Apulian cereal, forage and legume species (Project leadership)**

Activity: Interdisciplinary approach to obtain a multidimensional data set for common bean local varieties. Study of the relationship between local varieties and their traditional area of cultivation contextualized in both space and time.



REGIONE PUGLIA



Genet Resour Crop Evol (2019) 66:1459–1468
<https://doi.org/10.1007/s10722-019-00810-9>



RESEARCH ARTICLE

Monti Dauni district (Apulia region, southern Italy):
an environment promoting *on farm* conservation of common
bean (*Phaseolus vulgaris* L.) landraces

Angela Rosa Piergiovanni · Giuseppe Procino · Salvatore Cifarelli ·
Lucia Lioi



ECP/GR

IBBR Projects on legumes:

6) PHAS.G.RE.EN.: (PHASeolus Genetic REsources ENhanced) Conservazione e Uso Sostenibile di Risorse Genetiche di Fagiolo (*Phaseolus vulgaris* L.) Lucano

(budget: 150.000,00 €; period 2018-2021)

PSR Basilicata 2014-2020. Misura 10 - Pagamenti agro-climatico-ambientali. Sottomisura 10.2 -Sostegno per la conservazione, l'uso e lo sviluppo sostenibili delle risorse genetiche in agricoltura. Operazione 10.2.1 - Progetti per la conservazione e valorizzazione delle risorse genetiche in agricoltura

Task: Conservation and deep characterization of common bean ecotypes from Basilicata region (Partner)

Activity: Agronomical, morphological and biochemical evaluation of several common bean accessions from Basilicata region, including PGI (Protected Geographical Indication)-marked ecotypes. Valorization and socio-economical promotion of promising local genotypes.

| SESSIONE 29 | Biodiversità vegetale - specie erbacee
Contributo poster

Fenotipizzazione di risorse genetiche di fagiolo (*Phaseolus vulgaris* L.) nell'areale del "Fagiolo di Sarconi IGP"

Marzario S.^{1*}, Latorraca A.¹, Sica R.¹, Galante M.A.¹, Nuzzaci M.¹, Piergiovanni A.R.², Papa R.³, Logozzo G.¹, Gioia T.¹

¹Scuola di Scienze Agrarie, Forestali, Alimentari ed Ambientali, Università della Basilicata, Viale dell'Ateneo Lucano 10 – 85100 Potenza

²Istituto di Bioscienze e Biorisorse, Via G. Amendola 165/a, I - 70126 Bari

³Dipartimento di Scienze Agrarie, Alimentari e Ambientali, Università Politecnica delle Marche, Via Brecce Bianche 2-8, 60121 Ancona



Proceedings of the LXIV SIGA Annual Congress
Online, 14/16 September, 2021
ISBN: 978-88-944843-2-8

Poster Communication Abstract – 1.30

KNOWLEDGE OF COMMON BEAN (*PHASEOLUS VULGARIS* L.) LANDRACE RESOURCES MAINTAINED IN SITU AND EX SITU IN BASILICATA REGION

MARZARIO S.*, SICA R.*, LATORRACA A.*, MORANTE V.*, BEVILACQUA V.*, GALANTE M. A.*, PIERGIOVANNI A. R.**, PAPA R.***, NUZZACI M.*, GIOIA T.**, LOGOZZO G.*



IBBR Projects on legumes:

7) **VAL.BIO.LUC:** Tutela della biodiversità di leguminose tradizionali degli ambienti lucani e valorizzazione mediante innovazioni agronomiche nutraceutiche e di mercato.

(budget IBBR: 168.473,25 €; period 2012-2015)

PSR Basilicata 2007-2013. Misura 124 HC.

Task: **Characterization of typical common bean ecotypes from Basilicata region (Partner)**

Activity: Evaluation of phosphorus accumulation and partitioning (free and as phytic acid, Phy) in seeds of ten common bean landraces from Basilicata region → (1) wide variation of total and phytic phosphorus contents is present; (2) Pi and Phy amounts, as well as seed quality traits, are strongly affected by growing location (↑ Phy outside the traditional area of cultivation).



Cultivation of landraces outside of their traditional area may appreciably affect the harvest quality!!!

Italian Journal of Agronomy 2017; volume 12:849

Comparative evaluation of phosphorus accumulation and partitioning in seeds of common bean (*Phaseolus vulgaris* L.)

Angela Rosa Piergiovanni, Lucia Lioi, Vincenzo Montesano, Giulio Sarli
Institute of Biosciences and Bioresources, National Research Council, Bari, Italy



IBBR Projects on legumes:



8) **PROM**: Progetto di ricerca per potenziare la competitività di orticole in aree meridionali

(budget: 168.473,25 €; period 2005-2010)

MiPAF: DM n.353 del 16/7/2003, delibera CIPE 17/2003 (2005-2009).

Task: **Characterization of local legume species from the Mediterranean basin: agronomic, genetic and biochemical evaluation (Partner)**

Activity (lens and chickpea): Investigation of genetic relationships and analysis of agronomic, nutritional and technological traits. Seed storage proteins (biomarkers) revealed ↑ variability mainly related to polypeptide abundance. SSRs clustered landraces principally on the basis of their geographical origin. Identification of landraces with highest adaptability, and technological/nutritional value.

Field trials, performed in different geographical areas of Southern Italy, revealed a high influence of field location on the yield and seed quality of these legume species.

Genet Resour Crop Evol (2012) 59:727–738
DOI 10.1007/s10722-011-9714-5

RESEARCH ARTICLE

Characterization of Italian lentil (*Lens culinaris* Medik.) germplasm by agronomic traits, biochemical and molecular markers

Massimo Zaccardelli · Francesco Lupo · Angela Rosa Piergiovanni ·
Gaetano Laghetti · Gabriella Sonnante · Maria Gloria Daminati ·
Francesca Sparvoli · Lucia Lioi

Genet Resour Crop Evol (2013) 60:865–877
DOI 10.1007/s10722-012-9884-9

RESEARCH ARTICLE

Characterization of Italian chickpea (*Cicer arietinum* L.) germplasm by multidisciplinary approach

Massimo Zaccardelli · Gabriella Sonnante ·
Francesco Lupo · Angela Rosa Piergiovanni ·
Gaetano Laghetti · Francesca Sparvoli · Lucia Lioi



ECP/GR

The IBBR collection...



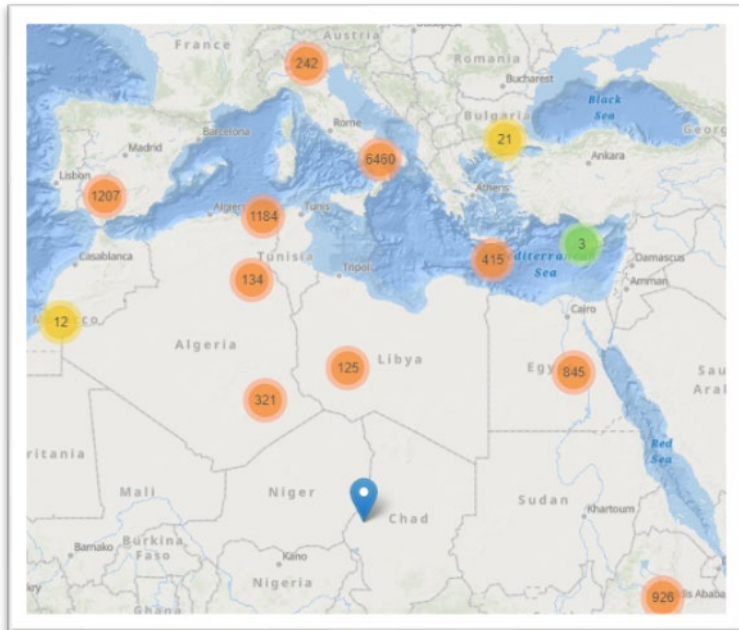
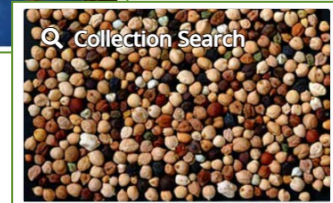
- ❖ several **ex situ collections** of crop species, crop wild relatives, forest and fruit trees
- ❖ some **in vivo collections** of organisms such as bacteria, fungi, nematode
- ❖ indexed to the European Research Infrastructure **EURISCO**, **DiSSCo** (Distributed System of Scientific Collections) and available on the platform **GBIF** (Global Biodiversity Information Facility)
- ❖ **Mediterranean Germplasm Genebank - MGG** (59.000 accessions of 870 species from 203 genera and 39 families, mainly *Poaceae*, *Fabaceae*, *Solanaceae*, *Brassicaceae*, *Asteraceae*), tree species (220 citrus, 850 olive, 480 grapevine), artichoke (50), annual legumes (67) and perennial grass (28), *Medicago truncatula* (4000 mutant lines)



...and the IBBR grain legume collection



- About **16.000 samples** belonging to different species
- The most studied legume species in last decades for our research unit: **LENTIL, BEAN, CHICKPEA** (pre-breeding activity for seed quality, nutraceutical and anti-nutritional compounds, and support to the request for the awarding of quality marks – PGI, PDO)
- Data for most accessions are computerized and collected in the **MGD** (<https://ibbr.cnr.it/mgd/>) (unique e-labels with genotypic -SSRs and SNPs-, biochemical and morphological traits, as well as name of the explorer and/or donor, species, taxonomic family and genus, country of origin, seed conservation method, seed multiplication in experimental fields, and GPS coordinates).
- **Small batches of seeds** are available for both users and scientific community based on SMTA



ibbr Mediterranean Germplasm Database

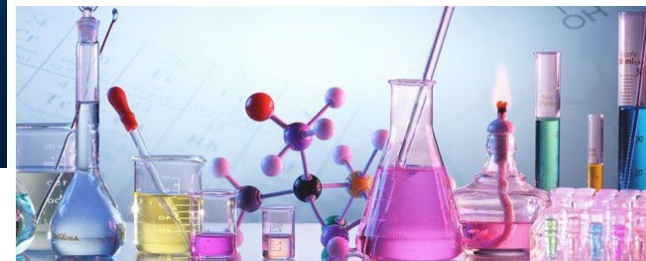
Search Results (Records: 1-10 out of 280)

#	ACCENUMB	FAMILY	GENUS	SPECIES	SUBTAXA	SUBSP	CROPNAME	ORIGIN	INFO	ADD TO CART (*)
1	103215	Fabaceae	Lens	culinaris	-	-	Lentil	Italy	📄	🛒
2	103510	Fabaceae	Lens	culinaris	-	-	Lentil	Ethiopia	📄	🛒
3	103653	Fabaceae	Lens	culinaris	-	-	Lentil	Italy	📄	🛒
4	106286	Fabaceae	Lens	culinaris	-	-	Lentil	Iran	📄	🛒
5	106287	Fabaceae	Lens	culinaris	-	-	Lentil	Iran	📄	🛒
6	106299	Fabaceae	Lens	culinaris	-	-	Lentil	Ethiopia	📄	🛒
7	106300	Fabaceae	Lens	culinaris	-	-	Lentil	Ethiopia	📄	🛒
8	106301	Fabaceae	Lens	culinaris	-	-	Lentil	Ethiopia	📄	🛒
9	106302	Fabaceae	Lens	culinaris	-	-	Lentil	Ethiopia	📄	🛒
10	106303	Fabaceae	Lens	culinaris	-	-	Lentil	Ethiopia	📄	🛒

Expectations from EVA legumes



- Material: IBBR will supply partners with **small batches of legume seeds** to be multiplied and propagated for future project purposes (at IBBR as service)
- Operation: IBBR will provide genetic and biochemical **data** (for example about common bean and lentil) obtained with previous projects to be included in the **ForEVA database** (if considered); IBBR can contribute to the design and the implementation of this database (according to EURISCO information format)
- Species of interest: legume species for food use, preferably **LENTILS** and **LUPINS** for the *ForEVA* experimental activities
- Experience: long-term experience and skills in the field of **germplasm collection/management** and of plant diversity studies as well as in **genetic and biochemical characterization** of seeds





THANK YOU
FOR YOUR
KIND
ATTENTION!



National Research Council
Institute of Bioscience and BioResources

IBBR staff involved in the *ForEVA* project:
Dr. Angela Piergiovanni (angelarosa.piergiovanni@ibbr.cnr.it)
Dr. Wilma Sabetta (wilma.sabetta@ibbr.cnr.it)

