



Agricultural Institute of Slovenia

ECPGR SMARTLEG:  
Efficient Management of Genetic  
Resources for **Smart Legumes** Utilization

ECPGR SMARTLEG meeting  
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Ljubljana, Slovenia



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**Background** – The current proposal came in the context of the International Year of Pulses, aimed to underline the importance of pulses as primary source of protein and other essential nutrients. The pulses importance is found both on the agenda of governments that work to find solutions in terms of providing enough and healthy food for the world population and on the agenda of researchers from various fields (conservation, breeding, food, agriculture), thanks to its multiple benefits for human health and for clean environment.

In the fifth meeting of the ECPGR Grain Legumes WG held in May 2013 at Novi Sad, Serbia, considering the message from the Steering Committee (SC) that the WGs need to focus on very specific areas, there were established ten crop-specific interest groups, among which we can find *Phaseolus* group. Our proposal involves investigation on *P. coccineus* and *P. vulgaris* aimed to strengthen the *Phaseolus* Database as part of the EURISCO and also the cooperation inside the group.

Both species need to be investigated, due to:

- very limited number of *P. coccineus* accessions – the improvement of collection is imperatively needed.
- large number of *P. vulgaris* accession - but insufficient information.



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**Justification** - Common bean (*Phaseolus vulgaris* L.) is the most important edible food legume for direct human consumption in the world as it represents a valuable source of proteins, carbohydrates, dietary fibre and is a rich source of other components with nutritional and health benefits (Broughton et al., 2003). The scarlet runner bean (*P. coccineus*) is agronomically the second most important species of the genus *Phaseolus* introduced from the American continent into Europe since the XVI century (Gepts and Debouck, 1991).

In the last decade several thousand accessions were collected in different parts of Europe and are stored in national gene banks. At present the *Phaseolus* Database as part of the EURISCO Web catalogue contains over 46000 records, including more than 1000 characterization data and 585 photos (ECPGR, 2013). However, the characterization data are still lacking or/and are not easily accessible. A very large number of accessions (cca. 6000) are still of unknown origin. On the other hand, *P. coccineus* is represented only by a small number of accessions in the database.

Information on genetic diversity of common bean from Central Europe is limited to the studies carried out at the Agricultural Institute of Slovenia (AIS) by AFLP and microsatellite markers (Šuštar-Vozlič et al., 2006; Maras et al., 2013, 2015). All these surveys revealed that extensive diversity resides in common bean cultivated in this area and includes variation beyond the two gene pools, Andean and Mesoamerican. Molecular diversity described in these studies reflects itself in numerous variations of phenotypic traits, particularly seed characteristics. With regards to the runner bean germplasm from Central Europe significantly less information is available.



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**Methodology or Approach** - multi-crop passport descriptors and seed characteristics of *P. vulgaris* and *P. coccineus* from different collections will be used by project partners to establish a set of several hundreds of accessions with diverse phenotypes and distinct geographical origin. These accessions will be further examined by the partners for morpho-agronomical traits in the field trials. The phenotypic traits used in the present study will be selected from descriptor list proposed by the PHASELIEU consortium. This consortium, which consists of members with a large experience in *Phaseolus* genetic resources, selected a minimum of 15 characters of plant, flower, pod and seed from the several descriptor lists. Besides, a set of 90 representative *P. coccineus* accessions from partner gene banks will be genotypically assessed at the AIS using microsatellite markers developed for *P. vulgaris*. The accessions will be selected on the basis of multi crop passport descriptors, available morphological characterization data based on descriptor list and seed availability from all GB involved in the consortium. The collected data of phenotypical and genetic characterization will be uploaded into the *Phaseolus* Database and EURISCO.

Our activity will be accomplished in four work packages, as follows:

**WP1 Project management;** establishment of communication way, coordination, distribution of activities and responsibilities

**WP2 Experimental protocol;** methods, cultural practices for field and lab investigation

**WP3 Investigation of *Phaseolus* PGR;** phenotypic traits, morpho-agronomical traits

**WP4 Dissemination,** communication, popularization



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One of the main goals of the SMARTLEG project is proper identification and phenotypic characterization of European *Phaseolus* accessions, providing new data to EURISCO for integration of information and extending genomic information on *ex situ* material.

The meeting organized by Kmetijski Inštitut Slovenije in Ljubljana, Slovenia, will enable, in addition to updating C&E data for accessions stored, discussion on possible collaboration with BEAN\_ADAPT, Collaborative Research Project, GLWG being associated partner.

In BEAN\_ADAPT more than 11000 *P. vulgaris* and *P. coccineus* accessions from American and European continent will be characterized by genotyping-by-sequencing to define the population structure and to obtain subsets of genotypes for phenotyping (field and growth chamber) and for a deeper genomic–transcriptomic–metabolomic characterisation which will be carried out with the aim to identify genes/QTLs that control important agronomic and adaptive traits.

***Expected impact*** - The available EURISCO/national database including newly acquired data will be made available and linked to the specific bean databases and to the researchers involved in bean research, breeding and to the other users.

The newly acquired knowledge, experience and data will enable better and more efficient genebank management in accordance with principles of AEGIS.

SMARTLEG will provide useful contributions to further *Phaseolus* research and production, thanks to implication of different specialists in team.



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### ***Links with other non-ECPGR projects or individuals***

The project SMARTLEG will be developed in relation with other projects (non-ECPGR) related with Phaseolus. For example:

- BEAN\_ADAPT, Collaborative Research Project. We envisage interaction with other projects, developed at national level by the members involved in this proposal.
- SLO Bean project
- SRB national project/PhD work
- BiH bilateral project
- MKD bilateral project
- ROM national project



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## Expected products and related ECPGR Objectives

### 1 SSR marker data on commonly agreed set of 90 European *Phaseolus coccineus* accessions

Corresponding ECPGR outcome, output, activity: **Outcome 1, output 1.2., activity 1.2.3:** Monitoring of the management of AEGIS accessions by the AMs in accordance with the principles of AEGIS

### 2 Increasing the number of AEGIS *Phaseolus sp.* Accessions

Corresponding ECPGR outcome, output, activity: **Outcome 1, output 1.1., activity 1.1.2.:** Establishment of proper documentation of AEGIS accessions.

### 3 Increasing quality and quantity of data in EURISCO

Corresponding ECPGR outcome, output, activity: **Outcome 1, output 1.2., activity 1.2.2.:** Verification of the proposed AEGIS accessions

### 4 Acquired information will be useful for end users (e.g. breeders)

Corresponding ECPGR outcome, output, activity: **Outcome 1, output 1.2., activity 1.2.1.:** Identification of eligible accessions to be proposed for registration as AEGIS accessions

**Outcome 1, output 1.5.; activity 1.5.3.:** Services for characterization, evaluation and/or phenotyping of AEGIS accessions provided to AMs **Outcome 2, output 2.1.; activity 2.1.2.** Collaboration between NFPs and collection holding institutes strengthened **Outcome 5, output 5.4., activity 5.4.1:** Research partnerships established between genebanks and researchers, including through EU projects



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## Workplan for the proposed period of the Activity

Type of Action (*indicate if “meeting” or “other action”*)

- 1 ‘other action’ Survey and analysis of European *Phaseolus* database to prepare list of candidate AEGIS accessions to be sent to the GLWG Chair
- 2 ‘other action’ Defining a subset of *P. coccineus* accessions for the European diversity survey with morphological and molecular markers
- 3 ‘other action’ Phenotypical characterization of selected germplasm done by SMARTLEG partners, followed by SSR analysis at AIS
- 4 ‘other action’ Updating C&E *Phaseolus sp.* accessions data
- 5 ‘meeting’ Meeting in order to prepare and agree national “databases” with all available information which will be valid for EURISCO
- 6 ‘other action’ Report on the genetic diversity of the accessions analyzed in SMARTLEG Project