BEANS (*Phaseolus* spp.) COLLECTION AT THE MISIÓN BIOLÓGICA DE GALICIA - CSIC IN SPAIN

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**Summary**

At the Misión Biológica de Galicia - CSIC (Pontevedra, Spain) there is a bean (*Phaseolus* spp.) collection which includes 843 accessions from Spain as well as from other origins from Europe and America. Since 1987 there have been evaluated 498 accessions of this collection for agronomic traits and nutritional value and their degree of genetic diversity has been displayed by means of electrophoretic analysis of isoenzymes. Since the main tasks of the Misión Biológica de Galicia - CSIC are the genetic research and the breeding, some of the bean accessions of the collection are the basic material for improvement by means of hybridization and selection.

**Key words:** beans, genetic improvement, germplasm, *Phaseolus*

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Introduction

Beans (*Phaseolus* spp) are some of the more common crops in many areas of Europe and America being an important source of proteins in human diet. During years landraces or well-adapted populations were cultivated by farmers but currently new improved varieties have displaced the traditional ones in the most important areas of production as Spain and Argentina. On the other hand the forsake of lands mainly in marginal areas has contributed also to the genetic erosion in beans, so that security for food production could be affected by this process (Esquinas-Alcázar, 1987).

For these reasons the Misión Biológica de Galicia - CSIC (MBG-CSIC), in cooperation with other organizations, has devoted an important effort to the conservation of plant genetic resources in several cultivated species including beans (Ron et al., 1991).

Collection expeditions

The first labour was to collect germplasm in those areas where the presence of old varieties and traditional methods permit it in order to acquire the genetic material and the associated information from farmers.

During 1988 were made five collecting expeditions in the North and Northwest of Spain and in the North of Portugal. In 1989 and 1990 there were two expeditions to the North of Spain. In 1993, in cooperation with the University of Tras-os-Montes e Alto Douro (Vila Real, Portugal) an expedition was made in the North of Portugal. The last expedition was in 1996 in the Northwest of Argentina, in cooperation with organizations from Argentina: CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas), University of Buenos Aires and INTA (Instituto Nacional de Tecnología Agropecuaria).
**Germplasm collection**

At present the germplasm collection of beans at the MBG-CSIC includes 843 accessions (Table 1) all of them with their passport data in a computerized database.

The seeds are maintained in cold storage rooms at 0-2 ºC with 50 % relative humidity. Multiplication and characterization of accessions is conducted mainly in the experimental fields of the MBG-CSIC located in Pontevedra (northwestern Spain, 42° 38' N, 8° 08' W, 20 m altitude, 14 ºC mean temperature and 1608 mm average rainfall). Since 1987 have been evaluated 498 accessions from the germplasm collection on the basis of botanical traits, agronomic value and nutritional quality (Escribano et al., 1994, Santalla et al., 1995). Some of these evaluations have been made in association with maize, which is an usual cropping system in the North of the Iberian Peninsula (Santalla et al., 1994).

**Breeding programmes**

The main research task at the MBG-CSIC is genetic improvement of cultivated species (maize, legumes, brassica crops and grasses). Thus the bean collection is the basis for breeding programmes involving some aspects like:

a) study of variation in populations in terms of agronomic value and quality traits of pod and seed. Since 1987 there have been evaluated 498 populations, mainly from the Iberian Peninsula and Argentina, in both open field and greenhouse. Evaluations were focused in agronomic traits concerning plant, pod and seed as well as quality traits of pod and seed.

b) analysis of genetic diversity by means of electrophoretic analysis of isoenzymes. The analysis of isoenzymes could provide an appropriate method for
characterization of populations not subject to errors caused by changes in the environmental conditions. These techniques are all based on the concept that each cultivar is distinct and relatively homogeneous at the genetic level (Weeden, 1984) and were applied to closely related lines that were difficult to distinguish on the basis of seed morphology. Thus starch-gel electrophoresis was employed on primary leaves to study the differences between the isozyme patterns of different common bean (Phaseolus vulgaris, L) varieties. GOT (Glutamate oxaloacetate transaminase), EST (Esterase), ACP (Acid phosphatase), MDH (Malate dehydrogenase), DIA (Diaphorase), ME (Malic enzyme) were the isozymes assayed.

c) hybridization and selection for seed quality in monoculture and in intercropping with maize. Based on the results of the agronomic and quality evaluations of the collection, some populations were chosen to be utilised in breeding programmes with the objective to improve the protein content, the physical quality of seed and the architecture of the plant. Thus in 1990-91 was started an hybridization program including 13 local populations from the North of Spain displaying good characteristics. Since intercropping with maize is an extended practice in the North of the Iberian Peninsula, the advanced generations were cultivated both in monoculture and in mixture with maize.

d) interspecific hybridization between different species of the genus Phaseolus as a basis for selection programmes. The scarlet bean (P. coccineus) is a species phylogenetically close to the common bean; both share traits that can be useful to widen the genetic basis of the common bean. There are some incompatibility
barriers to obtain hybrids from these species but they can be avoided to a certain extent by using the embryo rescue technique (Monnier, 1976). To obtain hybrids through this technique, crosses have been made between several populations of *P. coccineus* from the North of Spain, Rwanda and Mexico and several pure lines of *P. vulgaris* from the collection existing in the MBG-CSIC. To increase the number of pods which are useful to be rescued, different treatments have been applied to the female flower (*P. coccineus*).

References


Resumen
En la Misión Biológica de Galicia - CSIC (Pontevedra, España) hay una colección de germoplasma de judías (*Phaseolus* spp.) que, en el momento presente, incluye 843 entradas, tanto de España como de otras procedencias de Europa y América. Desde 1987 han sido evaluadas 498 entradas de la colección, sobre la base de caracteres agronómicos y valor nutritivo y, además, se ha estudiado su grado de diversidad genética por medio de análisis electroforético de isoenzimas. Dado que las principales tareas de la Misión Biológica de Galicia - CSIC son la investigación y la mejora genética, algunas de las entradas de la colección son el material básico de mejora, por medio de hibridación y selección.
Table 1. The germplasm collection of beans at the MBG-CSIC

<table>
<thead>
<tr>
<th>SOURCE OF GERMPLASM</th>
<th>ACCESSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Phaseolus vulgaris</em></td>
<td></td>
</tr>
<tr>
<td>cultivated European</td>
<td>616</td>
</tr>
<tr>
<td>cultivated non-European</td>
<td>73</td>
</tr>
<tr>
<td>primitive Argentinean</td>
<td>43</td>
</tr>
<tr>
<td>wild Argentinean*</td>
<td>18</td>
</tr>
<tr>
<td>commercial</td>
<td>69</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>819</strong></td>
</tr>
</tbody>
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| *Phaseolus coccineus*|            |
| European             | 17         |
| non-European         | 5          |
| commercial            | 2          |
| **TOTAL**             | **24**     |

* *P. vulgaris* var. *aborigineus*