DIVERSITY IN COMMON BEAN LANDRACES (Phaseolus vulgaris L.) FROM BULGARIA AND PORTUGAL

РАЗНООБРАЗИЕ НА МЕСТНИ ФОРМИ ПОЛСКИ ФАСУЛ (Phaseolus vulgaris L.) ОТ БЪЛГАРИЯ И ПОРТУГАЛИЯ

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ABSTRACT

The genetic diversity of landraces is thought to be the economic valuable part of global biodiversity and is considered of paramount importance for future world production.

The investigation was performed on 30 common bean landraces (Ph. vulgaris L.) from different geographic origin of Portugal and Bulgaria. The morphological characterization was done according to the IPGRI descriptors (Rome, Italy).

Twenty morphological traits were studied in Portuguese and Bulgarian landraces of common bean (Phaseolus vulgaris L.).

Accessions number 99E059(BG), 99E0123(BG), PH2(PT) and PH23(PT) are of special interest for breeding purposes.

KEYWORDS: Phaseolus vulgaris, diversity, landraces, germplasm, evaluation.

РЕЗЮМЕ

Генетичното разнообразие на местните форми представлява значителна потенциална ценност от цялостното растително биоразнообразие. и е от първостепенна важност за бъдещото световно производство.

Това проучване бе проведено върху 30 местни форми полски фасул с произход от България и Португалия. Морфологичната оценка бе направена съгласно международния Дескриптор на фасула (IPGRI, Rome). Наблюденията бяха направени върху двадесет морфологични, фенологични и стопански признаци.

Образците с кат. № 99E059(BG), 99E0123(BG), PH2(PT) и PH23(PT) представляват интерес за бъдеща селекционна работа.

КЛЮЧОВИ ДУМИ: Phaseolus vulgaris, биоразнообразие, местни форми, генплазма, оценка

INTRODUCTION

Grain legumes have an important role in dry-land farming systems in many types of agriculture around the world. These crops provide high amount of crude protein used for human consumption and animal feeding.

Among the pulses (annual grain legumes for dry seeds) the common bean is by far the most important and widely distributed and has the broadest range of genetic resources[9]. There are a large number of bean landraces in Europe [5], [7].

The genetic diversity of landraces is thought to be the economic valuable part of global biodiversity and is considered of paramount importance for future world production [11].

In Bulgaria as in Portugal, common bean landraces still represent important genetic resources used directly by farmers in a small – scale. For centuries farmers from both countries have grown these plants that were selected for their adaptation to the local environmental conditions. Common bean landraces are an important component in dry-land farming systems.

Common bean landraces usually have local names. They have particular properties (early or late maturing), a reputation for adaptation to local climatic conditions and cultural practices, and resistance or tolerance to diseases and pests [4]. As a result of that landraces are thought to show high yield stability and intermediate yield level under a low input agricultural system. Landraces have played a significant role in the improvement of the common bean in Bulgaria.

Landraces are characterized with great polymorphism resulting from the introduction, the spontaneous formation process and long-term people's selection [1].

Up to 60's all beans sown in Bulgaria were local landraces and cultivars obtained by individual selection. After that started new method of hybridization to introduce bred bean cultivars where the main purpose of bean improvement program was to increase the yield. Other traits like brightness, seed colour and shape, cooking time etc. were ignored.

In order to increase the genetic diversity available to breeding programmes many authors started to study landraces [2], [6], [10].

The main purpose of this work was to study the morphological variability of Portuguese and Bulgarian landraces of dry bean in different environments in order to generate additional information with the aim of better utilization of them. To identify accessions with particular characteristics that could be exploited by plant breeders.

MATERIAL AND METHODS

The study took place in Institute for Plant Genetic Resources (IPGR, Sadovo, Bulgaria) during the period 2003 and 2004.

The investigation was performed on 30 bean landraces (Ph. vulgaris L.) from different geographic origin of Portugal and Bulgaria (Table 1). Sowing took place within 15-20 of April at the experimental field of the IPGR, after predecessor cereals. Each sample was sown in three replications, on an experimental plot of 3.2 m^2 with 20 plants per row. The morphological characterization was done according to the IPGRI descriptors [3] In each genotype, 5 plants per replication were harvested randomly for biometric measurements. Observations were made in 20 characteristics: date of emergence, days to flowering (DFLO), flowering duration (PFLO), days to maturity (DMAT), flower colour(Col. Fl.), plant height (Height pl), number of brunches, height of 1st pod (H. 1st pod), growth habit (Gr. H.), biological yield (W. plant), number of pods per plant (N pod/pl), weight of pods per plant (W pod/pl), pod length (L. pod), pod width (W/pod), number of seeds per plant (N seeds/pl) weight of seeds per plant (W seeds/pl.), colour and shape of the seeds (Seed col.; Seed shape), 100 seeds weight (W 100s). protein content was established by Kjeldahl method.

The meteorological conditions in 2003 and 2004 were comparatively favourable for bean growth, development and yield.

Data were analysed by numerical taxonomy techniques, using NTSYS-pc package, version 2.01, [8]. An Unweighted Pair-Group Method of the Arithmetic (UPGMA) average clustering procedure was employed to construct dendogram.

RESULTS AND DISCUSSIONS

Mean, maximum and minimum values, with coefficient of variation of 12 morphological and phenological characters are shown in Table 2.

The results obtained show a large variation between genotypes. The mean period to initial flowering was 36,5 days (range 30,3-50,3). Most accessions flowered after 35 days and had a cycle to maturity ranging from 71,7 to 86,3 days. The earliest material originated from Bulgaria were 99E059, 95E05, 99E0128. The registered days to their initial flowering were 31-33 days. According to the maturity date, Bulgarian landraces are comparatively early maturing with an average value of this character 77,9 days with low variation coefficient (CV = 4,7%). Early maturity accession from Portugal also was found, cat. № PH2. Most of Bulgarian landraces raised the biological maturity between 74 and 78 days. The Portuguese accessions are characterized to be later,

Table 1. Origin of common bean landraces from Portugal (PT) and Bulgaria (BG)

N	Cat. No	Origin	N	Cat. No.	Origin
1.	PH1	Central-Northern, Pt	**16.**	A3E0001	South-Central, BG
2.	PH2	Northern region, Pt	**17.**	AOE0005	South-Central, BG
3.	PH5	Northern region, Pt	**18.**	AOE0007	South-Central, BG
4.	PH7	Northern region, Pt	**19.**	91E0300	South-West, BG
5.	PH8	Northern region, Pt	**20.**	91E0293	South-West, BG
6.	PH10	Northern region, Pt	**21.**	92E0056	South-Eastern, BG
7.	PH11	Northern region, Pt	**22.**	91E0287	South-West, BG
8.	PH12	Northern region, Pt	**23.**	97E0003	South-Central, BG
9.	PH23	Northern region, Pt	**24.**	97E0005	South-Central, BG
10.	PH37	Northern region, Pt	**25.**	97E0006	South-Central, BG
11.	PH43	Northern region, Pt	**26.**	97E0012	South-Central, BG
12.	PH50	Central-Northern, Pt	**27.**	97E0011	South-Central, BG
13.	PH51	Northern region, Pt	**28.**	99E0059	South-Central, BG
14.	PH71	Northern region, Pt	**29.**	99E0123	South-Central, BG
15.	PH75	Northern region, Pt	**30.**	99E0128	South-Central, BG

Tabl. 2 Mean, Min., Max. values and Coefficient of var. (CV %) of morph. characters in IPGR, Sadovo

Morph. Char.	Mean	Min	Max	CV %
W. plant	43,12	21,3	123,4	48,4
Height pl.	44,7	19,5	101,2	43,3
H 1st pod	15,2	10,2	28	27,5
N pod/pl.	13,9	6,4	20,6	24,5
W pod/pl.	18,5	8,7	29,3	25,1
L. pod	10,5	8,9	12,9	8,1
W. pod	1	0,87	1,3	8,9
N seeds/pl.	36,3	19,9	53,9	25,2
W seeds/pl.	12,5	7,2	19,9	23,3
DFLO	36,5	30,3	50,3	13,9
PFLO	14,2	12	16,7	8,7
DMAT	77,9	71,7	86,3	4,7

with maturity cycle 79 - 86 days, except of PH2 and PH11 with 74 days duration.

The local forms differ in their growth habit. The plants which belong to the climbing habit, during vegetation cycle were well brunched and were the highest, but they produced only few seeds No. PH1 and PH37. That's why the range in plant height was from 19,5 to 123,4 cm. The average value of the plant height is 44,7cm with high variation coefficient CV%=43,3%. The tallest accessions were No. PH 43, PH 8, 95E07, 92E053. These genotypes had high values of plant biological weight. They are characterized to be earlier of beginning to flower (39, 48, 50 days) comparing with accessions PH1 and PH37 and produced high number of seeds and pods per plant.

The number of pods and seeds per plant varied widely from 6,4 to 20,6 and 19,9 to 53,9 with CV% 24,5 and 25,2% respectively. These characters are of major importance of bean yield and selection. The highest value of these parameters were registered in genotypes No. PH2, 99E059, 99E0128. The lowest value of these characters was with accessions No. PH1 and PH37 with Portuguese origin. It can be explained with annual weather conditions which was characterized by the lowest rainfall value and high temperature during June and July, when these plants were in flowering and pod filling stages. The populations possessing shorter time to reach biological maturity have erect habit and produced higher number of pods and seeds per plant. These genotypes avoided unfavourable conditions, high daily temperature (>30 C0) and low air humidity during second and third decade of June and July. Accessions characterized to be earlier which raised biological maturity were PH2, PH11, 99E059, AO3E001.

To understand better the overall diversity of common bean landraces, the data collected were analysed by cluster analysis which gave opportunity to observed the distribution of samples in Fig. 1.

The dendogram shows comparatively low similarity among populations. Genotypes were displayed in clusters ranging from 0,57 to 1,57 units with r=0,67 (Fig.1). A clear separation among genotypes wasn't found. Bulgarian and Portuguese populations were dispersed all over the dendogram. The cluster analysis identified five groups, consisting from 5 to 8 accessions. The populations with climbing growth habit with high value of weight of plant and low number of pods and seeds per plant are clustered together No. PH1, PH37,

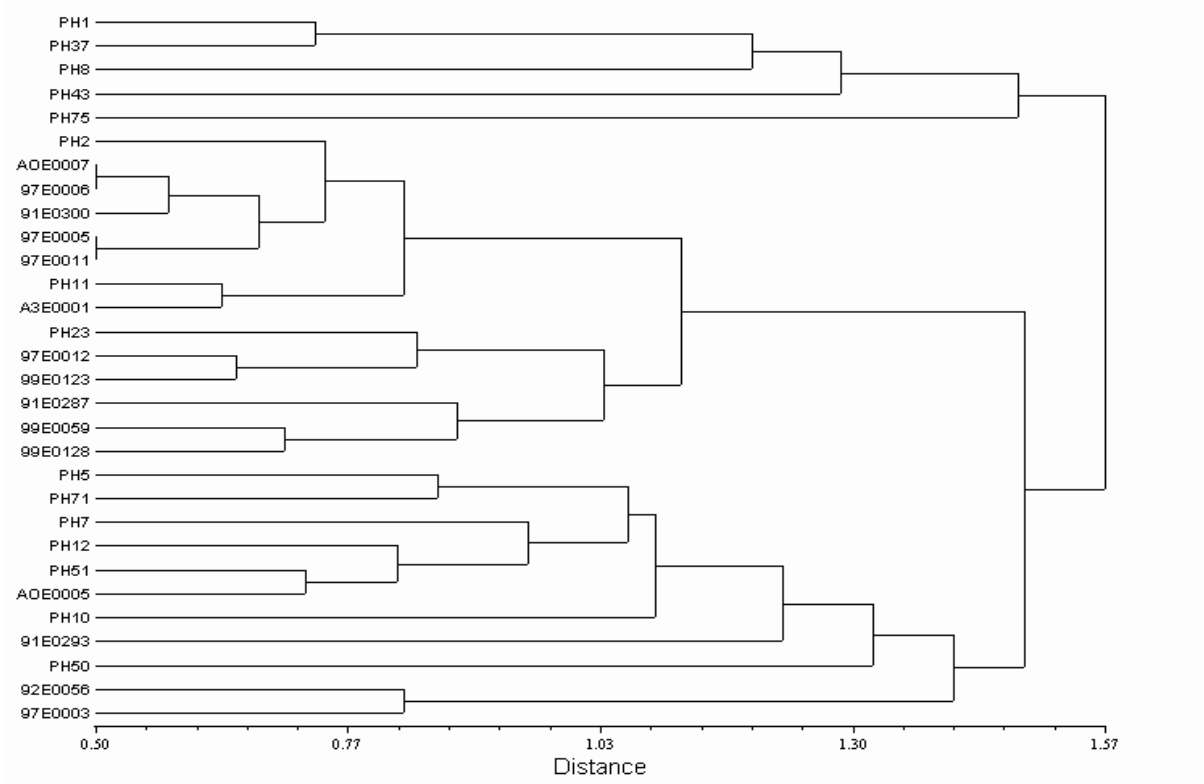

Fig. 1. Dendogram obtained by cluster analysis showing the similarity rate of 30 common bean landraces

Tabl. 3 Qualitative traits observed in common bean landraces

No	Cat. No	Gr. H.	Col. Fl.	Coat Pat.	Seed Col.	Seed sh.	W100s (g)	Prot.C. (%)
1.	PH1	C	white	0				
2.	PH2	B	lilac	2	red	kidney	31.4	28.47
3.	PH5	C	white	0	white	kidney	35.5	29.22
4.	PH7	C	lilac	1	brown	kidney	46.6	27.21
5.	PH8	C	lilac	0	red	kidney	45.3	27.09
6.	PH10	C	lilac	0	red	kidney	39.5	29.61
7.	PH11	B	lilac	0	brownish	cuboid	41.1	29.18
8.	PH12	B	lilac	0	brownish	cuboid	50.3	28.87
9.	PH23	B	white	0	white	oval	32.5	28.00
10.	PH37	C	white	0				
11.	PH43	C	white	2	bicolour	kidney	30.5	28.67
12.	PH50	B	lilac	0	brown	kidney	55.7	28.04
13.	PH51	B	lilac	1	brownish	kidney	39.4	28.16
14.	PH71	B	white	0	white	kidney	40.4	29.65
15.	PH75	C	white	0	white	kidney	25.3	29.97
16.	A3E001	B	white	0	white	kidney	32.3	28.9
17.	AOE005	B	white	0	bicolour	kidney	45.6	30.1
18.	AOE007	B	white	0	white	kidney	39.5	28.9
19.	91E300	B	white	0	white	kidney	37.8	29.6
20.	91E287	B	white	0	white	cuboid	37.2	30.41
21.	91E293	B	lilac	0	brownish	kidney	44.1	31.00
22.	92E056	C	white	0	white	cuboid	32.9	30.8
23.	97E003	B	white	0	white	cuboid	28,6	29.8
24.	97E005	B	white	0	white	cuboid	38.6	30.2
25.	97E006	B	white	0	white	cuboid	36.8	30.1
26.	97E012	B	white	0	white	kidney	35.9	30.5
27.	97E0011	B	white	0	white	kidney	34.3	29.96
28.	99E0059	B	white	0	white	cuboid	41	30.6
29.	99E0123	B	white	0	white	cuboid	42.8	30.4
30.	99E0128	B	white	0	white	cuboid	38.9	30.2

Gr. H., growth habit; B, bush; C, climbing
Col. Fl., colour flower; Coat. Pat., coat pattern; 0-absent; 1-constant mottled; 2-striped
Seed Col, seed colour; Seed sh, seed shape; Prot.C., protein content; Prot.C

and PH8. Accessions PH43 and PH75 differed from the others because of high number of pods and seeds per plant and their weight. Eight genotypes with bush growth habit clustered together from cat No AOE0007 to cat No A3E0001.

The most interesting group consists two subclusters with 14 accessions from No. PH2 to 99E0128. These accessions produced high number of pods and seeds per plant and have erect plants. No. PH2 remained isolated because it differs from the other members of the cluster with bigger number of seeds.

Accessions No. 92E056 and 97E003 are situated together, because of the differences in the same traits.

The seeds of common bean landraces are characterized with the larger variation. There is variability in terms of seed colour and shape (Tabl.3). .Most of them are white but there are also brown, red, white and red around hilum (bicolor), brownish. The prevailing shape is kidney and cuboid, except for cat. No. PH7 and PH23 have oval shape of seeds. The variation in the studied genotypes by seed size, expressed as the weight of 100 seeds, range from 25,3 to 55,7g. The highest value were found in the populations with. cat. No PH50 and PH12 with Portuguese origin and AOE005 and 91E0293 with Bulgarian origin. The accessions with seed size more than 40g (100seeds) with white colour of seeds are of special attention to consumers. The most interesting according to the quality traits are No. 99E059, 99E0123, 99E128 and PH23 with medium large seeds (>25g) and white colour.

For the protein content – an important trait to estimate seed quality, the accessions involved in this study showed a clearly defined tendency to higher protein content

(range from 27.09 to 30.8%).

CONCLUSIONS

Twenty morphological, phenological and agronomic traits were studied in Portuguese and Bulgarian landraces of common bean (Phaseolus vulgaris L.). The evaluation of phenotypic variability by cluster analysis enables to identify the most suitable resources with important parameters to be included in future breeding activities.

Accessions number 99E059(BG), 99E0123(BG), PH2(PT) and PH23(PT) with erect habit, short cycle to rise the maturity and high number of pods and seeds per plant are of special interest for breeding purposes. These genotypes avoided unfavourable conditions, high daily temperature (>30^0 C) and low humidity during the flowering and pod formation periods.

The populations with Portuguese and Bulgarian geographical origin were distributed in five basic groups (Figs.1) by cluster analysis. The most interesting group consists two subclusters with 14 accessions from No. PH2 to 99E0128. These accessions characterised with high number of pods and seeds per plant and with erect plants.

The large-seeded genotypes are No. PH12 (PT), PH50(PT) and AOE005(BG) with weight of 100 seeds >45g with white and brown seed colour.

The variability obtained renders the opportunity to select suitable initial forms for accomplishment of breeding objectives.

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