EVALUATION OF THE AMELIORATIVE POTENTIAL OF SOME LANDRACES OF GARDEN BEANS FROM THE SUCEAVA PLANT GENETIC RESOURCES BANK COLLECTION

EVALUAREA POTENȚIALULUI AMELIORATIV AL UNOR POPULAȚII LOCALE DE FASOLE DE GRĂDINĂ DIN COLECȚIA BĂNCII DE RESURSE GENETICE VEGETALE SUCEAVA

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Abstract: *The research that was the basis of this work aimed to know the variability of some morphological and physiological descriptors of some landraces from the collection of the Suceava Plant Genetic Resources Bank (BRGV). These morphological descriptors relate to plant vigour, number of main branches, leaf colour, flower colour, berry colour, pod size, expressed as length and width, number of pods per plant, number of kernels in pod, berry weight and resistance to factors abiotic stress, in order to identify valuable characters and traits for the breeding process*
Key words: determined growth, garden bean, landraces, phenotypic variability, plant breeding

Rezumat: *Cercetările care au stat la baza acestei lucrări au avut ca scop cunoașterea variabilității unor descriptori morfologici și fiziologici ai câtorva populații locale din colecția Bancii de Resurse Genetice Vegetale (BRGV) Suceava. Acești descriptori morfologici se referă la vigoarea plantelor, numărul de ramificații principale, culoarea frunzelor, culoarea florilor, culoarea boabelor, dimensiunile păstăilor, exprimate prin lungime și lățime, numărul de păstăi pe plantă, numărul de boabe în păstaie, greutatea boabelor și rezistența la factorii abiotici de stres, în scopul identificării unor caractere și însușiri valoroase pentru procesul de ameliorare.*
Cuvinte cheie: ameliorarea plantelor, creștere determinată, fasole pentru păstăi, populații locale, variabilitate fenotipică

INTRODUCTION

Agriculture in recent years in Romania has recorded a major decline in the areas cultivated with leguminous species, including beans, either for pods or for grains, although the importance of culture, with its multiple aspects, is one that is

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unanimously recognized. Maintaining and replenishing collections of genetic resources is essential for using variability in legume breeding (Parker *et al*., 2022). Promising results regarding the creation of smart collections, which have been developed standardized protocols for characterization, maintenance and dissemination to interested users, have been obtained at the EU level, through the implementation of the INCREASE project, in bean species (Cortinovis *et. al*., 2021) , lentils (Garcia *et. al*, 2021) chickpea (Rocchetti *et. al*, 2022) and lupine (Kroc *et al*., 2021). Climate change and the need for food resources have a high impact on conservation and improvement activities of plant genetic resources. Among these resources, varieties and landraces are the depositories of a high genetic diversity (Angioi *et al*., 2010), accumulated over time through natural and empirical selection and under the action of local environmental factors. According to the Genesys database (www.genesys-pgr.org), more than 135,000 accessions are registered for the species *Phaseolus vulgaris* L., of which about 71,000 are landraces. After the large collections of the Columbia International Center for Tropical Agriculture (about 32,000 accessions), the United States Department of Agriculture Agricultural Research Service (USDA-ARS), with about 14,000 accessions, the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) from Germany (about 8400 accessions), N.I. Vavilov Institute of Plant Genetic Resources (VIR) from Russia (about 6400 accessions), Suceava Plant Genetic Resources Bank preserves a number of 3289 accessions (https://svgenebank.ro/).

MATERIAL AND METHOD

The biological material was represented by five landraces of garden beans with determined growth from the BRGV Suceava collection, placed in the field in an experiment according to the randomized block method, in five repetitions, each population being sown in two rows with a length of 2.5 m, at a distance of 50 cm between the rows, each plot-repetition being thus represented by 45-50 plants.

From each repetition, ten plants were analyzed, during the vegetation period and then at harvest, determinations were made regarding the following morpho-physiological descriptors: color of leaves, flowers and seeds, plant vigor (with grades in the FAO scale 1 – 9) and frequency of attack (in percentage of plants attacked) by common bean blight (*Xanthomonas campestris.* pv *phaseoli*). Also, biometric determinations were performed to evaluate the phenotypic variability of the following morphological descriptors: the number of branches per plant, the number of flowers in the inflorescence, the number of pods per plant, the number of seeds in the pod, the number of seeds per plant and the mass of 1000 grains (TKW). For the quantitative characters, mean character values and coefficients of variation were determined. The control was represented by the average of the experience, and the differences between the experimental variants and the control were processed through the analysis of variance and interpreted with the help of the limit differences method, according to the model specified by the literature (Leonte, 1997)

The accumulation of a precipitation deficit of 97.8 mm with temperatures higher by about 2^0C from May to September of the year of the experiment did not allow the

development of plants in the best conditions, but it can be a selection factor for identifying landraces with resistance to drought and high temperatures.

RESULTS AND DISCUSSIONS

From the analysis of the values of the analyzed morphological descriptors (tab. 1), it emerged that all the landraces had a determined type of growth, with white flowers in four of them and one with pink-purple flowers. Two landraces had white seeds, one with brown seeds, one with purple seeds with white spots, and one with beige seeds with brown stripes. Plant vigor (on the FAO 1 – 9 scale) was average, with the BRGV-04 population having a slightly higher vigor than the other landraces. Regarding the frequency of attack by *Xanthomonas campestris* pv. *phaseoli*, the lowest percentage of attacked plants (2%), was recorded in the BRGV-05 population, for the other four landraces the average frequency was 10%.

Table 1

Morpho-physiological characterization of local french bean landraces from the BRGV Suceava collection

Cultivar	The morpho-physiological descriptors analyzed					
	Growth type	The color of the leaves	The color of the flowers	The color of the seeds	Plant vigor	Attack frequency of *X.c.* pv. *phaseoli* (%)
BRGV-01	dwarf	green	white	brown	5	9
BRGV-02	dwarf	green	pink-purple	beige with brown stripes	5	11
BRGV-03	dwarf	green	white	white	5	10
BRGV-04	dwarf	green	white	white	6	10
BRGV-05	dwarf	green	white	purple with white spots	5	2

The statistical processing of the average values of the characters corresponding to the morphological descriptors and the significance of the differences compared to the average of the experience revealed a significant positive difference in the average number of branches per plant for the local population BRGV-05 (tab. 2), in which the average number of flowers in inflorescence recorded a distinctly significant increase (tab. 3). The average number of pods per plant (tab. 4) and the number of seeds per pod (tab. 5) did not show significant differences in any of the variants tested, except for the BRGV-03

population, which resulted in a significant negative difference for the number of pods per plant. The number of seeds per plant was significantly higher compared to the average of the experience for the BRGV-05 population (tab. 6), this being also the variant where the MMB was significantly lower compared to the average of the character in the five tested landraces (tab. 7).

Table 2

The variability of the number of branches per plant

Cultivar	Average number of branches/plant		Coefficient of variability	± d	Significance of the differences
	$\bar{x} \pm s_{\bar{x}}$	%	s%	Nr.	
BRGV-01	4.90 ± 0.14	96.46	15.5	-0.18	-
BRGV-02	5.07 ± 0.13	99.74	13.6	-0.01	-
BRGV-03	4.77 ± 0.14	93.83	16.2	-0.31	-
BRGV-04	5.07 ± 0.14	99.74	15.5	-0.01	-
BRGV-05	5.60 ± 0.10	110.24	10.1	0.52	*
Average experience	5.1	100.00	14.2	-	-

DL 5% = 0.48 DL 1 % = 0.70 DL 0.1 % = 1.05

Table 3

The variability of the number of flowers in the inflorescence

Cultivar	The average number of flowers in the inflorescence		Coefficient of variability	± d	Significance of the differences
	$\bar{x} \pm s_{\bar{x}}$	%	s%	Nr.	
BRGV-01	3.83 ± 0.12	101.59	17.6	0.06	-
BRGV-02	3.87 ± 0.11	102.47	14.8	0.09	-
BRGV-03	2.60 ± 0.09	68.90	19.6	-1.17	ooo
BRGV-04	4.17 ± 0.11	110.42	14.2	0.39	*
BRGV-05	4.40 ± 0.09	116.61	11.2	0.63	**
Average experience	3.80	100.00	15.5	-	-

DL 5% = 0.29 DL 1 % = 0.43 DL 0.1 % = 0.64

Table 4

The variability of pod number on the plant

Cultivar	Average number of pods per plant		Coefficient of variability	± d	Significance of the differences
	$\bar{x} \pm s_{\bar{x}}$	%	s%	Nr.	
BRGV-01	15.43 ± 0.45	99.91	17.5	-0.01	-
BRGV-02	15.90 ± 0.52	102.93	18.0	0.45	-
BRGV-03	14.33 ± 0.56	92.79	21.3	-1.11	o
BRGV-04	15.43 ± 0.65	99.91	22.9	-0.01	-
BRGV-05	16.13 ± 0.60	104.45	20.5	0.69	-
Average experience	15.40	100.00	20.04	-	-

DL 5% = 1.09 DL 1 % = 1.59 DL 0.1 % = 2.38

Table 5

Variability of the number of seeds on the pod

Cultivar	Average number of seeds per pod		Coefficient of variability	± d	Significance of the differences
	$\bar{x} \pm s_{\bar{x}}$	%	s%	Nr.	
BRGV-01	4.60 ± 0.09	99.00	11.4	-0.05	-
BRGV-02	4.43 ± 0.10	95.41	11.4	-0.21	-
BRGV-03	4.70 ± 0.08	101.15	9.9	0.05	-
BRGV-04	4.50 ± 0.09	96.84	11.3	-0.15	-
BRGV-05	5.00 ± 0.13	107.60	14.9	0.35	-
Average experience	4.60	100.00	11.8	-	-

DL 5% = 0.39 DL 1 % = 0.57 DL 0.1 % = 0.85

Table 6

Variability of the number of seeds on the plant

Cultivar	Average number of seeds per plant		Coefficient of variability	± d	Significance of the differences
	$\bar{x} \pm s_{\bar{x}}$	%	s%	Nr.	
BRGV-01	68.40 ± 2.95	96.17	23.7	-2.73	-
BRGV-02	70.67 ± 2.86	99.35	22.2	-0.46	-
BRGV-03	66.97 ± 2.61	94.15	21.4	-4.16	-
BRGV-04	69.17 ± 3.10	97.24	24.6	-1.96	-
BRGV-05	80.43 ± 3.64	113.08	24.8	9.31	*
Average experience	71.10	100.00	23.34	-	-

DL 5% = 8.62 DL 1 % = 12.54 DL 0.1 % = 18.81

Table 7

Variability of TKW (g)

Cultivar	Average of TKW (g)		Coefficient of variability	± d	Significance of the differences
	$\bar{x} \pm s_{\bar{x}}$	%	s%	g	
BRGV-01	593.87	100.46	18.7	2.70	-
BRGV-02	607.93	102.84	18.9	16.77	-
BRGV-03	600.47	101.57	18.7	9.30	-
BRGV-04	588.27	99.51	16.4	-2.90	-
BRGV-05	565.30	95.62	12.2	-25.87	o
Average experience	591.20	100.00	17.0	-	-

DL 5% = 22.73 g DL 1 % = 33.07 g DL 0.1 % = 49.60 g

The resulting coefficients of variability for these morphological characters (tab. 2 – 7) fell between the limits of a medium variability for the number of branches per plant, the number of flowers in the inflorescence, the number of seeds per pod and TKW. The number of pods per plant had a medium variability for landraces BRGV-01 and BRGV-02 and only landraces BRGV-03, BRGV-04 and

BRGV-05 were characterized by a high variability of this character. Only the number of seeds per plant showed high variability in all landraces analyzed

CONCLUSIONS

The morphological descriptors for which positive and statistically assured differences were recorded were the number of branches per plant (BRGV-05), the number of flowers in the inflorescence (BRGV-04 and BRGV-05) and the number of seeds per plant (BRGV -05).

Regarding the quantitative characters, the BRGV-05 population shows a better ameliorative potential than the other four tested landraces.

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