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RESEARCH CONCERNING THE VARIABILITY OF THE MAIN CHARACTERISTICS OF THE DWARF BEAN PODS AT THE LOCAL POPULATIONS FROM EAST ROMANIA

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Abstract

Since 2010, the Breeding Laboratory from Vegetable Research – Development Station Buzău initiated a great conservation program concerning the bean germplasm resources (Phaseolus vulgaris L.) from the traditional vegetable areas. There were procured, taken into study and cultivated in open field conditions over 50 local populations of dwarf bean (P. vulgaris var. nanus). The researches had the purpose to create a germplasm base for these species. The paper presents the main characteristics of the pods for 10 local populations. The results obtained dignified a great variability of the biological material taken into study, fact that offers it a great value for the following breeding works.

Key words**:** *breeding, germplasm, Phaseolus vulgaris L. var. nanus*.

INTRODUCTION

In context of vegetable variety diversification, in 2010, from the surface cultivated with vegetables, the green bean occupied 2,8% in the world and 4% in Romania. From the point of view of the surface cultivated with green bean, our country is situated on the 5th place in Europe, but on the 21st in what it concerns the mean yield made at the surface unit [8]. The low level of the yield comparative to other states from Europe determined the researches from the Vegetable Research – Development Station (V.R.D.S.) Buzău to initiate an ample breeding program for this species (*Phaseolus vulgaris* L.) in order to create productive varieties adapted to the new climatic conditions.

The first step made in order to realize a breeding program is represented by collecting or creating the biological material which posses the genes that can offer the wanted characteristics to the new cultivar [2].

The east zone of Romania is famous for the richness of the local populations for the vegetable varieties, including green bean [6]. Because of this fact, the initial biological material for breeding was represented generally by the local populations from Buzău vegetable area and from the neighboring vegetable areas.

The research presents the study of the initial collected material. This stage of the breeding process is very important because it allows to the researcher to orientate to the practical possibilities in order to realize new cultivars according to the breeding objectives proposed [4].

Collecting, introducing in culture and studying the local bean populations from the traditional vegetable area allow the enrichment of the germplasm collection and also it allows the biodiversity conservation at this species. In the same time, the enrichment of the initial biological material represents a safe guaranty to the breeding process [5].

MATERIAL AND METHOD

The enrichment of the germplasm collection for bean started in 2010 through local population collection. Until nowadays (2012) there were collected over 50 local populations for dwarf bean.

The researches were made at The Plant Breeding Laboratory from V.R.D.S. Buzău during 2010 – 2012.

The main objectives of the breeding process were the following: productivity, high accommodation capacity to the environmental conditions and earliness.

From the local populations procured, 8 of them manifested phenotypical stability and valuable characteristics, being comparative studied with *Ioana* variety:

- V_{1Mt} - Ioana variety, control variant;
- V_2 – local population 1 Buzău;
- V_3 - local population 2 Iaşi;
- V_4 - local population 12 Buzău;
- V_5 - local population 3 Iaşi;
- V_6 - local population 4 Iaşi;
- V_7 - local population 5 Bîrlad;
- V_8 - local population 23 Buzău;
- V_9 – local population 7 Bacău.

The biological material taken into study was cultivated in open field conditions, according to the technology recommended by the specialty literature [7].

There were made many determinations: length, width, pods thickness and weight, number of pods/plant and number of seeds from pod. These quantitative characteristics are determined in what it concerns the pods commercial aspect. All the proveniences taken into study do not present stringiness of ventral suture at the technological maturity.

The experiment was organized according to the randomized blocks method with three repetitions. There were made biometric mensurations in order to determine the variability of the of the main pods characteristics according to the specialty literature [1, 3].

RESULTS AND DISCUSSIONS

The analysis of a character variability quotient (s%) shows the uniformity of the plants taken into study (as the variability quotient is lower, as the analyzed plants are more stable for the analyzed character).

The control variant (*Ioana* variety) presented pods with a 14.03 cm mean length. V_6 and V_9 variants had values superior to the control variants (16.8 cm and 14.37 cm). The local populations taken into study presented a low variability (s%<10%), the variability quotient varying between 3.8% at V_8 and 8.24% at V_7 (Table 1).

Table 1. Pods length variability

Variants	Pods length (cm)	Variability quotient (%)	Differences than V_{1Mt} (cm)
V_{1Mt}	14.03	6.77	–
V_2	12.17	4.53	-1.86
V_3	10.40	6.31	-3.63
V_4	13.30	5.97	-0.73
V_5	11.73	4.69	-2.30
V_6	16.80	5.19	2.77
V_7	12.63	8.24	-1.40
V_8	12.43	3.80	-1.60
V_9	14.37	8.13	0.34

The mean length of the pods varied between 16.8 cm at V_6 and 10.4 cm at V_3 (Photo 1).

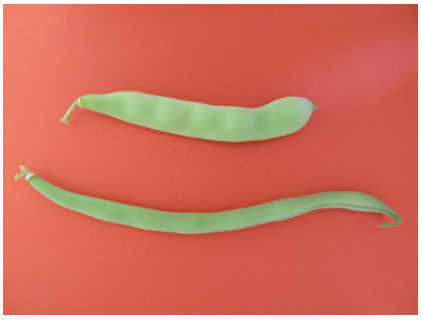


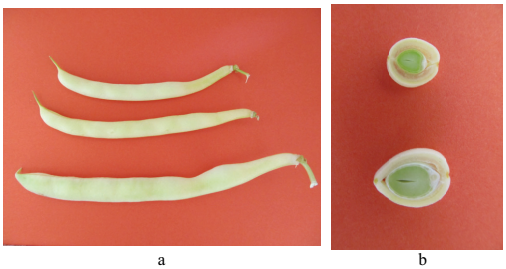
Photo 1. Comparison between pods length at V_3 and V_6 variants

Pods width had values within 1.47 cm at V_3 and 0.85 cm at V_7. V_3 and V_4 variants surpassed the control variants value with 0.47 cm and 0.37 cm (Table 2).

Table 2. Pods width variability

Variants	Pods width (cm)	Variability quotient (%)	Differences than V_{1Mt} (cm)
V_{1Mt}	1.00	10.00	–
V_2	0.88	3.27	-0.12
V_3	1.47	3.94	0.47
V_4	1.37	4.22	0.37
V_5	0.90	11.11	-0.10
V_6	1.13	5.09	0.13
V_7	0.85	5.94	-0.15
V_8	0.88	3.27	-0.12
V_9	0.95	5.26	-0.05

The variability quotient in what it concerns pods width had low values (s%<10%), except V_5 variant (11.11%) which had a mean variability quotient (s%=10 – 20 %).
The transversal sections through pod mark the differences determined by the width registered during the experiment (Photo 2).



a b

Photo 2. Pods width (a) and transversal sections (b) at V_8 and V_4 variants

The variability quotient of the pods width varied between 5.56% at V_9 and 12.74% at V_4 (table 3). V_4 and V_7 variants had mean variability, while the other variants presented a high stability for this character. At V_5 variant was registered the highest value of pods width (1.17 cm) and the highest value of the thickness/width proportion (1.3).

Table 3. Pods thickness variability

Variants	Pods thickness (cm)	Variability quotient (%)	Differences than V_{1Mt} (cm)	Thickness/width proportion
V_{1Mt}	0.92	8.33	–	0.92
V_2	0.77	7.53	-0.15	0.87
V_3	0.97	5.97	0.05	0.66
V_4	0.82	12.74	-0.10	0.60
V_5	1.17	9.90	0.25	1.30
V_6	0.83	6.93	-0.09	0.74
V_7	0.76	10.44	-0.16	0.90
V_8	0.75	6.67	-0.17	0.85
V_9	0.90	5.56	-0.02	0.95

At V_8 (0.75 cm), V_7 (0.76 cm) and V_2 (0.77 cm) variants were registered the lowest values in what it concerns pods thickness, while at V_4 (0.60 cm), V_3 (0.66 cm) and V_6 (0.74 cm) variants was observed the lower thickness/ width proportion. The shape of the pods transversal sections from in the experiment varied between elliptical, circular or "eight" shape (Photo 3).
In what it concerns the number of seeds/pod, the highest value was registered at the control variant (6.9), and the lowest value was registered at V_3 (4.67).

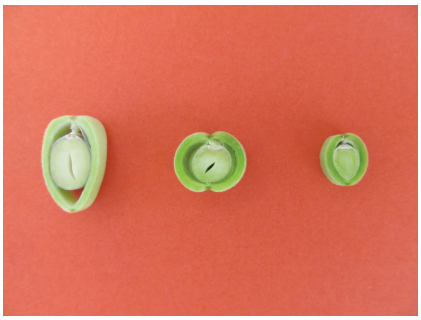


Photo 3. Transversal section through V_3, V_5 and V_6 pods

From the analysis of the seeds/pod number variability there can be observed the fact that most variants had a mean variability quotient. V_{1Mt} (8.07%) and V_5 (4.6%) variants presented a high stability of this character (table 4).

Table 4. Variability of the number of seeds from pod

Variants	Number of seeds from pod	Variability quotient (%)	Differences than V_{1Mt} (cm)
V_{1Mt}	6.90	8.07	–
V_2	5.67	10.19	-1.23
V_3	4.67	12.37	-2.23
V_4	5.13	15.75	-1.77
V_5	6.17	4.68	-0.73
V_6	6.17	12.39	-0.73
V_7	4.93	19.16	-1.97
V_8	6.67	17.32	-0.23
V_9	6.00	16.67	-0.90

Pods weight and the number pods/plant represents two very important characteristics because it determines productivity.
During the experiment, pods weight varied between 9.78 g at V_4 and 5.76 g V_2 (table 5).
At V_2 (5.76 g) and V_8 (5.89 g) variants were registered lower values than the control variant; the other variants presented higher values. V_2, V_4 and V_8 variants presented a mean variability of this character.

Table 5. Pods weight variability

Variants	Pods weight (g)	Variability quotient (%)	Differences than V_{1Mt} (cm)
V_{1Mt}	6.17	9.22	–
V_2	5.76	14.25	-0.41
V_3	9.26	7.39	3.09
V_4	9.78	14.83	3.61
V_5	8.89	8.36	2.72
V_6	7.60	6.20	1.43
V_7	9.47	7.51	3.30
V_8	5.89	10.81	-0.28
V_9	8.29	8.26	2.12

The variability quotient in what it concerns the number of pods/plant was low for most variants, mean for 3 variants (V_{1Mt}, V_2 and V_7) and high for V_3 variant (Table 6).

Table 6. Variability of number of pods/plant

Variants	Number of pods/plant	Variability quotient (%)	Differences than V_{1Mt} (cm)
V_{1Mt}	32.00	12.50	–
V_2	32.67	13.80	0.67
V_3	29.00	27.37	-3.00
V_4	27.40	4.44	-4.60
V_5	27.07	3.72	-4.93
V_6	34.20	8.36	2.20
V_7	28.33	11.35	-3.67
V_8	38.40	6.83	6.40
V_9	33.33	7.55	1.33

The highest number of pods/plant (38.4) was registered at V_8, and the lowest (27.07) at V_5 (Photo 4).

V_8

V_5

Photo 4. Plants aspect for V_8 and V_5

In what it concerns productivity, V_9 variant obtained the highest yield 276.33 g pods/plant, having 8.29 g mean pods weight and 33.33 mean number of pods/plant. The lowest yield was registered at V_2 variant (188.05 g) and it was determined by 32.67 mean pods/plant number and 5.76 g mean pods weight.

During the experiment, 4 variants had yellow pods (V_{1Mt}, V_2, V_4 and V_8) and 5 variants had green pods.

CONCLUSIONS

V_6 variant presented very long pods, and V_4 and V_3 variants had broad pods (elliptical transversal section).

Mean pods weight varied between 9.78 g at V_4 and 5.76 g at V_2.

At V_8 variant was registered the highest number of pods/plant (3.84), and the lowest (27.07) at V_5 variant.

At V_2 variant were registered the lowest values of: pods thickness, mean pods weight and yield.

V_5 variant manifested high stability for all studied characters, less in what it concerns pods width which presented middle variability.

The studied material presents high stability or mean stability for the studied characters, fact that offers a great value to the forthcoming breeding works.

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