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Studies regarding the value of a garden beans (*Phaseolus vulgaris* L. var,*nanus*) local landraces collection concerning the number of pods per plant

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Abstract Variability of traits in garden beans is very high there are many genotypes being untapped. Land races are a pool of genes for breeding programs. The number of pods per plant varies widely depending on the growing type and vegetation conditions. The study aimed to assess the garden beans land races collected in western Romania in terms of pods per plant, as an element of productivity. Local land races are inferior to varieties grown in the area. There are emphasized as valuable Joia Mare 2 and Bârzava land races. The number of pods per plant is directly correlated with the number of beans in the pod, number of beans per plant and weight beans per plant. The links of number of pods per plant with the main traits components of productivity are linear.

Key words

bean, local landraces, number of pods per plant

Consumption of beans differ from country to country. In underdeveloped countries there is greater consumption of beans, while in developed countries is higher consumption of pods. [1]

Variability of important traits in terms of productivity and quality is very wide. In general, garden beans grown for pods, these limits are much broader.

Germplasm is very rich in beans. Variability is very pronounced due to the large number of species and cultivated forms. Within species the variability is very important and is maintained by selfpollinating.

Variability is manifested on several traits, such as plant port, shape, size and color of beans, flowers and pods. Variability is present also in physiological characters, especially in those of resistance. [4]

An extremely valuable category for breeding is the large number of local land races. Applied selection over time has led to homogenization of this land races and highlight some valuable features.

These forms can be used to improve some morphological features involved in the production capacity or disease resistance. [12, 9, 10]

Maintaining the collection is quite difficult due to sensitivity to unfavorable environmental factors and disease and pest attack. They may compromise the production of beans. [5, 13]

Cultivated varieties along with ancient forms an important primary gene pool, its study allowing to conclude on their evolution.

Worldwide there are many collections, the most valuable being those made in the areas of origin of the beans. Valuable forms can still be found in other areas of culture. [11, 2]

As in other crops, the beans production capacity is achieved by genotype interaction with environmental conditions by developing physiological processes throughout the growing season. Most researchers argue that productivity is dependent on photosynthetic efficiency or complex interactions between photosynthesis, respiration and assimilates use. [7]

The number of pods per plant varies depending on the type of growth and vegetation periode. In forms with limited growth in optimal conditions, the number of pods per plant varies between 15 and 25, which is the minimum acceptable limits in the selection process. These limits can be achieved in garden beans, the last Romanian varieties showing more than 12 pods per plant, depending on climatic conditions. [8, 6]

Materials and Methods

The collected biological material was consisted of local land races from western Romania have been studied beside some romanian and foreign varieties cultivated in this area. As control, Maxidor variety was used.

The purpose of the study was to determine the variability value of an important trait for productivity in beans cultivated for pods: number of pods per plant.

Field study was conducted over a period of three years (2008-2010), the collected data being obtained by performing biometric measurements.

By applying statistic calculations, the variability of this trait was studied and its link with other important traits for breeding process. This study helps in recommending genitors for breeding programs, or to evidence of valuable land races that can be processed by selection. [3].

Table 1

Origin of studied biological material

Variety	Local land races	
Maxidor (martor), Unidor, Budai Piaci, Bobis Nano, Carson, Inka	Arad County	Juliţa, Bârzava, Joia Mare 1, Joia Mare 2, Buteni 1, Buteni 2, Vinga, Olari 1, Secusigiu, Păulean, Olari 2, Sebiş, Bata, Birchiş, Bârsa,
	Timiş County	Buzad, Cutina, Voiteg, Cenad, Valcani, Bobda 1, Şandra, Răchita, Făget, Bethausen, Dudeştii Vechi, Becicherecu Mic, Bobda 2,
	Bihor County	Tărcaia, Fiziş 1, Pietrani, Fiziş 2, Ioniş
	Caraş Severin County	Cornereva, Bolvaşniţa
	Mehedinţi County	Sviniţa, Vănători

Results and Discussions

The number of pods per plant had a great variability within the collection. It appears that improved varieties are superior to local land races concerning this trait. However, there are some land races that are emphasized: Bârzava and Joia Mare 2, which presented a higher average than the most valuable of the varieties (Bobis Nano).

Table 2.

Estimates values and significance of differences between local land races of dwarf bean for the number of pods per plant

No. crt.	Local land races	Number of pods /plant		Relative value (%)	Difference signification	No. crt.	Local land races	Number of pods /plant		Relative value (%)	Difference signification
		$\bar{x} \pm s_{\bar{x}}$	$s_{\%}$					$\bar{x} \pm s_{\bar{x}}$	$s_{\%}$		
1	Maxidor (control)	7,87±0,13	2,44	100,00	Control	23	Cenad	5,07±0,19	5,75	64,42	-2,80^{000}
2	Unidor	8,70±0,31	6,59	110,54	0,83*	24	Bata	5,62±0,08	1,56	71,41	-2,25^{000}
3	Budai Piaci	4,92±0,08	1,80	62,51	-2,95^{000}	25	Birchiş	6,94±0,08	2,96	88,18	-0,93^{0}
4	Bobis Nano	9,02±0,40	7,02	114,61	1,15**	26	Valcani	5,92±0,17	5,99	75,22	-1,95^{000}
5	Carson	7,42±0,41	8,70	94,28	-0,45	27	Bobda 1	3,91±0,18	11,84	49,68	-3,96^{000}
6	Inka	6,64±0,16	4,32	84,37	-1,23^{000}	28	Şandra	5,13±0,12	3,08	77,89	-2,74^{000}
7	Juliţa	7,29±0,19	4,33	92,63	-0,58	29	Răchita	6,95±0,52	13,07	88,31	-0,92^{0}
8	Bârzava	9,98±0,10	1,92	126,81	2,11***	30	Făget	3,09±0,13	7,16	39,26	-4,78^{000}
9	Joia Mare 1	6,53±0,23	5,12	82,97	-1,34^{000}	31	Bethausen	4,86±0,08	2,95	61,75	-3,01^{000}
10	Joia Mare 2	9,35±0,84	14,83	118,80	1,48***	32	Dudeştii Vechi	6,63±0,25	8,95	84,24	-1,24^{000}
11	Buteni 1	5,91±0,20	5,36	75,09	-1,96^{000}	33	Bârsa	4,84±0,05	1,79	61,49	-3,03^{000}
12	Buzad	5,05±0,19	4,88	64,16	-2,82^{000}	34	Sviniţa	5,23±0,07	3,33	66,45	-2,64^{000}
13	Cutina	6,82±0,32	6,68	86,65	-1,05^{00}	35	Becicherecu Mic	3,73±0,14	8,97	47,39	-4,14^{000}
14	Buteni 2	4,49±0,33	11,03	57,05	-3,38^{000}	36	Bobda 2	4,27±0,09	3,04	54,24	-3,60^{000}
15	Vinga	8,07±0,16	3,01	102,54	0,20	37	Fiziş 1	5,58±0,26	7,17	70,90	-2,29^{000}
16	Olari 1	3,91±0,11	2,28	49,68	-3,96^{000}	38	Pietrani	6,74±0,20	5,78	85,64	-1,13^{000}
17	Secusigiu	6,26±0,13	2,94	79,54	-1,61^{000}	39	Fiziş 2	4,18±0,12	6,74	53,11	-3,69^{000}
18	Păulean	5,84±0,19	4,69	74,20	-2,03^{000}	40	Ioniş	4,54±0,09	4,48	57,68	-3,33^{000}
19	Olari 2	6,53±0,21	5,98	82,97	-1,34^{000}	41	Cornereva	4,23±0,15	5,95	53,74	-3,64^{000}
20	Tărcaia	6,33±0,29	10,95	80,43	-1,54^{000}	42	Vănători	6,32±0,14	3,96	80,30	-1,55^{000}
21	Voiteg	6,54±0,09	3,92	83,10	-1,33^{000}	43	Bolvaşniţa	4,30±0,25	10,64	54,63	-3,57^{000}
22	Sebiş	7,73±0,29	8,16	98,22	-0,14						

$DL_{5\%} = 0,69$ $DL_{1\%} = 0,95$ $DL_{0,1\%} = 1,16$

Compared to Maxidor control variety, the averages differences for number of pods per plant are very significant. Most local land races are lower than the control variety. In fact they are inferior to all varieties of experience. Compared to control variety the differences are statistically ensured, except Vinga and Sebiş land races that are at the Maxidor variety level. (Table 2)

From this we can see that for the number of pods per plant the collected material is not very important. The two special land races for this trait can be used both as genitors in breeding programs, but may be subject even to selection, being superior, especially to romanian varieties.

Analyzing the collection as a whole, one can see that almost half of the land races had between 4 and 6 pods per plant, about one third (27.90%) 6-7 pods per plant, and over 8 pods per plant were registered only at 5 genotypes. (Figure 1).

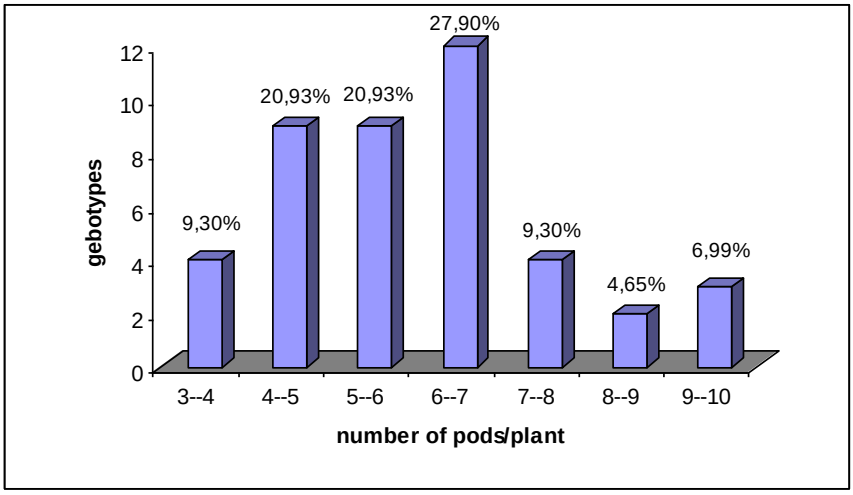

Fig. 1. Variability of the number of pods per plant in the local landraces collection

Analysis of variance for experimental cycle shows that the variability of pods number per plant is mainly due to differences between land races and not experimental years because the experimental testing period included years with differences less favorable for beans culture, with no differences from one year to another. However, conditions of experimental years also influenced the number of pods per plant.

Compared to biological potential of plant, recorded values were modest because in all experimental years, during the growing season high temperatures very and lack of precipitation have been reported. Table 3.

Table 3.

Analysis of variance on the number of pods per plant for dwarf bean local populations studied

Variantion source	SP	GL	S^2	F Test
Total	3579,79	129		
Years	0,25	2	0,12	F = 0,30
Land races	3546,01	42	84,42	F = 216,46**
Error	33.53	85	0,39	

According to the significance of correlation coefficients, the number of pods per plant is directly correlated with the number of beans in the pod, number of beans per plant and weight of beans per plant. The number of pods per plant had no influence on beans and pods size. (Table 4)

Analysis of variances and covariances, shows that between most studied traits pairs a linear relationship exists. Links between the number of pods per plant and beans weight per plant, respectively between the number of beans in pods and number of pods per plant, are of nonlinear nature.

For linear links, establishing the selection strategy is simple, taking into account only the significance of correlation. For these it can be known with approximation about how a trait will change at the increase the other. In the case of nonlinear connections is difficult to make such findings.

Table 4.

Variance and coefficients of correlation values between number of pods per plant and other traits on components of production capacity in local land races of dwarf bean

Trait	Pod length	Pod diameter	Beans number/pod	Beans weight/pod	Beans number/plant	Beans weight/plant
No. pods /plant (s^2=2,04)	r = 0,175 S^2_{XY} = 0,47	r = -0,173 S^2_{XY} = 0,03	r = 0,332** S^2_{XY} = 0,38	r = 0,043 S^2_{XY} = 0,03	r = 0,822*** S^2_{XY} = 10,16	r = 0,581*** S^2_{XY} = 3,00

Conclusions

1. Breeded varieties are superior to local land races concerning number pods per plant.
2. Bârzava and Joia Mare 2 land races are emphasized, because of the presented higher average than the most valuable of the varieties (Bobis Nano).
3. Number of pods per plant variability is mainly due to differences between land races and, not to experimental years.
4. To biological potential of plant, values recorded were modest because in all experimental years, very high temperatures and lack of precipitation have been reported.
5. The number of pods per plant is directly correlated with the number of beans in the pod, number of beans per plant and bean weight per plant.
6. Links between the number of pods per plant and beans weight per plant, number of beans in pods respectively, are nonlinear. Compared to other traits, the links are linear.

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