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Original scientific paper

THE EFFECT OF GENETIC PARAMETERS ON INHERITANCE OF THE FIRST POD HIGHT IN SNAP BEAN (*PHASEOLUS VULGARIS* L.)

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In order to research the inheritance, gene effect, combination abilities and genetic variance components, we investigated six divergent snap bean genotypes (Supernor, Darija, Grinkrop, Palanačka rana, Šumadinka and Zora) and their F_1 progeny created by diallel crossing without reciprocals. For the trait of height of forming the first pod, variance of average value of parents and hybrids was highly significant. The value of dominant components (H_1 and H_2) was higher than additive component (D), meaning that dominant genes control the inheritance of number of pods per plant. The average level of domination $\sqrt{H1/D}$ is higher than 1, pointing to superdomination. Heritability in broader sence amounts 90% pointing to high contribution in inheriting the number of pods per plant.

Key words: snap bean, combinating ability, first pod height

INTRODUCTION

The first pod height is an important trait because the height of the first pod enables mechanical harvest, which indirectly influences the production of snap

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bean for processing industry. If the first pod is not high enough, combined harvester will cut, damage or even miss the low pods. Further more, this trait effects the quality of the first pod because when the top of the pod touches the ground in high humidity it provokes rottening and in dry conditions, the first pod changes the natural color. Also, this trait will effect the seed production, since low pods are the first to be effected by diseases and usually in these pods the seed will germinate. In manual harvest, too low pods are not visible enough, so the pickers miss them. Unpicked pods enable the plant to turn from technological to physiological maturity so the multiple harvests are not possible.

Many authors worked on this subject. DAVIS and FRAIZER (1966) found that the height of forming the first pod is inherited recessively. According to MITRANOV (1981), the first pod height, besides the number of grains per pod and number of pods per grain, is the trait that varies the most.

Our opinion is that including 6 divergent parents in process of selection for first pod height represent good base for further work on breeding and creating new snap bean varieties, suitable for mechanical harvest in technological maturity.

MATERIAL AND METHODS

Six divergent snap bean genotypes have been selected for great number of traits. Genotypes Supernor, Darija and Grinkrop originate from Holand, and Palanačka rana, Šumadinka and Zora originate from Serbia. Varieties Šumadinka, Grinkrop, Palanačka rana, Supernor and Darija belong to determinant genotype group. Except Grinkrop, all varieties are on the List of Agricultural and Forest Plant Varieties and Hybrids of Yugoslavia. Genotypes Supernor, Darija and Grinkrop have green, Palanačka rana and Zora yellow and Šumadinka marble yellow pods.

Controlled hybridization by castrating mother plants and application of pollen from father lines has been performed in warm beds in the Center's greenhouse. Comparative experiment has been conducted applying standard agro-technique, on experimental plot of the Centre for Vegetable Crops. The sowing has been performed in 60 x 5 cm lines, in random block system with three replicas. Plants have been harvested in the technological maturity. The height of the first pod has been measured in the Center's laboratory on dry material and represents the distance from the crown to node with the first pod. Analysis of genetic components has been done according to JINKS (1954) and HAYMAN'S (1954) method. A graphic analysis of regression (Wr/Vr) has been done applying MATHER and JINK'S (1971) method.

RESULTS AND DISCUSSION

The height of forming the first pod per plant has been between 13.86 cm (Supernor) and 18.26 cm (Grinkrop). Besides Supernor, all parents satisfied the criteria of height of forming the first pod on at least 15cm. In F_1 generation the researched trait was between 10.63 cm (Supernor x Palanačka rana) and 19.13 cm

(Šumadinka x Zora). The criterion of forming the first pod height has been satisfied in 7 combinations. Coefficient of variance (*CV*) was: parents from 2.09% (Palanacka rana) to 6.33% (Darija), hybrids form 0.56% (Supernor x Zora) to 9.82% (Darija x Grinkrop), (Table 1).

Table 1: The height of forming the first pod (cm)

	δ	S_e	*CV*		δ	S_e	*CV*
Supernor	13.86	0.36	4.92	2x3	15.28	0.36	9.82
Darija	16.11	0.51	6.33	2x4	16.50	0.40	0.83
Grinkrop	18.26	0.44	4.66	2x5	17.10	0.44	0.71
Palanačka rana	15.51	0.34	2.09	2x6	14.25	0.40	2.26
Šumadinka	17.22	0.44	4.66	3x4	15.50	0.30	1.15
Zora	17.45	0.44	3.47	3x5	14.25	0.54	4.74
1x2	15.22	0.50	4.88	3x6	14.34	0.52	1.55
1x3	13.78	0.48	3.19	4x5	14.75	0.44	0.56
1x4	10.63	0.38	0.91	4x6	11.44	0.39	2.83
1x5	16.08	0.45	6.7	5x6	19.13	0.57	0.97
1x6	11.67	0.39	2.59				

Components of variance of forming the first pod are shown in Table 2.

The values of dominant components (H_1 and H_2) are higher than additive components (D), which points that inheritance of the number of pods per plant in F_1 generation is being controlled by dominant genes. Negative value of interaction additive x dominant gene effect (F) points to dominant recessive parent genes. Average level of domination $\sqrt{H1/D}$ is higher than 1 and points to super-domination in inheriting the first pod height compared to all crossing combinations. Ratio of total number of dominant and recessive genes (K_D/K_R) is lower than 1 and points to higher participation of recessive compared to dominant allele. Heritability in broader sense was 90% and points to high participation of genetic factors in inheriting the number of pods per plant.

Table 2: Genetic variances of height of forming the first pod

Values	Components
D	1.94
H_1	13.81
H_2	11.57
F	-0.34
E	0.57
$H_2/4H_1$	0.21
u	0.701
v	0.299
sqrt(H_1/D)	2.67
K_d/K_r	0.94

The line of regression Wr/Vr for forming the first pod per plant is shown in Fig 1. The regression with equation b=0.364± 0.102 does not significantly differ from 1 and points to absence of epitasis. The regression lines cuts Wr axis below the beginning of coordinate (a=-0.44) pointing to super-dominant heredity of

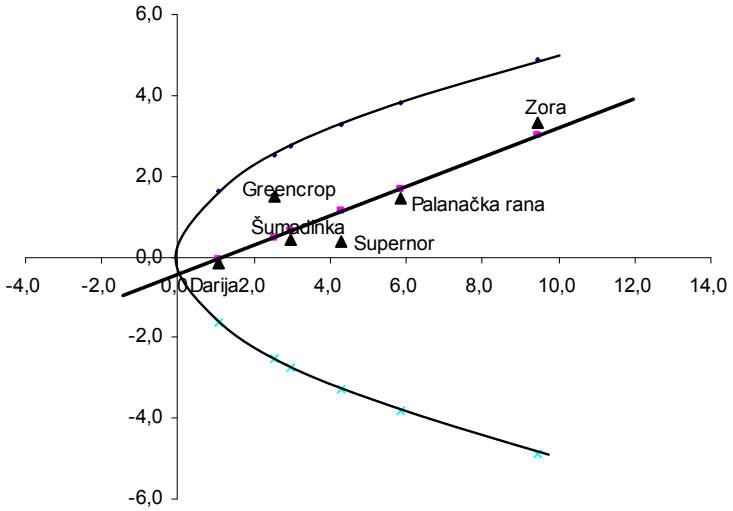

Fig. 1. The line of regression for the first pod per plant

height of forming the first pod which is in accordance with average domination level. Darija was the closest to coordinate beginning, which means it has the highest number of dominant genes and Zora has the highest number of recessive gene because it is the furthest from coordinate beginning.

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UTICAJ GENETIČKIH PARAMETARA NA NASLEĐIVANJE VISINE PRVE MAHUNE PO BILJCI BORANIJE (*PHASEOLUS VULGARIS* L.)

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I z v o d

U cilju istraživanja načina nasleđivanja, efekta gena, kombinacionih sposobnosti i komponente genetičke varijanse, ispitivano je šest divergentnih genotipova boranije (Supernor, Darija, Grinkrop, Palanačka rana, Šumadinka i Zora) i njihovo F_1 potomstvo dobijeno dialelnim ukrštanjem - bez recipročnih. Za osobinu visine formiranja prve mahune dobijena je visoko značajna varijansa srednjih vrednosti roditelja i hibrida. Izračunate vrednosti dominantih komponenti (H_1 i H_2) su veće od aditivne komponente (D), što ukazuje da u nasleđivanju broja mahuna/biljci u F_1 generaciji preovladavaju dominantni geni. Prosečan stepen dominacije $\sqrt{H1/D}$ je veći od 1 i ukazuje na superdominaciju. Heritabilnost u širem smislu iznosi 90% i ukazuje na visok udeo genetičkih faktora u nasleđivanju broja mahuna po biljci.

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