GENETIC ANALYSIS OF SOME METRIC TRAITS IN SMALL-SEEDED BEAN (*PHASEOLUS VULGARIS* L.) LINE CROSSES

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Introduction

Understanding the type of gene action and mode of inheritance of complex metric traits of the breeding materials is helpful for breeders in choice of suitable breeding procedure. The intrinsic genetic properties of breeding populations can be evaluated using genetic designs (Hallauer and Miranda, 1988). Therefore, the present study was undertaken to assess the relative magnitude of gene effects contained in the means of some metric traits in crosses of small seeded bean lines using factorial analysis of generation means.

Materials and Methods

The experimental material consists of six generations (P_1, P_2, F_1, F_2, BC_1 and BC_2) of two crosses, Roba x G-6 and DOR-794 x Red Wolayta. The materials were grown in compact family design with two replications during the 2002 main rainy season ('Meher') at Awassa agricultural research station, southern Ethiopia. The non-segregating generations (P_1, P_2 and F_1) and back cross generations (BC_1 and BC_2) of each cross were sown in three rows plot of 2 meters long. F_2 generations were sown in four rows of plot of 2 meters long. The spacing was maintained at 40 cm between rows and 10 cm within rows. The data on grain yield (gm/plant), plant height (cm), numbers of pods/plant and pod length (cm) were collected on individual plant basis (20 plants each in P_1, P_2 and F_1, 30 plants in F_2 and 24 plants each in BC_1 and BC_2). Hayman (1958) and Jinks and Jones (1958) model were used to determine the type of genetic information contained in generation means. The significance of scales and gene effects were tested by t-test as described by Sharma (1998).

Results and Discussion

The results of scaling tests applied to detect the presence of epistatic interaction and estimates of gene effects are presented in Table 1. The analysis showed that the dominance [h] gene effect was larger than additive [d] gene effects in magnitude in all the crosses for all the traits under study. DOR -794 x Red Wolayta cross would be realized in selection practiced in advanced generations when majority of loci approach to homozygosity.

A simple additive-dominance model was sufficient to explain most of genetic variations for the expression of plant height in both the crosses, of pods per plant and pod length in Roba x G-6 cross as none of the scales were significant. This implied that selection could be practiced effectively at F_2 population for improvement of plant height in both the crosses, and for number of pods per plant and pod length in Roba x G-6 cross.

At least one of the scales was significant for grain yield per plant in both crosses, but only for number of pods per plant and pod length in DOR 794 x Red Wolayta cross. This indicated that epistatic effects contributed to the inheritance of the traits. The interaction components accounted for larger proportion of the variation, in addition to high dominance main effect for the traits in these crosses suggested that larger variation would be expected in later generation. Hence success of selection for grain yield in both the crosses, number of pods and pod length in DOR -794 x Red Wolayta cross would be realized in selection practiced in advanced generations when majority of loci approach to homozygosity. Moreover, the type of epistasis operating in the populations of the crosses Roba x G-6 and DOR-794 x Red Wolayta for grain yield, DOR 794 x Red Wolayta for number of pods per plant and pod length is duplicate type. Hence recurrent or gamete selection can be employed for the genetic improvement of these traits.

Table 1. Scaling test and gene effects for some metric traits in small-seeded bean line crosses.

Cross	scale				gene effect						Type of epstasis
	A	B	C	D	[m]	[d]	[h]	[i]	[j]	[l]	
Grain yield (gm/plot)											
Roba x G-6	-	-	**	-	27.7**	-1.1	18.8	15.4	-4.3	-7.9	D#
DOR 794 x Red Wolayta	-	-	**	**	24	-10.2**	46.8**	49.0**	-13.7*	-47.5**	D
Plant height (cm)											
Roba x G-6	-	-	-	-	65.1**	4.01**	-4.92	-	-	-	-
DOR 794 x Red Wolayta	-	-	-	-	50.9**	-5.1**	17.0	-	-	-	-
Number of pods/plant											
Roba x G-6	-	-	-	-	18.0	2.1**	24.0	-	-	-	-
DOR 794 x Red Wolayta	-	-	*	**	24.3**	-1.3	28.1**	27.8**	5.9	-22.9	D
Pod length (cm)											
Roba x G-6	-	-	-	-	10.2**	0.15	-1.25	-	-	-	-
DOR 794 x Red Wolayta	-	-	*	**	9.5**	-1.1**	2.1**	1.8*	-1.0	-1.8	D

#D= duplicate

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