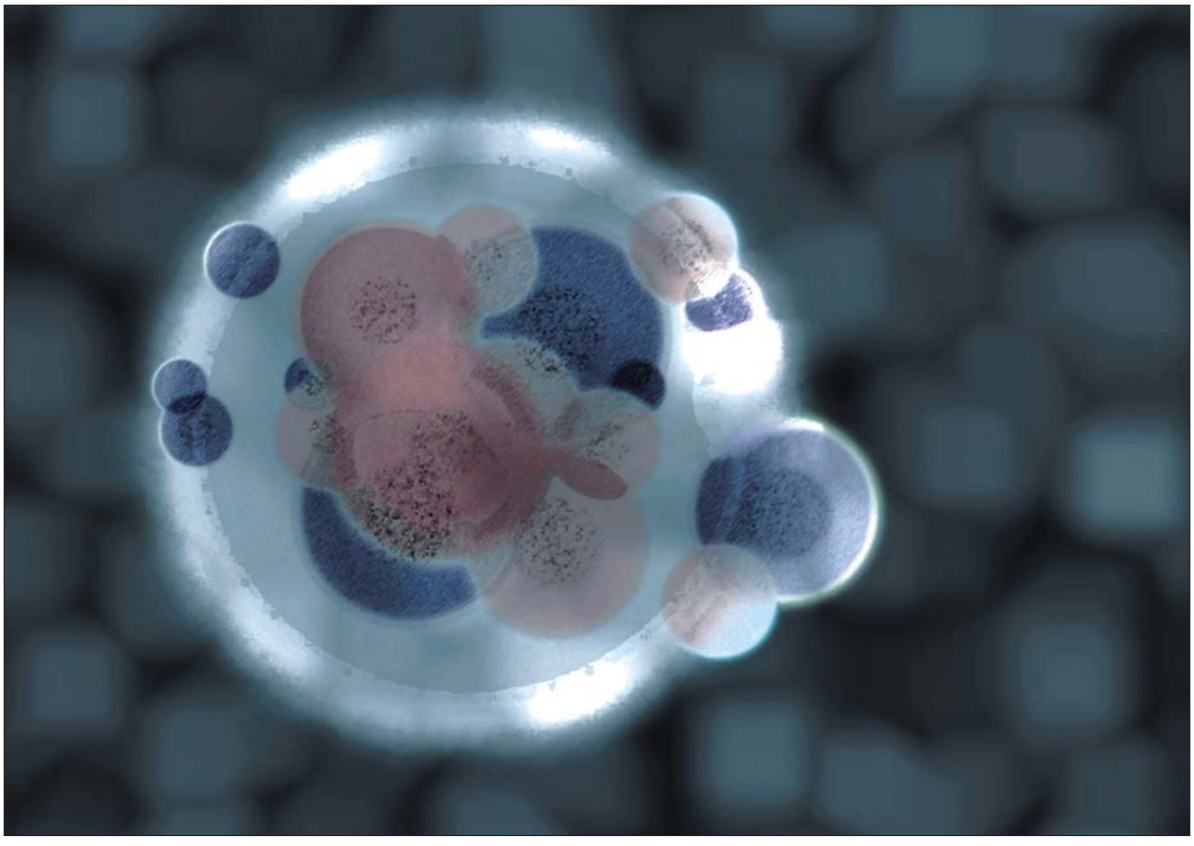

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Variability, Heritability, Genetic Advance and Relationships of Yield and Yield Contributing Characters in Dry Bean (*Phaseolus vulgaris* L.)

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Abstract: Thirty one dry bean genotypes were used to study their performance, genetic variability, heritability and genetic advance of yield and yield contributing characters viz., days to 50% flowering, days to maturity, plant height, number of pods plant^{-1}, pod length, number of seeds plant^{-1}, 20 seed weight. Significant variations were observed for all the characters in all the genotypes used in the experiment. Highest and genotypic and phenotypic variations were observed for days to maturity and pod length, respectively. All the characters showed high heritability with high genetic advance. Grain yield was found to be positively correlated with number of pods plant^{-1}, pod length, number of seeds plant^{-1}and 20 seed weight. Path coefficient analysis revealed that all the pod and seed characters showed positive and significant direct effects on seed yield.

Key words: Variability, heritability, genetic advance, correlation, path analysis, dry bean, *Phaseolus vulgaris* L.

INTRODUCTION

Dry bean (*Phaseolus vulgaris* L.), also called french bean, common bean, rajmah bean, kidney bean etc. is one of the most important legume crops in the world. In Bangladesh, it is sporadically cultivated in some areas of Sylhet, Chittagong, Cox's Bazar and Chittagong Hill Tracts; but in recent times some non-govt. organizations (NGO's) have ventured on commercial production of dry bean and already started exporting little quantity of the produce (both green pod and dry seeds) to some European countries[1]. Yield in dry bean like other crops, is a complex character and many morphological and physiological characters constitute it. These yield contributing characters are related between themselves in addition to complex chain their relationships with yield. Quantitative characters which are of economic value, highly influenced by environmental condition, progress of breeding in such characters are primarily conditioned by the magnitude and nature of variation and interrelationships among them[2]. Success in crop breeding is also depend on the isolation of genetically superior genotypes based on the amount of variability present in the materials. Therefore, information on genetic variability existed in a group of populations of dry bean are essential. Some studies have been carried out by Rai *et al.*[3], Rebeiro *et al.*[4], Shete and Kale[5], Vaid *et al.*[6], Vaid and Singh[7], Singh *et al.*[8] etc. on variability and interrelationships of characters on dry bean. In this study, the components of phenotypic variation, heritability, genetic advance, the correlation among different characters at genotypic and phenotypic levels and their direct and indirect effects on yield were studied.

MATERIALS AND METHODS

Thirty one genotypes of dry bean were grown in a randomized complete block design with three replications at Genetics and Plant Breeding Field laboratory, Bangladesh Agricultural University, Mymensingh during rabi season of 2001-2002. Some genotypes were received from CIAT (Centro International de Agricultura Tropical), Columbia through Govt. sponsored CDP (Crop Diversification Program) and the others were locally collected and developed. The unit block (replication) measured 3 m in length and 6 m in width; block to block distance was 60 cm, row to row distance was 30 cm and plant to plant distance was maintained at 10 cm. Standard agronomic practices were followed. The crop was harvested when over 90% of the plants with mature pods of a genotype withered and turned brown. Data were recorded on viz. days to 50% flowering, days to maturity, plant height, number of pods plant^{-1}, pod length, number of seeds plant^{-1}, 20 seed weight and seed yield plant^{-1}. All the data were subjected to statistical analysis as per standard references and the subject texts[9,10]. Genotypic and phenotypic coefficient of variations, heritability in broad sense and genetic advance were estimated

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Table 1: Genotypic variance, phenotypic variance, genotypic coefficient of variation, phenotypic coefficient of variation, heritability and genetic advance of yield and yield contributing characters of 31 genotypes of dry bean

Genetic components	Mean±SE	Genotypic variance	Phenotypic variance	Genotypic coefficient of variation (%)	Phenotypic coefficient of variation (%)	Heritability	Genetic advance
Days to 50% flowering	46.69±0.32	10.65	14.00	6.99	8.01	76.07	586.33
Days to maturity	105.63±0.72	57.64	74.13	7.19	8.15	77.76	1379.18
Plant height	27.08±0.39	18.02	22.80	15.67	17.63	79.04	777.47
No. of pods plant^{-1}	5.23±0.15	1.08	1.97	19.81	26.75	54.82	158.50
Pod length	7.93±0.12	1.84	2.30	17.10	19.12	80.00	249.93
No. of seeds plant^{-1}	17.18± 0.78	29.17	48.66	31.43	40.60	59.95	90.93
20 seed weight	4.69± 0.11	3.91	4.31	42.19	42.29	90.93	388.88
Seed yield plant^{-1}	3.76± 0.18	2.18	3.20	39.35	47.64	68.24	251.78

Table 2: Direct and indirect effects of yield contributing characters on seed yield plant^{-1} in dry bean of dry bean

Traits	Days to 50% flowering	Days to maturity	Plant height	No. of pods plant^{-1}	Pod length	No. of seeds plant^{-1}	20 seed weight	Total correlation to seed yield plant^{-1}
Days to 50% flowering	0.001	-0.0055	-0.0058	0.1599	-0.1495	0.0070	-0.1799	-0.173
Days to maturity	0.0005	-0.0111	-0.0008	0.0272	-0.1661	-0.0529	-0.2397	-0.443
Plant height	0.0004	-0.0005	-0.0169	0.1361	-0.0591	-0.0274	0.0454	0.078
No. of pods plant^{-1}	0.0003	-0.0006	-0.0046	0.5043	-0.0798	0.1999	-0.1656	0.454
Pod length	-0.0005	0.0059	0.0032	-0.1286	0.3129	0.0144	0.4147	0.622
No. of seeds plant^{-1}	0.0000	0.0022	0.0017	0.3711	0.0166	0.2716	-0.2123	0.451
20 seed weight	-0.0003	0.0043	-0.0012	-0.1341	0.2084	-0.0926	0.6226	0.607

Residual effect: 0.2693

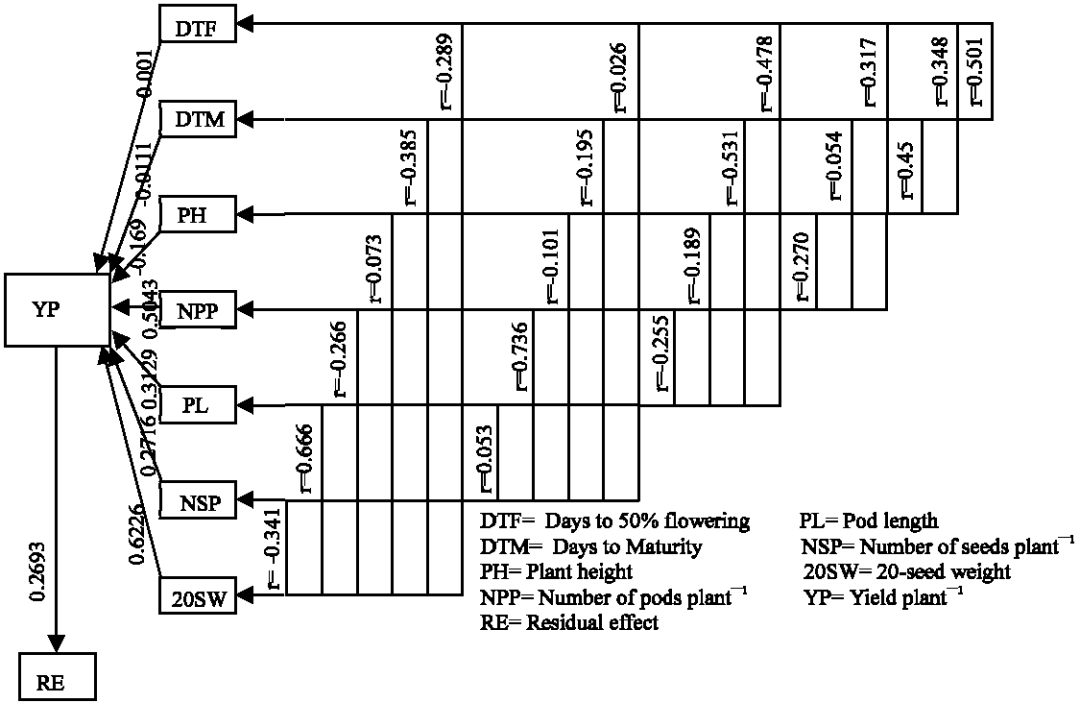

Fig. 1: Path Diagram in dry bean genotypes of yield contributing characters on yield plant^{-1}

following Burton[11], Johnson *et al.*[12], Hanson *et al.*[13] and Lush[14], respectively. The genotypic and phenotypic correlation coefficients and path coefficients were estimated as suggested by Miller *et al.*[15] and Dewey and Lu[16], respectively.

RESULTS AND DISCUSSION

Genetic variability: Days to maturity showed highest genotypic and phenotypic variance whereas pod length showed the lowest (Table 1). In case of number of seeds plant^{-1} the variation between genotypic and phenotypic variance and coefficient of variation were found high indicating larger environmental effect. Chand[17] found moderate variation in seeds pod plant^{-1}. In case of number of pods^{-1} the difference between genotypic and phenotypic variation and coefficient of variation were found comparatively higher, indicating less genotypic but more environmental effect on the trait. Chand[17] also found same result in a study. The 20 seed weight showed

the highest genotypic coefficient of variation and also had minute difference in both genotypic and phenotypic variance and coefficient of variation indicating more or less equal genetic effect on the trait. Here, the environmental effect is negligible, which is an agreement with the observation of Babar *et al.*[18].

High heritability with very high genetic advance was exhibited by all the studied traits of the genotypes (Table 1) reflecting that the traits could be further improved through individual plant selection.

Path coefficient analysis: The relationships between seed yield with its component characters were further analysed by path coefficient as presented in Table 2 and Fig. 1. Days to 50% flowering had a positive but nonsignificant direct effect on seed yield. But Babar *et al.*[18] found positive and also significant direct effect. Days to maturity and plant height had negative direct effect on seed yield, which is an agreement with the results of Babar *et al.*[18]. The pod and seed characters had positive and significant effect on seed yield, indicating an increase in number of pods plant^{-1}, pod length, number of seeds plant^{-1} and 20 seed weight may be contributed on seed yield directly. The results were more or less similar with the observation of Coimbra *et al.*[20]. These results with the above information revealed that number of pods plant^{-1}, pod length, number of seeds plant^{-1} and 20 seed weight were related to the yield mostly through their direct effects and warrants possible use in selections for future yield improvement programmes in dry bean.

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