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Variability, Correlation and Path Coefficient Studies in Summer Mustard (*Brassica Juncea* L.)

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Abstract: Eighteen lines/varieties of *Brassica juncea* L. were evaluated for plant height, number of branches plant^{-1}, Number of siliquas plant^{-1}, 1000 seed weight and seed yield plant^{-1} through PCV, GCV, h^2, G.A., correlations and path coefficient analysis. Number of siliquas plant^{-1} found strong parameter followed by number of branches and Plant height for seed yield improvement. Siliquas plant^{-1} had highest GCV, h^2, G.A., highly significant positive correlation and maximum direct contribution for seed yield followed by number of branches plant^{-1} and plant height.

Key words: *Brassica juncea* L., genetic parameters, correlations, path coefficient analysis, Pakistan

Introduction

Pakistan has been facing a drastic shortage of edible oil because 66% oil has to be imported to meet the demand of 117 million people. Pakistan imported 1234 thousands tones of edible oil costing 24.90 Billion rupees in 2001-02. It is thus imperative to take appropriate measures to improve the domestic production of edible oil for load shedding of the import expenses. Rapeseed and Mustard contributed 45% of the total oil being produced locally from all conventional oilseed crops. It has 42% oil and 24% protein and grown on 43% of the cultivated area under oilseed crops (Anonymous, 2001-02).

Among Rapeseed and Mustard, Raya (*B. juncea*) is very popular among the farmers due to higher yielding and better tolerance against lodging, pests and heat. It can be successfully grown from end of August to end of October. Raya Anmol is cultivated as zaid kharif crop while RL-18 and Khanpur Raya are sown as Rabi crops. Now efforts are being imposed to develop better Raya genotypes. Such consolidated breeding efforts need critical evolution of existing genetic variability, heritability, G.A. interrelationship among seed yield and its components as depicted by earlier studies (Khan and Salam, 1995; Khan *et al*., 2000; Sheikh *et al*., 1999; Chaudhry *et al*., 1999; Pant and Singh, 2001; Mahmood *et al*., 2003). Present investigations were planned to measure extent of genetic variability mode of genic behavior and interrelationship of various parameters in 16 advanced lines with two varieties as check to devise suitable selection criteria for further breeding.

Materials and Methods

16 advanced lines with two checks viz; ZBJ-2K001, 2K002, 2K003, 2K004, 2K008, 2K012, 99010, 99005, 99012, 99009, 2K1001, 2K1002, 2K1003, 2K1004, 2K1005, 2K1006, Raya Anmol and Toria Selection “A” were selected for the study. All the lines were sown in triplicate randomized complete block design at Oilseeds Research Institute, Faisalabad during 2001, keeping plot size 1.35x5 m, row spacing 0.45 cm between rows and plant space 10 cm respectively. At maturity data were recorded on five randomly selected plants from each plot of each replication for plant height (cm), Number of branches plant^{-1}, Number of siliquas plant^{-1}, 1000 seed weight (g) and seed yield plant^{-1} (g) were used for various statistical analysis. Genotypic and phenotypic correlation coefficients were computed as suggested by Kwon and Torrie (1964) and path coefficient were worked out as Dewey and Lu (1959).

Results and Discussion

Wide range of phenotypic variability for all the parameters except 1000 seed weight could be exploited for initiation of a breeding endeavor seeking to develop new high yielding Raya genotypes. Genotypic and phenotypic coefficients of variability, heritability and genetic advances as % of mean were calculated for various parameters (Table 1, 2). Perusal of the data revealed highest genotypic coefficient of variability for seed yield plant, Number of siliquas plant^{-1}, Number of branches plant^{-1}, plant height and least G.C.V. for 1000 seed weight. Heritability was maximum for number of siliqua plant^{-1} and plant height(0.84) followed by number of branches plant^{-1} (0.64) seed yield plant^{-1} (0.49) and least for 1000 seed weight (0.22) Genetic coefficient of variability to gather with heritability are considered the good estimates of the amount of advance to be expected from selection on phenotypic performance basis. Efficacy of the selection on phenotypic basis can be improved if genetic advance is also considered as genetic advance along with heritability indicate mode of gene action being operated in the development of a parameter (Mahmood *et al.,* 2003; Pant and Singh, 2001; Khulbe *et al.*, 2000; Shalini *et al.*, 2000 and Ghoshak and Ghulati, 2001). A parameter having high heritability and high genetic advance are considered under control of additive genes which highlighted the usefulness of selection based on phenotypic performance. (Goshak and Gulati, 2001; Khulbe *et al.*, 2000; Chaudhry *et al.*, 1999 and Kakroo *et al.*, 2000) Genetic advance as % of mean was maximum for number of siliquas (35.66) followed by seed yield plant (33.53), number of branches plant^{-1} (16.70), plant height (11.50) and least for 1000 seed weight (5.60).

Table 1: Range of phenotypic variability ,mean values and variety mean squares for various parameters in 18 advanced lines of *B.juncea*

Parameters	Range	Mean Value	Variety mean square
Plant height (cm)	140.0-190	176.07	421.23 **
Number of branches plant^{-1}	4.80-6.43	5.50	1.01**
Number of siliquas plant^{-1}	329.0-623	464.0	24374.18 **
1000 seed weight (g)	2.76-3.83	3.32	0.262 $^{N.S.}$
Seed yield plant^{-1} (g)	10.14-33.36	23.75	115.43 **

Table 2: Estimates of genotypic and phenotypic coefficients of variability, heritability, Genetic advance as % of mean in 18 *B.juncea* lines

Parameters	GCV	PCV	h^2	GA as % of mean
Plant height (cm)	6.53	7.12	0.84	11.50
Number of branches plant^{-1}	9.64	12.08	0.64	16.70
Number of siliquas plant^{-1}	18.85	20.51	0.84	35.66
1000 seed weight (g)	5.94	12.94	0.22	5.60
Seed yield plant^{-1} (g)	22.53	32.10	0.49	33.59

GCV= Genotypic coefficient variability, PCV= Phenotypic coefficient variability, h^2 = Heritability (broad sense), GA= Genetic advance

Table 3: Genotypic and Phenotypic correlation coefficients of 18 advanced lines Of *B.juncea* for seed yield with seed yield components

Parameters		Plant height (Cm)	Number of branches plant^{-1}	Number of siliquas plant^{-1}	1000- seed weight (g)
Number of branches plant^{-1}	rg	0.500 *	-	-	-
	rp	0.403 ^{NS}			
Number of siliquas plant^{-1}	rg	0.445^{NS}	0.461 ^{NS}	-	-
	rp	0.393^{NS}	0.414 ^{NS}		
1000 seed weight (g)	rg	0.022 ^{NS}	-0.080 ^{NS}	-0.182 ^{NS}	-
	rp	0.066 ^{NS}	0.186 ^{NS}	-0.068 ^{NS}	
Seed yield plant^{-1}(g)	rg	0.785 **	0.873**	0.846 **	0.371**
	rp	0.531*	0.304*	0.622**	-0.012**

Table 4: Path Coefficient analysis of 18 *B.juncea* lines

Parameters	Plant height (Cm)	Number of branches plant^{-1}	Number of siliquas plant^{-1}	1000-seed weight (g)	Seed yield plant^{-1}
Plant height (cm)	(0.253)	0.258	0.262	0.012	0.785**
Number of branches plant^{-1}	0.127	(0.516)	0.271	-0.041	0.873**
Number of siliquas plant^{-1}	0.113	0.238	(0.589)	-0.093	0.846**
1000 seed weight (g)	0.006	- 0.041	-0.107	(0.513)	0.371^{NS}

The view of the data in Table 3 depicted correlations of seed yield with its components (Mahmood *et al.*, 2003; Pant and Singh, 2001; Khulbe *et al.*, 2000; Shalini *et al.*, 2000 and Goshak and Gulati, 2001). While a parameter having high h^2 but low G.A., is considered under control non-additive (dominant/ epistatic) genes. High value of genetic advance for Number of siliquas plant^{-1} (35.66%) and seed yield plant^{-1} (33.59%) depicted that mass selection based on these parameters could be useful in improving the seed yield from 33.59 to 35.66%.

Perusal of the data in Table 3 showed correlations among seed yield and its components. Number of siliquas plant^{-1} had strong positive correlation with seed yield followed by Number of branches plant^{-1} and plant height. Plant height itself positively and significantly correlated with Number of branches plant^{-1} and non-significantly positively correlated with number of siliquas plant^{-1} and plant height. Number of branches plant^{-1} had non significant positive correlation with number of siliqua plant^{-1} and negative non significant correlation with 1000 seed weight. Similarly number of siliqua plant^{-1} had non significant negative correlation with 1000 seed weight. 1000 seed weight itself also had non significant positive correlation with seed yield which was minimized with adversely effected environment. (Malik *et al.*, 2000 and Khan *et al.,* 1992).

View of the Table 4 revealed direct and indirect contribution of the parameters in the development of seed yield (Khan *et al.*, 1992; Khan *et al.*, 1995 and Chaudhry *et al.*, 1999) All the parameters had direct positive contribution towards seed yield. Plant height had not optimum direct effect on seed yield. However indirect effect through number of branches plant^{-1} and number of branches plant^{-1} and number of siliqua plant^{-1}made it highly significant. Number of branches plant^{-1} had optimum positive direct contribution towards seed yield which was strengthened by indirect positive effect of number of siliqua plant^{-1} and plant height. However 1000 seed weight slightly reduced it due to negative effect. Number of siliqua plant^{-1} not only exerted maximum positive direct effect on seed yield but also via number of branches plant^{-1} and plant height. However it was minimized at some extent through 1000 seed weight. Although 1000 seed weight had optimum positive direct effect on seed but it was minimized through negative effect of number of branches plant^{-1} and number of siliquas plant^{-1} (Sheikh *et al.*, 1999; Khan *et al.*, 2000; Mondal and Khajuria, 2000; Kakroo *et al.*, 2000; Ghoshak and Ghulati, 2001).

A parameter which had high range of genetic variability, high heritability, high genetic advance, highest degree of positive and significant correlation coefficient and highest direct effect on seed yield would be very effective and excellent tool for improving seed yield potential. Such a parameter in this study was number of siliqua plant^{-1} which could raise the seed yield potential up to 35.66% followed by number of branches plant^{-1}. It is concluded that selection of taller plants on the basis of higher number of siliquas plant^{-1} and higher number of branches plant^{-1} would raise the potential of seed yield from 11.5 to 35.66%.

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