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INTERGENOTYPIC VARIABILITY STUDY IN 58 ADVANCED LINES OF *Brassica rapa*

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ABSTRACT

An experiment was carried out with 55 genotypes of *Brassica rapa* along with three commercially cultivated varieties as check to study their intergenotypic variability, correlation and path co-efficient analysis in respect of 10 different morphological characters at the experimental farm of Sher-e-Bangla Agricultural University, Dhaka during November 2007 to March 2008. Significant variation was observed among all the genotypes for all the characters studied except thousand seed weight. High GCV value was observed for number of secondary branches per plant. High heritability values along with high genetic advance in percentage of mean were obtained for days to 50% flowering, number of secondary branches per plant, seeds per siliqua and siliqua length. Highly significant positive association of seed yield per plant was observed with number of primary branches per plant, number of secondary branches per plant, number of siliquae per plant. Path analysis showed that yield per plant had the highest direct effect on number of primary branches per plant, number of siliquae per plant, number of secondary branches per plant and number of seeds per siliqua. Thus, these components were found as the important yield contributing traits and some lines were selected for future hybridization program to improve the yield status of the existing *Brassica rapa* genotypes.

Key words: Intergenotypic variability, advanced lines, *Brassica rapa*

INTRODUCTION

Accounting for over 16% of the world's edible oil supply, *Brassica* have great economic commercial value and play a major role in feeding the world population. Rapeseed and mustard are the major source of edible oil in Bangladesh. In Banglaesh, more than 183 thousand metric ton of mustard and rape seeds are produced from total 216.92 thousand hectares of cultivable land in the year 2005-2006 (BBS, 2006). Its average yield per hectare was only 733 kg, which is very low indeed. The country is facing increasing deficiency in oil seed production and consequently, import cost for edible oil is increasing. The causes of low yield include- low yield potential of the varieties, insufficient precipitation when the crops are cultivated under rainfed conditions and the shifting of crop to the marginal land. Thus to reduce the import of edible oil, we need to develop genotypes with higher seed yield with more tolerance to biotic and abiotic stress. The improved genotypes should well fit into–T. amon-Mustard-Boro cropping pattern. Information on genetic variability is a prerequisite for initiating a successful breeding program aiming to develop high yielding varieties. Determination of character association has a considerable importance in selecting breeding materials. The path co-efficient analysis has been found to give more specific information on the direct and indirect influence of each of the component characters upon seed yield (Behl *et al.*, 1992). Thus the study was undertaken to estimate inter-genotypic variation and to determine the nature of association, direct and indirect relationship between yield and yield contributing characters and relative contribution of each character towards seed yield in *Brassica rapa* genotypes.

MATERIALS AND METHODS

The experiment was carried out in the experimental farm under the Department of Genetics and Plant

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Breeding, Sher-e-Bangla Agricultural University (SAU), Dhaka during November 2007-March 2008. Altogether 58 genotypes including three check varieties (BARI Sarisha-15, SAU Sarisha-1 and Real Tori-7) were used for this study. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The plot size was 13 m × 55 m. A distance of 1 m from block to block, 30 cm from row to row and 10 cm from plant to plant were maintained. Seeds were sown in lines and placed at about 1.5 cm depth in the soil. Fertilizer were applied at the rate of 250, 170, 85,150 and 1-1.5 kg/ha of urea, T.S.P.,M.P.,Gypsum and boron, respectively. Optimum cultural practices were followed to have a healthy crop. Data were recorded on ten characters such as- days to 50% flowering, days to maturity, plant height, number of primary branches per plant,. of secondary number branches per plant, number of siliquae per plant, siliqua length, seeds per siliqua, 1000 seed weight and seed yield per plant. The collected data were analyzed by using MSTAT softwere program and also using the formula of Johnson *et al.* (1955), Singh and Chaudhury (1985) and Allard (1960), Burton (1952) and Dewey and Lu (1959).

RESULTS AND DISCUSSION

The extent of variation among the genotypes in respects of ten characters were studied and mean value, range, genotypic variance (σ_g^2), phenotypic variance (σ_p^2), genotypic co-efficient of variation (GCV) , phenotypic co-efficient of variation (PCV), heritability (h^2b) in broad sense, genetic advance in percent of mean and co-efficient of variation (CV%) have been presented in Table 1. Significant variation was observed among all the genotypes for all the characters studied except thousand seed weight. The phenotypic variance (σ_p^2) was higher than the corresponding genotypic variance (σ_g^2) for

Table 1. Estimation of genetic parameters in 10 characters of 58 *Brassica rapa* genotypes

Characters	Range	Mean	Mean sum of square	σ_g^2	σ_p^2	GCV (%)	PCV (%)	h^2b	GA(5%) of mean	CV%
DF (50%)	24.66-49.66	38.37	72.62**	23.57	25.47	12.65	13.15	92.52	25.06	3.60
DM	77.33-89.33	87.08	16.66**	4.63	7.38	2.47	3.12	62.80	4.03	1.90
PH	73.43-124.06	107.17	231.57**	59.12	113.33	7.17	9.93	52.16	10.67	6.87
NPB	4.43-9.13	6.72	2.25**	0.45	1.34	10.05	17.24	34.00	12.08	14.01
NSB	0.86-11.80	3.86	18.66**	5.21	8.22	59.16	74.27	63.45	97.08	44.91
NSP	129.26-289.63	190.48	5485.41**	1250.11	2985.17	18.56	28.68	41.87	24.74	21.87
SL	4.04-6.42	5.80	.55**	0.15	0.23	6.85	8.33	67.61	11.61	4.75
SS	10.70-26.41	21.63	35.28**	9.82	15.64	14.48	18.28	62.80	23.65	11.15
TSW	2.5-4.0	0.29	0.003	0.0003	0.0023	6.23	16.48	14.28	4.85	5.25
SYPP	5.27-12.14	8.01	6.48**	1.17	4.12	13.54	25.34	28.55	14.91	15.42

** Significant at 1% level of probability, DF (50%) = Days to 50% flowering, DM = Days to maturity, PH = Plant height (cm), NPB = Number. of primary branches plant^{-1}, NSB = No. of secondary branches plant-1, NSP = Number of siliquae plant^{-1}, SL = Siliqua length (cm), SS = Seed siliquae^{-1}, TSW = Thousand seed wt. (g), SYPP = Seed yield plant-1, σ_g^2 = Genotypic variance, σ_p^2 = Phenotypic variance, GCV (%) = Genotypic co-efficient of variation, PCV (%) = Phenotypic co-efficient of variation, h^2b = heritability in broad sense, GA (5%) of mean = Genetic advance in 5% of mean, CV% = % of co-efficient of variation

all the characters. Similarly, phenotypic co-efficient of variation (PCV) was higher than the genotypic co-efficient of variation (GCV). The difference between PCV and GCV value was higher in case of plant height, number of primary branches /plant, number of siliquae/plant, 1000 seed weight and seed yield/plant indicating greater influence of environment for the expression of these characters. High

GCV value was observed for number of secondary branches/plant. Lekh *et al.* (1998) reported similar result while studing with *Brassica* genotypes.

Heritability estimate observed higher in case of days to 50% flowering followed by siliqua length, number of secondary branches/plant, seeds/siliqua, days to maturity and plant height. High heritability coupled with high genetic advance in percentage of mean were obtained for days to 50% flowering and number of secondary branches/plant indicating that the heritability was most likely due to additive gene effects and selection might be effective. High genetic advance in percentage of mean with moderate heritability was observed for number of siliquae plant^{-1} indicating effectiveness of selection in such case. Similar results were also reported by Afroz *et al.* (2004), Parveen (2007), Siddikee (2006), Rashid (2007) and Singh *et al.* (1987).

Correlation co-efficient

Genotypic and phenotypic correlation co-efficient between pairs of characters for *Brassica rapa* are presented in Table 2. In most of the cases, the genotypic correlation co-efficient was higher than the corresponding phenotypic correlation co-efficient. This indicating a strong inherent association between the characters studied and suppressive effect of the environment modified the phenotypic expression of these characters by reducing phenotypic correlation values.

Table 2. Genotypic (g) and phenotypic (p) correlation coefficient between yield and its component characters in *Brassica rapa*

Characters		DM	PH	NPB	NSB	NSP	SL	SS	TSW	SYPP
DF (50%)	G	0.744**	0.704**	0.329*	-0.862**	-0.675**	-0.491**	0.683**	-0.567**	-0.334*
	P	0.596**	0.413**	-0.025	-0.782**	-0.626**	0.606**	0.624**	-0.340**	-0.270*
DM	G		0.335*	0.265*	-0.660**	-0.503**	0.168	0.374**	0.284*	-0.365**
	P		0.428**	0.238	-0.314*	-0.207	0.245	0.248	0.110	-0.006
PH	G			0.622**	0.498**	0.073	0.136	0.160	0.334*	0.103
	P			0.433**	-0.140	0.092	0.060	0.055	0.066	0.307*
NPB	G				0.106	-0.296*	-0.212	-0.074	-0.057	0.663**
	P				0.388**	0.500**	-0.235	-0.176	0.128	0.737**
NSB	G					0.881**	-0.702**	-0.920**	0.543**	0.441**
	P					0.834**	-0.696**	-0.769**	0.433**	0.527**
NSP	G						-0.773**	-0.910**	0.721**	0.694**
	P						-0.699**	-0.671**	0.321*	0.666**
SL	G							0.898**	-0.293*	-0.276*
	P							0.790**	-0.269*	-0.372**
SS	G								-0.674**	-0.325*
	P								-0.431**	-0.318*
TSW	G									0.334*
	P									0.223

** Significant at 1% level of probability, * Significant at 5% level of probability

Seed yield was significantly and positively associated with number of primary branches per plant followed by number of siliquae per plant and number of secondary branches per plant at both genotypic and phenotypic level, which indicated that, if the number of primary branches per plant increase, seed yield per plant would also increase. Similar relationship was observed in case of number of secondary branches per plant and number of siliquae per plant. Days to 50% flowering showed highly significant positive association with days to maturity, plant height and seeds per siliqua. The findings of the experiment were in partial agreement with Siddikee (2006).

Plant height showed significant positive correlation with number of primary branches per plant. Similar findings were reported by Rashid (2007), Siddikee (2006) and Woyke (1993). Number of primary branches per plant was significantly and positively correlated with number of secondary branches per plant and number of siliquae per plant. Similar results were obtained by Afroz *et al.* (2004), Rashid (2007), Siddikee (2006), Kumar *et al.* (1996), and Shabana *et al.* (1990). Significant positive correlation was noted between number of secondary branches per plant and number of siliquae per plant.

Path analysis

Association of character determined by correlation co-efficient might not provide an exact picture of the relative importance of direct and indirect influence of each of yield components on seed yield per plant. As a matter of fact, in order to find out a clear picture of the inter-relationship between seed yield per plant and other yield attributes, direct and indirect effects were worked out using path analysis, which also measured the relative importance of each component.

Path co-efficient analysis revealed that (Table 3), number of primary branches per plant had the highest direct positive effect on seed yield followed by number of siliquae per plant, number of secondary branches per plant, seeds per siliqua, plant height, thousand seed weight and date to 50% flowering, which indicated true relationship between them and direct selection for these traits would be rewarding for yield improvement. The present results are similar to the findings of Chen *et al.* (1983), Kumar *et al.* (1984) and Sabana *et al.* (1990) in rapeseed. Days to maturity and siliqua length showed negative direct effect on yield per plant. The number of secondary branches per plant had highest positive indirect effects on number of siliquae per plant. Siddikee (2006) found the similar result. It is evident that the correlation between the yield and various characters has been partitioned into direct and indirect effect. Here direct effect is positive but the correlation is negative in such situation direct selection for such trait (days to 50% flowering, seeds/siliqua) should be practiced to reduce the undesirable indirect effect. (Singh and Kakar, 1977).

Table 3. Direct (Diagonal) and indirect effect of some yield contributing characters on *Brassica rapa*

Characters	DF(50%)	DM	PH	NPB	NSB	NSP	SL	SS	TSW	SYPP (g)
DF(50%)	**0.053**	-0.070	0.039	-0.013	-0.135	-0.220	-0.006	0.104	-0.022	-0.270*
DM	0.032	**-0.119**	0.040	0.122	-0.054	-0.073	-0.002	-0.041	0.007	-0.006
PH	0.022	-0.051	**0.093**	0.221	-0.024	0.032	-0.001	0.009	0.004	0.307*
NPB	-0.001	-0.028	0.040	**0.511**	0.058	0.176	0.002	-0.029	0.008	0.737**
NSB	-0.042	0.037	-0.013	0.173	**0.172**	0.293	0.006	-0.128	0.028	0.527**
NSP	-0.033	0.025	0.009	0.255	0.144	**0.352**	0.006	-0.111	0.021	0.666**
SL	0.032	-0.029	0.006	-0.120	-0.120	-0.246	**-0.009**	0.131	-0.017	-0.372**
SS	0.033	-0.029	0.005	-0.090	-0.132	-0.236	-0.007	**0.166**	-0.028	-0.318*
TSW	-0.018	-0.013	0.006	0.065	0.075	0.113	0.002	-0.071	**0.064**	0.223

Residual effect (R): 0.564 ** Significant at 1% level of probability, * Significant at 5% level of probability

In correlation and path co-efficient analysis it was observed that, days to 50% flowering, plant height, number of primary branches per plant, number of secondary branches per plant and number of siliquae per plant were the most important yield components in *Brassica rapa*. These characters also showed the moderate to high genotypic co-efficient of variation and heritability and also moderate to high genetic advance in percent of mean. Therefore, the results suggested that these components were important as yield contributing traits and identification of materials for hybridization program should be selected based mainly on these traits in case of *Brassica rapa*.

The residual effect observed in path analysis was high (0.56) indicating that the character under study contributed 44% of the seed yield per plant. It is thus evident that there were some other traits those contributed 56% to the seed yield per plant, which should be taken care of for future improvement program.

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