CORRELATION AND PATH COEFFICIENT ANALYSIS IN INDIAN MUSTARD [*Brassica juncea* (L.) CZERN & COSS]

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ABSTRACT

Fifty genotypes of Indian mustard were evaluated for seed yield and its yield components for correlation and path coefficient analysis. The seed yield per plant had significant and positive correlation with harvest index, biological yield per plant, number of siliquae per plant and number of secondary branches per plant at both genotypic and phenotypic levels. Among the component traits, biological yield per plant had significant and positive association with harvest index and oil content at genotypic level. Further, path coefficient analysis of twelve yield contributing characters clearly indicated that biological yield per plant showed the highest positive direct effect on seed yield followed by harvest index, length of siliqua, days to 50 per cent flowering, oil content, number of secondary branches per plant and number of primary branches per plant, which indicated positive direct effects in descending order and other characters contributed indirectly towards seed yield in Indian mustard.

KEYWORDS: Correlation, path analysis, yield components, mustard.

INTRODUCTION

Oleiferous *Brassicas,* collectively known as rapeseed and mustard are important oilseed crops of India and stand second after soybean in production among the eight annual edible oilseeds cultivated in our country. Among the four oleiferous *Brassica* species, major area is under *Brassica juncea,* which contributes about 80 per cent of the total rapeseed-mustard production in the country. Among the various oilseed crops grown globally, the estimated area, production and yield of rapeseed-mustard in the world was 33.57 mha, 60.56 mt and1800 kg/ha, respectively (USDA, 2011). India accounts for 21.7 per cent and 10.7 per cent of the total acreage and production with area, production and productivity of rapeseed-mustard are 6.5 mha, 8.79 mt and 1179 kg/ha, respectively (USDA, 2010).

Various components of seed yield very often exhibit varying degree of associations with seed yield as well as among themselves. Analysis of correlation coefficients between characters contributing directly or indirectly towards seed yield is a matter of considerable importance in exercising the selection programme. A study of correlation alone is not enough to provide an exact picture of relative importance of direct and indirect influences of each of the component traits on seed yield. In this context, path coefficient analysis is an important tool for the plant breeders in partitioning the total correlation coefficients into direct and indirect effects of independent variables on dependent variable i.e. seed yield

per plant. Therefore, an attempt was made to study correlation and path coefficient analysis in 50 genotypes of Indian mustard (*Brassica juncea* L.).

MATERIALS AND METHODS

Fifty diverse genotypes of mustard, collected from various states of India, were grown in randomized block design with three replications at Instructional Farm, Junagadh Agricultural University, Junagadh during *Rabi* 2011-12. Each entry was sown in a single row plot of 3.0 m length with a spacing of 60 x 10 cm. All the recommended agronomical practices and necessary plant protection measures were followed timely to raise healthy crop. The observations were recorded on five randomly selected plants in each entry and in each replication on 13 characters (Table 1) and the mean values were used for statistical analysis. The phenotypic and genotypic correlation coefficients of all the pair of characters were worked out as per Al-Jibouri *et al*. (1958), while path coefficient analysis was carried out according to the method suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The analysis of variance revealed that mean squares due to genotypes were highly significant for all the thirteen characters indicating the presence of sufficient amount of variability among the genotypes.

The association analysis (Table 1) revealed that, in general, the values of genotypic correlations were higher than their phenotypic correlations indicating the inherent association among the traits. Similar findings were also reported by Shah *et al*. (2002), Singh *et al*. (2003) and Joshi *et al*. (2009). Correlation coefficient analysis revealed that seed yield had significant and positive association with harvest index, biological yield per plant, number of siliquae per plant and number of secondary branches per plant at genotypic and phenotypic levels. Thus, these four attributes can serve as marker characters for seed yield improvement in mustard. Such positive interrelationships between seed yield and these attributes have also been reported in mustard by Illmulwar *et al*. (2003), Sirohi *et al*. (2004), Kardam and Singh (2005), Acharya (2006), Singh and Singh (2010) and Sekhar *et al*. (2012).

Days to 50 per cent flowering, number of seeds per siliqua and length of siliqua had positive, but non-significant association with seed yield per plant at both levels, as also reported by Verma *et al*. (2008). However, seed yield per plant exhibited negative and non-significant correlations with days to maturity and 1000-seed weight at both levels. Days to maturity, which had significant and positive association with days to 50 per cent flowering, is an important component in identifying and deciding the duration of the crop. Both these traits had positive interrelationship with plant height, number of primary branches per plant, number of siliquae per plant and biological yield per plant at genotypic level. Such relationship may bring collective improvement in different characters and in turn the seed yield. Plant height had significant and positive correlation with days to 50 per cent flowering, days to maturity, number of primary branches per plant, number of secondary branches per plant, number of siliquae per plant and biological yield per plant at both levels, which is in accordance with the findings of Pant *et al*. (2002) and Dastidar and Patra (2004) in mustard. Significant and positive association between number of siliquae per plant and biological yield per plant has reported by Joshi *et al*. (2009). Number of primary as well as secondary branches per plant and number of siliquae per plant had significant and positive correlation among themselves at both levels.

The results of path coefficient analysis of direct and indirect effects of different characters on seed yield are presented in Table 2. The genotypic path coefficient analysis revealed that biological yield per plant, harvest index and length of siliqua exhibited high and

positive direct effects on seed yield per plant. These characters turned out to be the major components of seed yield. The maximum and positive direct effects of biological yield per plant and harvest index were also reported by Dastidar and Patra (2004), Sirohi *et al*. (2004) and Sirohi *et al*. (2008).

The negative direct effect of low magnitude of days to maturity and plant height was nullified by high and positive indirect effects of days to 50 per cent flowering. Similarly, the negative direct effect of low magnitude of number of siliquae per plant was nullified by high and positive indirect effects of biological yield per plant. The residual effect was of low magnitude suggesting that the majority of the yield attributes have been included in the path analysis. Considering the correlation and path coefficient analysis for seed yield per plant and its component traits, an ideal plant type in mustard would be one with high biological yield per plant, high harvest index and more length of siliqua accompanied with early flowering and maturity. Therefore, more emphasis should be given to these components while making selection for higher seed yield in mustard.

CONCLUSION

From the present investigation, it can be concluded that seed yield had significant and positive association with harvest index, biological yield per plant, number of siliquae per plant and number of secondary branches per plant at genotypic and phenotypic levels. Thus, these four attributes can serve as marker characters for seed yield improvement in mustard. Further, path coefficient analysis clearly indicated that biological yield per plant, harvest index and length of siliqua exhibited high and positive direct effects on seed yield per plant. Therefore, more emphasis should be given to these components while making selection for higher seed yield in mustard.

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Table 1: Genotypic (r_g) and phenotypic (r_p) correlations coefficients among 13 characters of mustard

Characters		Days to 50 Per Cent Flowering	Days to Maturity	Plant Height (cm)	Number of Primary Branches Per Plant	Number of Secondary Branches Per Plant	Number of Siliquae Per Plant	Number of Seeds Per Siliqua	Length of Siliqua (cm)	1000-Seed Weight (g)	Biological Yield Per Plant (g)	Harvest Index (%)	Oil Content (%)
Seed Yield Per Plant (g)	r_g	0.082	-0.150	-0.247**	0.202*	0.243**	0.304**	0.049	0.099	-0.025	0.909**	0.910**	0.353**
	r_p	0.040	-0.082	-0.077	0.174*	0.250**	0.295**	0.106	0.027	-0.022	0.699**	0.620**	0.083
Days to 50 Per Cent Flowering	r_g		0.611**	0.516**	0.525**	0.139	0.308**	0.036	-0.094	-0.493**	0.386**	-0.273**	-0.008
	r_p		0.535**	0.402**	0.381**	0.088	0.240**	0.002	-0.095	-0.445**	0.165*	-0.146	-0.079
Days to Maturity	r_g			0.204*	0.261**	-0.077	-0.081	-0.019	0.019	-0.246**	0.036	-0.329**	-0.342**
	r_p			0.195*	0.206*	-0.077	-0.023	0.000	0.020	-0.194*	0.037	-0.175*	-0.223**
Plant Height (cm)	r_g				0.440**	0.438**	0.291**	-0.189*	0.200*	-0.220**	0.181*	-0.596**	0.190*
	r_p				0.309**	0.343**	0.236**	-0.048	0.099	-0.120	0.217**	-0.361**	-0.076
Number of Primary Branches Per Plant	r_g					0.345**	0.354**	-0.054	-0.144	-0.331**	0.598**	-0.236**	0.102
	r_p					0.228**	0.291**	-0.079	-0.162*	-0.194*	0.353**	-0.150	0.040
Number of Secondary Branches Per Plant	r_g						0.433**	-0.201*	-0.223**	-0.116	0.679**	-0.203*	0.372**
	r_p						0.291**	-0.149	-0.123	-0.072	0.392**	-0.096	0.142
Number of Siliquae Per Plant	r_g							-0.052	-0.174*	-0.483**	0.607**	-0.019	0.415**
	r_p							-0.015	-0.158	-0.338**	0.423**	-0.049	0.131
Number of Seeds Per Siliqua	r_g								0.255**	-0.189*	-0.137	0.205*	-0.184*
	r_p								0.210**	-0.168*	-0.025	0.184*	-0.070
Length of Siliqua (cm)	r_g									0.379**	-0.063	0.188*	-0.268**
	r_p									0.264**	-0.081	0.110	-0.063
1000- Seed Weight (g)	r_g										-0.260**	0.205*	0.022
	r_p										-0.038	-0.003	-0.014
Biological Yield Per Plant (g)	r_g											0.650**	0.450**
	r_p											-0.110	0.039
Harvest Index (%)	r_g												0.197*
	r_p												0.075

***,** Significant at 5 per cent and 1 per cent levels of significance, respectively*

Table 2: Genotypic path coefficient analysis showing direct (diagonal and bold) and indirect effects of different characters on seed yield of mustard

Characters	Days to 50 Per Cent Flowering	Days to Maturity	Plant Height (cm)	Number of Primary Branches Per Plant	Number of Secondary Branches Per Plant	Number of Siliquae Per Plant	Number of Seeds Per Siliqua	Length of Siliqua (cm)	1000-Seed Weight (g)	Biological Yield Per Plant (g)	Harvest Index (%)	Oil Content (%)	Genotypic Correlation with Seed Yield Per Plant
Days to 50 Per Cent Flowering	**0.158**	-0.037	-0.143	0.026	0.013	-0.023	-0.002	-0.020	0.046	0.189	-0.123	-0.001	0.082
Days to Maturity	0.097	**-0.060**	-0.057	0.013	-0.007	0.006	0.001	0.004	0.023	0.018	-0.148	-0.040	-0.150
Plant Height (cm)	0.082	-0.012	**-0.278**	0.022	0.041	-0.022	0.013	0.043	0.021	0.089	-0.267	0.022	-0.247**
Number of Primary Branches Per Plant	0.083	-0.016	-0.122	**0.049**	0.032	-0.027	0.004	-0.031	0.031	0.293	-0.106	0.012	0.202*
Number of Secondary Branches Per Plant	0.022	0.005	-0.122	0.017	**0.092**	-0.032	0.014	-0.048	0.011	0.332	-0.091	0.043	0.243**
Number of Siliquae Per Plant	0.049	0.005	-0.081	0.017	0.040	**-0.075**	0.004	-0.038	0.045	0.297	-0.008	0.048	0.304**
Number of Seeds Per Siliqua	0.006	0.001	0.052	-0.003	-0.019	0.004	**-0.069**	0.055	0.018	-0.067	0.092	-0.021	0.049
Length of Siliqua (cm)	-0.015	-0.001	-0.056	-0.007	-0.021	0.013	-0.018	**0.217**	-0.036	-0.031	0.084	-0.031	0.099
1000- Seed Weight (g)	-0.078	0.015	0.061	-0.016	-0.011	0.036	0.013	0.082	**-0.094**	-0.127	0.092	0.003	-0.025
Biological Yield Per Plant (g)	0.061	-0.002	-0.050	0.029	0.063	-0.045	0.009	-0.014	0.024	**0.490**	0.291	0.053	0.909**
Harvest Index (%)	-0.043	0.020	0.165	-0.012	-0.019	0.001	-0.014	0.041	-0.019	0.318	**0.448**	0.023	0.910**
Oil Content (%)	-0.001	0.021	-0.053	0.005	0.034	-0.031	0.013	-0.058	-0.002	0.220	0.088	**0.117**	0.353**

***,** Significant at 5 per cent and 1 per cent levels of significance, respectively*

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