Environment and Ecology 37 (4B) : 1497—1500, October—December 2019
ISSN 0970-0420

Characters Association Studies for Yield Contributing Traits in Indian Mustard (*Brassica juncea*)

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Received 27 August 2019; Accepted 15 October 2019; Published on 15 November 2019

ABSTRACT

Nineteen genotypes of Indian mustard were evaluated during *rabi* 2017-2018 in a Randomized Block Design (RBD) with three replication to study of character association and path analysis. Genotypic correlation coefficient between all characters was higher than phenotypic correlation coefficient indicating strong association among the characters genetically, but phenotypic value is lessened by the significant interaction of environment. Days to 50% flowering, plant height, number of siliqua per plant, biological yield per plant and harvest index had significant and positive association with seed yield per plant at genotypic and phenotypic level respectively. Whereas, number of primary branches was observed significant positive correlation at genotypic level. Path analysis revealed days to 50% flowering, number of primary branches, plant height, number of siliqua per plant, biological yield per plant and harvest index had positive direct effect on seed yield per plant.

Keywords Mustard, *Brassica juncea,* Character association.

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INTRODUCTION

Rapeseed mustard is second most important oil seed crops of our country. Mustard is a member of family *Brassiceae*, amphidiploid, chromosome number 36. According to ancient scripture and literature, it has been cultivated as early as 5000 BC. The family *Brassiceae,* contains about 3500 species and 350 genera, is one of the 10 most economically important plant families. Presently rapeseed mustard covers 35.44 million ha with production and productivity of 73.95 metric tones and 2.09 tones/ha respectively. In India, the total cultivated area of rapeseed-mustard 6.50 million ha with the production 5.70 metric tons and productivity 1 tone/ha. The important state of India producing rapeseed and mustard are Rajasthan, Haryana, Madhya Pradesh, Uttar Pradesh and West Bengal. *Brassica* is high in dry matter digestibility @ 85 to 95% which contrasts with good alfalfa, @ 70%. Its leaves contain 18 to 25% crude protein, while the root contains about 10% crude protein. Due to their rich nutritional contents,these leaf and root crops have been commonly grown as nutritional fodder for sheep and cattle. The total seed-oil content in Indian mustard varies from 38-46 % and meal or oil cake constitutes nearly 50% of the whole seed. The protein content ranges between 24-30% of the whole seed and 35-40% of the meal (Anand et al. 1976, Singh et al. 2013).

MATERIALS AND METHODS

The experimental consisting 18 genotypes and one check i.e., total 19 treatment were sown in Randomized Block Design with three replications. The

genotypes was sown with spacing 0.4 m row to row and 0.3m plant to plant distance. The soil type of experimental site was sandy loam (pH=8.6) EC=1.009 rich in potash and low organic carbon, nitrogen and phosphorus. Five competitive plants from each plot were randomly selected for recording observations for all the quantitative characters except days to flowering and maturity, which was recorded on the plot basis. The data were recorded for the following characters; days to 50% flowering, days to maturity, plant height (cm), number of primary branches, number of secondary branches, number of siliqua per plant, siliqua length, number of seed per siliqua, biological yield per plant, volumetric seed weight and harvest index. The statistical procedure for calculation of these parameters is according to method recommended by Singh and Chaudhary (1971). Path co-efficient analysis was calculated by the formula suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The correlation coefficient for seed yield per plant and its contributing traits for nineteen genotypes are presented in Table 1. Seed yield per plant had positive and highly significant association with number of siliqua per plant (0.413), biological yield per plant (0.786) and harvest index (0.454). On the other hand seed yield per plant had positive and significant association with days to 50% flowering (0.299) and plant height (0.316). Number of secondary branches per plant, siliqua length, days to maturity, seeds per siliqua and volumetric seed weight had non-significant association (either positive or negative) with seed yield per plant. Days to 50% flowering had positive and highly significant correlation with days to maturity (0.538), plant height (0.718) and harvest index (0.463), while number of secondary branches (-0.668), seeds per siliqua (-0.534) and number of siliqua per plant (-0.322) showed negative but significant correlation with days to 50% flowering. Plant height had positive and highly significant association with days to maturity (0.582). On the other hand its showed positive and significant association with harvest index (0.316), While seed per siliqua (-0.318) had negative but significant association with plant height.

Table 1. Genotypic and phenotypic correlation coefficient among 12 characters in Indian mustard.

Characters		Days to 50% flowering 1	Number of primary branches 2	Number of secondary branches 3	Plant height (cm) 4	Number of siliqua per plant 5	Siliqua length (cm) 6
Days to 50% flowering	r_g		0.192	-0.702**	0.742**	-0.329*	-0.195
	r_p		(0.131)	(-0.668)**	(0.718)**	(-0.322)*	(-0.188)
Number of primary branches	r_g			0.231	0.217	-0.232	-0.533**
	r_p			(0.236)	(0.169)	(-0.195)	(-0.420)*
Number of secondary branches	r_g				-0.698**	0.300*	-0.218
	r_p				(-0.671)**	(0.295)*	(-0.171)
Plant height (cm)	r_g					-0.169	-0.031
	r_p					(-0.167)	(-0.024)
Number of siliqua per plant	r_g						0.086
	r_p						(0.084)
Siliqua length (cm)	r_g						
	r_p						
Days to maturity							
Seed per siliqua							
Biological yield							
Test weight							
Harvest index							

Table 1. Continued.

Characters	Days to maturity 7	Seed per siliqua 8	Biological yield 9	Test weight 10	Harvest index 11	Yield per plant 12
Days to 50% flowering	0.551** (0.538)**	-0.566** (-0.534)**	-0.003 (-0.002)	-0.275* (-0.162)	0.515** (0.463)**	0.322* (0.299*)
Number of primary branches	0.244 (0.221)	-0.277* (-0.229)	0.386** (0.327)*	-0.068 (-0.022)	-0.167 (-0.120)	0.279* (0.234)
Number of secondary branches	-0.501** (-0.483)**	0.429** (0.407)**	0.255 (0.248)	0.302* (0.274)*	-0.293* (-0.258)	0.064 (0.068)
Plant height (cm)	0.587** (0.582)**	-0.342** (-0.318)*	0.130 (0.128)	-0.048 (-0.039)	0.336** (0.311)*	0.329* (0.316)*
Number of siliqua per plant	-0.334* (-0.331)*	0.238 (0.228)	0.319* (0.319)*	0.180 (0.133)	0.237 (0.220)	0.427** (0.413)**
Siliqua length (cm)	0.123 (0.112)	0.463** (0.413)**	-0.153 (-0.141)	0.337** (0.236)	-0.175 (-0.173)	-0.237 (-0.226)
Days to maturity	r_g r_p	-0.301* (-0.284)*	0.039 (0.038)	0.126 (0.108)	-0.093 (-0.092)	-0.025 (-0.027)
Seed per siliqua		r_g r_p	0.273* (0.257)	0.305* (0.232)	-0.487** (-0.409)**	-0.036 (-0.016)
Biological yield			r_g r_p	-0.064 (-0.043)	-0.199 (-0.188)	0.809** (0.786)**
Tesat weight				r_g r_p	-0.136 (-0.085)	-0.139 (-0.082)
Harvest index					r_g r_p	0.411** 0.454**

Number of siliqua per plant revealed positive and significant correlation with biological yield per plant (0.319), negative but significant correlation observed between days to maturity (-0.331). Harvest index had positive and highly significant association with days to 50% flowering (0.463), while seeds per siliqua (-0.409) showed negative but significant association with harvest index. Similar result were also reported by Gosh and Gulati (2001), Mahla et al. (2003), Sirohi et al. (2008) and Hasan et al. (2014). The above discussion revealed that all the highly significant estimates of correlation coefficient observed among the important yield components such as number of siliqua per plant, biological yield per plant, harvest index, days to 50% flowering and plant height were highly significant/significant and positive correlation with grain yield. Thus, selection practiced for improving these traits individually or simultaneously, is likely to bring improvement in other traits due to correlated response.

Path coefficient analysis is a tool to partition the observed correlation coefficient into direct and indirect effects of yield components on grain yield. Path analysis provides clearer picture of character associations for formulating efficient selection strategy. Path coefficient analysis differs from simple correlation in that it points out the causes and their relative importance, whereas, the later measures simply the mutual association ignoring the causation. The results of path coefficient analysis carried out using simple correlation coefficients among 12 characters are given in Table 2. Biological yield per plant (0.890), harvest index (0.526), days to 50% flowering (0.125) and number of primary branches had highest positive direct effect on seed yield per plant. Biological yield and harvest index had very high magnitude of positive direct effect on their correlation value while a poor value of direct effect was noted for number of siliqua per plant. Similar result have been reported by Yohannes and Belete (2013), Hasan et al. (2014) and Dawar et al. (2018). The residual effect of path analysis denoted that a few character of really important to contribution to the yield which could not taken in study but also consider in future. Some residual effect was also observed R = (0.023). It is suggested that during selection, these characters may be given due emphasis for developing high yielding varieties.

Table 2. Direct and indirect effects of 12 characters on seed yield per plant in mustard.

Characters	Days to flowering 1	Number of primary branches 2	Number of secondary branches 3	Plant height 4	Number of siliquae per plant 5	Siliqua length 6	Days to maturity 7	Seeds per siliqua 8	Biological yield 9	Test weight 10	Harvest index 11	Genotypic correlation with yield
1	**0.125**	0.024	-0.088	0.093	-0.041	-0.025	0.069	-0.071	-0.0004	-0.034	0.065	0.322*
2	0.004	**0.021**	0.005	0.005	-0.005	-0.011	0.005	-0.006	0.008	-0.001	-0.003	0.279*
3	-0.068	0.022	**0.096**	-0.067	0.029	-0.021	-0.048	0.041	0.025	0.029	-0.028	0.064
4	0.033	0.010	-0.031	**0.044**	-0.008	-0.001	0.026	-0.015	0.006	-0.002	0.015	0.329*
5	-0.007	-0.005	0.006	-0.004	**0.022**	0.002	-0.007	0.005	0.007	0.004	0.005	0.427**
6	-0.014	-0.039	-0.016	-0.002	0.006	**0.074**	0.001	0.034	-0.011	0.025	-0.013	-0.237
7	-0.039	-0.017	0.036	-0.042	0.024	-0.009	**-0.071**	0.021	-0.003	-0.009	0.007	-0.025
8	0.016	0.008	-0.012	0.009	-0.007	-0.013	0.009	**-0.029**	-0.008	-0.009	0.014	-0.036
9	-0.003	0.343	0.227	0.115	0.284	-0.136	0.035	0.243	**0.890**	-0.057	-0.177	0.809**
10	0.004	0.001	-0.004	0.001	-0.003	-0.005	-0.002	-0.004	0.001	**-0.014**	0.002	-0.140
11	0.270	-0.088	-0.154	0.176	0.125	-0.092	-0.049	-0.256	-0.105	-0.071	**0.526**	0.411

Hence, emphasis should be given to select these traits for yield enhancement of mustard.

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