Indian J. Genet., 68(1): 87-89 (2008)

Short Communication

Association studies among yield and its component characters in Indian mustard [*Brassica juncea* (L.) Czern & Coss]

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(Received: July 2006; Revised: December 2007; Accepted: February 2008)

The present study was conducted to gather more knowledge of correlation between yield and its contributing traits and themselves which is useful in selecting superior plant type which could surpass existing agronomically accepted varieties. A set of 40 genotypes of Indian mustard [*Brassica juncea* (L.) Czern and Coss] were grown in the years 2003-2004 and 2004-2005 at KVK, Mathura Research Farm. The experiment was planned in randomized complete design with three replications. Each genotype was planted in two rows of 3 meter length. The spacing between and within lines were 30 cm and 15 cm, respectively. Observations were recorded on 5 randomly selected plants per genotype per replication for days to flower, days to maturity, plant height, primary branches per plant, secondary branches per plant, siliqua on main raceme, siliqua length, seeds per siliqua, 1000-seed weight and seed yield per plant. The correlation coefficients and their significance were computed as per the procedure given by [1].

Pooled analysis of variance (Table 1) indicated higher significant genotypic difference for all the characters. Significance of genotype x years interaction for all the characters revealed that genotypes have shown different responses in different years. Correlation studies at phenotypic and genotypic levels (Table 2) for pooled two years data revealed that highly significant and positive correlation of seed yield/plant existed with plant height (0.377 and 0.383), number of primary branches/plant (0.408 and 0.447), number of secondary branches (0.361 and 0.382), and number of seeds/siliqua (0.493 and 0.502). Similar findings were also reported by other workers [2, 3]. Significant and positive correlations of seed yield with plant height and seeds/siliqua was also reported by [4], whereas it was negative and significant for days to flower (–0.136 and 0.146) but negative and highly significant for days to maturity (–0.317 and 0.366), indicating a possible increase in seed yield by lowering to number of days to flower which will increase the flowering duration and number of siliqua on the main raceme as is also evident through a positive and significant correlation of the later with days to flower (0.242 and 0.263). Moreover, in general the association of these characters with seed yield and among themselves was much stronger at genotypic level (Table 2).

The results also tend to emphasize that improvement in seed yield can be achieved by improving the characters primary and secondary branches/plant and seeds per siliqua. This is evident from highly significant and positive correlation noted between number of primary branches and number of secondary branches (0.506 and 0.561); length of siliqua and number of seeds per siliqua (0.419 and 0.460). 1000-seed weight exhibited strong negative association with number of seeds per siliqua (–0.312 and –0.324); number of primary branches (–0.509 and –0.539 and plant height (–0.458 and –0.470). This finding is in agreement with earlier reports in Indian mustard [4-5]. Length of siliqua exhibited highly significant and positive association with 1000-seed weight (0.308 and 0.335). It is evident from the results that number of seeds per siliqua can be increased by improving siliqua length.

The character 1000-seed weight, an important yield contributing character in most of the crops, showed negative association with most of the characters except length of siliqua indicating the importance of this character while initiating the selection programme aiming improvement in any of these traits.

Table 1. Pooled analysis of variance for 10 quantitative traits in Indian mustard

Source	DF	MSS of characters									
		Days to flower	Days to maturity	Plant height branch	No. of primary branches	No. of secondary branches	No. of siliqua on main raceme	Lengths of siliqua	No. of seeds/ siliqua	1000-seed wt.(g)	Seed yield/ plant
Year	1	369.000**	136.000**	5389.200**	4.424**	757.578**	1027.156**	17.897**	298.996*	216.164**	3720.476**
Replication	2	6.718	3.500	138.000	1.046**	0.503	71.531**	9.838	0.195	0.218	5.730
Year x replication	2	10.5 39*	0.250	17.500	8.056**	2.062	5.703	0.455*	1.757	0.174	2.386
Genotypes	39	15.5 44**	13.2 82**	1207.8 07**	1.486**	11.751**	195.545**	0.686**	12.112**	2.651**	119.0 66**
Year x genotypes	39	13.5 83*	12.1 53**	428.991**	1.562**	12.807**	11.285**	0.292**	3.934**	1.378**	108.074**
Error	156	2.87 0	2.09 6	224.075	0.140	0.805	4.278	0.149	0.573	7.673	2.713

*,**Significant at 5% and 1% levels respectively

Table 2. Phenotypic and genotypic correlation coefficient among 10 characters in 40 genotypes of Indian mustard

Source		Days to maturity	Plant height (cm)	No. of primary branches	No. of secon-dary branches	No. of siliqua on main raceme	Length of siliqua	No. of seeds/ siliqua	1000-seed weight (g)	Seed yield/ plant(g)
Days to flower	P	0.068	0.134	0.045	0.036	0.242*	-0.081	-0.194	0.117	-0.138
	G	0.090	0.151	0.069	-0.046	0.263*	-0.076	-0.203	0.130	-0.146
Days to maturity	P		-0.003	0.023	-0.093	0.038	-0.023	-0.086	0.131	-0.317**
	G		-0.003	-0.010	-0.115	0.034	-0.023	-0.105	0.156	-0.366**
Plant height (cm)	P			0.357**	-0.074	-0.073	-0.287**	0.099	-0.458**	0.377**
	G			0.384**	-0.084	-0.071	-0.322**	0.097	-0.470**	0.383**
No. of primary branches	P				0.506**	0.065	0.084	0.048	-0.500**	0.408**
	G				0.561**	-0.075	-0.100	0.051	-0.539**	0.447**
No. of secondary br.	P					-0.201	0.099	0.174	-0.175	0.361**
	G					-0.207	0.127	0.187	-0.169	0.382**
No. of siliqua G on main raceme	P						-0.179	-0.171	-0.008	-0.165
							-0.196	-0.178	-0.005	-0.173
Length of siliqua	P							0.419**	0.308**	0.119
	G							0.460**	0.335**	0.128
No. of seeds per siliqua	P								-0.312**	0.493**
	G								-0.324**	0.502**
1000-seed weight (g)	P									-0.249*
	G									-0.265*

*,**Significant at 5% and 1% levels of respectively; P = Phenotypic correlation; G = Genotypic correlation

In general, the results showed that genotypic correlation coefficients were higher in magnitude than the phenotypic correlation coefficients for most of the characters. This suggested that the association between various characters, in general was genetically controlled. Similar findings are reported by [6].

Further, the path coefficient analysis results indicated that high positive direct effects on seed yield were noted for plant height (0.370 and 0.341); number of primary branches per plant (0.371 and 0.529); number of seeds per siliqua (0.536 and 0.639) and 1000-seed weight (0.394 and 0.549) on the other hand, days to flower (–0.137 and –0.165); days to maturity (–0.310 and –0.361) and length of siliqua (–0.117 and –0.211)

Table 3. Phenotypic and genotypic path coefficients among 10 characters in 40 genotypes of Indian mustard

Chara cters		Days to flower	Days to maturity	Plant height (cm)	No. of primary branches	No. of secondary branches	No. of siliqua on main receme	Length of siliqua	No. of seeds/ siliqua	1000-seed weight (g)	Seed yield/ plant (g)
Days to	P	**-0.137**	-0.021	0.050	0.017	-0.006	0.009	0.009	-0.104	0.046	-0.136
Flower	G	**-0.165**	-0.032	0.052	0.036	-0.003	0.010	0.016	-0.130	0.072	-0.146
Days	P	-0.009	**-0.310**	-0.001	0.009	-0.015	0.001	0.003	-0.046	0.052	-0.317
to maturity	G	-0.015	**-0.361**	-0.001	-0.005	-0.008	0.001	0.005	-0.067	0.086	-0.366
Plant	P	-0.018	0.001	0.370	0.133	-0.012	-0.003	0.034	0.053	-0.181	0.377
height2	G	-0.025	0.001	**0.341**	0.203	-0.006	-0.003	0.068	0.062	-0.258	0.383
No. of	P	-0.006	-0.007	0.132	0.371	0.082	-0.002	0.010	0.026	-0.197	0.408
prim ary br.	G	-0.011	0.004	0.131	**0.529**	0.041	-0.003	0.021	0.032	-0.296	0.447
No. of	P	0.005	0.029	-0.027	0.188	**0.162**	-0.008	-0.012	0.093	-0.069	0.361
second dary br.	G	0.008	0.041	-0.029	0.297	**0.073**	-0.008	-0.027	0.119	-0.093	0.382
No. of	P	-0.033	-0.012	-0.027	-0.024	-0.033	0.038	0.021	-0.092	-0.003	-0.165
siliqua on main raceme	G	-0.043	-0.012	-0.024	-0.039	-0.015	**0.037**	0.041	-0.114	-0.003	-0.173
Length	P	0.011	0.007	-0.106	-0.031	0.016	-0.007	**-0.117**	0.225	0.122	0.119
of siliqua	G	0.013	0.008	-0.110	-0.053	0.009	-0.007	**-0.211**	0.294	0.184	0.128
No. of	P	0.027	0.027	0.036	0.018	0.028	-0.006	-0.049	0.536	-0.123	0.493
seeds/siliqua	G	0.034	0.038	0.033	0.027	0.014	-0.007	-0.097	**0.639**	-0.178	0.502
1000-	P	-0.016	-0.041	-0.170	-0.185	-0.028	0.001	-0.036	-0.167	**0.394**	-0.249
seed weight	G	-0.022	-0.056	-0.160	-0.285	-0.012	0.002	-0.071	-0.207	**0.549**	-0.265

Pooled 1 - Phenotypic Path Coefficient, Residual effect = 0.3875 Pooled 2 - Genotypic Path Coefficient, Residual effect = 0.3064

showed high negative direct effects on seed yield. Plant height and number of primary branches showed high positive indirect effects through each other. High direct effects of 1000-seed weight were counter balanced by negative indirect effects *via* most of the yield contributing characters resulting into high negative correlation with seed yield per plant (Table 3).

Thus, on the basis of the results of the present study, the characters plant height, number of primary branches per plant, number of seeds per siliqua and 1000-seed weight be given due weightage for improving seed yield in Indian mustard.

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