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TO STUDY AND ESTIMATION OF THE GENOTYPIC AND PHENOTYPIC CORRELATIONS OF VARIOUS CHARACTERS IN INDIAN MUSTERED[BRASSICA JUNCEA (L.)] [CZERN & COSS]

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Abstract

Correlation studies revealed positive and significant genotypic as well as phenotypic correlations of plant height, number of seeds per siliqua, siliqua length, test weight and oil content with seed yield per plant among parents. In F_1 generations all the traits under study showed positive and significant correlation with seed yield per plant except test weight and oil content. Days to flowering had negative and significant correlation with seed yield. In F_2 generation, seed yield per plant showed positive and significant correlation with plant height, number of primary branches, number of secondary braches, number of siliqua per plant, number of seeds per siliqua, siliqua length, days to maturity and test weight.

Key words: *Genotype & phenotype characters, Correlation, Indian Mustered [Brassica juncea (l.)] [Czern & Coss]*

Introduction

In spite of the fact that Indian mustard is an important oilseed crop specially in northern part of the country, the basic genetic information needed for scientific breeding programme are scanty. Major research work has so far been done on the genetics of its economic attributes, as a result of which the breeding work has been confined mainly to conventional methods. The limited improvement, however, is due to narrow genetic base and arbitrary choice of the parents for hybridization. Informations on gene action, nature and magnitude of the variances, heritability, genetic advance, heterosis, in breeding depression and genetic correlation help in deciding the most appropriate and pragmatic breeding methodology.

There are various *Oliferous Brassica*, grown in India, Important among them are Indian mustard [*Brassica juncea* (L.)] [Czern & Coss], Toria (Brassica campestris var. toria), brown sarson (Brassica campestris var. brown sarson) and Banarsi Rai (Brassica nigra), Out of these, Indian mustard [*Brassica juncea* (L.) [Czern and coss] popularly known as rai, grained importance on account of this being widely cultivated in almost all the growing conditions and eco-geographical regions of the country. Indian mustard is preferred for cultivation because of the fact that it has better resistance to biotic and abiotic factors (Singh Balwant, 2004).

Rapeseed-mustard is major Rabi oilseed crop of northern India. It occupies a prominent position, next to groundnut, among the various oilseed crops grown in India. The total production under oilseeds has gone up from 0.76 million tonnes (1950-51) to 4.09 million tonnes in (2000-01). In U.P., the total area was 1.18 million hectares under oilseeds with the production of 1.14 million tones during 1996-97 and rapeseed-mustard occupied an area of about 1.07 million hectares and production of about 1.09 million tones, respectively during 1999-2000 (Singh and Sharma, 2022)

Geographically Rath, Hamirpur district lies in the Sub-tropical zone at a latitude and longitudinal range of 79.7^0 East and 25.5^0 North. It is located to an elevation of 526 feet's from the sea levels. The annual rainfall ranges between 900-1000 mm received mostly from last week of June to Last September with occasional showers in winter. The study area covered by boundaries in east Mahoba District near 65km from head quarter west Jalaun (Orai) near 55 km, nourth Hamirpur 85km and in south Harpalpur 45km from Study side (Sharma *et. al.* 2022).

Technique involving 'diallel cross analysis' has been widely used by the breeders in different crops for understanding the nature of genetic variances involved in the expression of characters and also for the identification of suitable parents for hybridization in crop pants. A brief account of literature available on Brassica sps., on different aspects of present investigation, i.e., diallel cross analysis, components of variance, combining ability, heterosis and inbreeding depression, heritability and genetic advance and correlation coefficient analysis has been reviewed by few researchers given as:

Badwal and Labana (1988) observed that both gca and sca variances were significant for seed size but sca variance was significant for oil content only, gca and sca interacted significantly for oil content. Non-additive gene effects were important for these two traits.

Seed yield was positively and significantly correlated with number of primary and secondary branches, and number of siliqua per plant as reported by Chaudhary (1967) in *Brassica juncea* and Banerjee *et al.* (1968) in *B. campestris* var. yellow *sarson.*

Chaudhary *et al.* (1988) observed that yield per plant showed positive and significant genotypic correlation with days to maturity, plant height, number of primary branches, number of siliqua on the main receme, number of siliquae on lateral branches, siliquae length and 1000 seed weight. Number of primary branches has the highest positive correlation with yield.

Methods and Materials

Genotypic correlation coefficient was calculated by the formulae:

$$\text{Genotypic correlation} = \frac{\text{Genotypic covariance of (x and y)}}{\{\text{Genotypic variance (x) Genotypic variance y}\}^{0.5}}$$

$$\text{Genotypic correlation of (x)} = \frac{\text{MSP treatment (xy)} - \text{MSP error (ry)}}{\text{Number of replications}}$$

$$\text{Genotypic correlation of (y)} = \frac{\text{MSP treatment (y)} - \text{MSP error (y)}}{\text{Number of replications}}$$

Test of significance:

The significance of correlation was tested with the help of correlation table prepared by Fisher and Yates (1943) at n-2 degree of freedom at 5 and 1 per cent level of significance, respectively.

Results

The correlation coefficients both at genotypic and phenotypic levels in parents, F_1s and F_2s separately have been presented in Table -1 to 2 respectively and described as under :

Among parents:

Among parents at genotypic level days to flowering showed positive and significant association with plant height, number of primary branches, siliqua length and days to maturity while its negative and significant association was observed with test weight. Its association with oil content and seed yield per plant was also negative but non-significant.

Plant height expressed its positive and significant correlation with siliqua length, seed yield per plant. Other traits showed non-significant association with this trait.

At genotypic level positive and significant correlations of number of primary branches per plant and secondary branches per plant were observed with number of secondary branches, number of siliquae per main branch, while negative and significant associations of these traits were noted with test weight and oil content. Seed yield showed negative but non-significant association.

Positive and significant genotypic association of siliqua length and seed yield per plant was observed with number of seeds per siliqua. Other traits showed non-significant positive association with this trait except oil content which showed negative and non-significant association.

The inter relationship of number of siliquae per main branch was significant and in desirable direction with test weight expressed significant and negative relationship with the trait.

The association of siliqua length at genotypic level was positive and significant with seed yield per plant. Its association with remaining traits was non-significant.

Days to maturity showed negative genotypic correlation with all other traits except seed yield per plant.

At phenotypic level the association matrix revealed same direction of relationship as described in genotypic level but the magnitudes were smaller.

In F_1 generation:

The genotypic and phenotypic association for F_1s are presented in table-3, which revealed that seed yield per plant was significantly and positively associated with days to flowering, plant height, number of primary branches, number of secondary branches, number of siliquae per main branch, number of seeds per siliqua and siliqua length. Oil content showed negative and non-significant correlation for seed yield.

The inter relationship of days to flowering with plant height and number of primary branches was positive and significant but negative and significant with test weight. Other traits showed non-significant relationship with days to flowering.

Plant height showed positive and significant association with number of siliquae per main branch and seed yield per plant at genotypic level.

The genotypic correlation of number of primary branches with number of secondary branches, number of siliquae per main branch, number of seeds per siliqua and seed yield per plant and negative and significant with test weight.

Number of secondary branches showed positive and significant association at genotypic level with number of siliquae per main branch, number of seeds per siliqua and seed yield per plant while its association with test weight was negative and significant. Number of siliquae per main branch showed desirable and significant correlation at genotypic level with number of seeds per siliqua and seed yield per plant. Other characters showed negative and non-significant relationship with this trait.

Desirable and significant genotypic correlation of number of seeds per siliqua was observed with siliqua length and seed yield per plant. Remaining traits showed statistically non-significant correlation with this character.

Siliqua length expressed its positive and significant genotypic correlation with test weight. Its correlation with oil content and seed yield per plant was positive but non-significant.

Other traits namely test weight and oil content showed positive/negative non-significant association with seed yield per plant. At phenotypic level the magnitudes of inter relationship were smaller than genotypic ones but they are same in direction.

Correlation coefficients in F_2 generation:

The correlation coefficients in F_2 generation both at genotypic and phenotypic levels are presented in Table -4 and revealed significant and positive association of seed yield per plant with the traits like plant height, number of primary branches, number of secondary branches, number of siliquae per main branch, number of seeds per siliqua, siliqua length. Its association with days to flowering and oil content was positive but non-significant at both the levels.

Among characters themselves revealed that days to flowering showed positive and significant genotypic association with plant height. Other traits showed non-significant relationship with days to flowering. At phenotypic level its association was positive and significant with plant height only.

Plant height had positive and significant genotypic correlation with siliqua length. At phenotypic level it showed positive and significant correlation with.

At genotypic level the association of number of primary branches was positive and significant with number of secondary branches per plant, number of siliquae per main branch, siliqua length. Its association with oil content was negative and significant. Same association was observed at phenotypic level also. Number of secondary branches had positive and significant correlation with number of siliquae per main branch, number of seeds per siliqua, siliqua length both at genotypic and phenotypic levels.

Number of siliquae per main branch showed positive and significant correlation coefficient with number of seeds per siliqua, siliqua length and seed yield per plant both genotypic as well as phenotypic levels.

The association of number of seeds per siliqua was positive and significant at both genotypic and phenotypic levels with siliqua length and seed yield per plant.

Desirable and significant genotypic and phenotypic correlation of siliqua length was noted with seed yield per plant.

Test weight showed positive and significant correlation seed yield per plant at both genotypic and phenotypic levels.

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Table 1 Genotypic and phenotypic correlations between 12 characters among parents used in 10 x 10 diallel cross in Indian mustard.

S. No.	Days to flowering	Plant height	No. of primary branches	No. of secondary branches	No. of siliquae / plant	No. of seeds / siliqua	Siliqua length (cm)	Biological yield/plant (g)	Harvest index	Test weight (g)	Oil content (%)	Seed yield / plant (g)
1	r_g r_p	0.733*	0.632**	0.404*	0.164	-0.003	0.391*	0.599**	-.583**	-0.423*	-0.201	-0.120
2	0.590**		0.281	0.174	0.084	-0.068	0.441**	0.528**	-0.216	-0.022	0.226	0.360*
3	0.334	0.206		1.006**	0.406*	0.067	0.53	0.644**	-0.748**	-0.4500**	-0.512**	-0.236
4	0.331	0.163	0.727**		0.702**	0.006	0.04	0.597**	-0.699**	-0.662**	-0.195	-0.262
5	0.144	0.084	0.300	0.654**		-0.280	-0.205	0.581**	-0.693**	-0.772**	0.022	-0.288
6	-0.027	-0.062	0.089	-0.028	-0.264		0.831**	0.125	0.320	0.293	-.013	0.601**
7	0.233	0.399*	.249	0.050	-0.201	0.787**		0.510**	0.048	0.308	-0.104	0.725**
8	0.455*	0.503*	0.559**	0.575**	0.562**	0.101	0.450*		-0.715**	-0.243	-0.228	0.228
9	-0.466*	-0.209	-0.615**	0.667**	-0.676**	0.289	0.028	-0.709**		0.680**	0.593**	0.517
10	-0.327	-0.025	-0.323	-0.585**	-0.753**	0.237	0.281	-0.213	0.650**		0.168	0.688**
11	-0.139	0.220	-0.368*	-0.175	0.021	-0.010	-0.080	-0.219	0.578**	0.175		0.499**
12	-0.087	0.354*	-0.145	-0.223	-0.260	0.523**	0.621**	0.268	0.476*	0.655**	0.463*	

Table 2 Genotypic and phenotypic correlations between 12 characters in F_1 generation of 10 x 10 diallel cross in Indian mustard

S. No.	Days to flowering	Plant height	No. of primary branches	No. of secondary branches	No. of siliquae / plant	No. of seeds / siliqua	Siliqua length (cm)	Biological yield/plant (g)	Harvest index	Test weight (g)	Oil content (%)	Seed yield / plant (g)
1	r_g r_p	0.290**	0.262**	0.128	0.096	-0.066	-0.134	-0.206*	0.041	-0.434**	-0.165	-0.215*
2	0.255*		0.165	0.194	0.320**	0.209*	0.187	0.343*	0.041	-0.066	0.209*	0.393**
3	0.158	0.112		0.789**	0.693**	0.295**	-0.246*	0.341*	0.151	-0.430**	-0.150	0.534**
4	0.084	0.167	0.594**		0.787**	0.281**	-0.187	0.229*	0.330**	-0.342*	-0.184	0.629**
5	0.082	0.314**	0.508	0.676**		0.287**	-0.185	0.307**	0.344**	-0.411**	-0.115	0.753**
6	-0.057	0.195	0.197*	0.227*	0.270**		0.500**	0.126	0.340*	-0.003	0.224	0.537**
7	-0.065	0.124	-0.080	0.118	-0.127	0.413**		0.105	0.085	0.334*	0.022	0.197*
8	-0.177	0.331**	0.273**	0.208*	0.306**	0.127	0.087		-0.592**	0.010	0.034	0.360**
9	0.033	0.040	0.077	0.272**	0.326**	0.309**	0.052	-0.597		0.106	-0.065	0.524**
10	-0.370**	-0.067	-0.298**	-0.297**	-0.402**	-0.011	0.254*	-0.005	0.105		-0.021	0.111
11	-0.137	0.204*	-0.107	-0.158	-0.115	0.026	0.026	0.027	-0.061	-0.014		-0.005
12	-0.189	0.386**	0.383**	0.550**	0.740**	0.501**	0.148	0.371**	0.504**	0.088	-0.012	

Table 3 Genotypic and phenotypic correlations between 12 characters for F_2 generation derived from 10 x 10 diallel cross in Indian mustard

S. No.	Days to flowering	Plant height	No. of primary branches	No. of secondary branches	No. of siliquae / plant	No. of seeds / siliqua	Siliqua length (cm)	Biological yield/plant (g)	Harvest index	Test weight (g)	Oil content (%)	Seed yield / plant (g)
1	r_g r_p	0.519**	0.262**	0.128	0.096	-0.066	-0.134	-0.206*	0.041	-0.434**	-0.165	-0.215*
2	0.419**		0.002	0.017	0.154	0.139	0.260**	0.238*	0.074	0.077	0.166	0.226*
3	0.088	0.005		0.815**	0.570**	0.091	0.335**	0.286**	0.23*	-0.102	-0.314**	0.429**
4	0.031	0.015	0.682**		0.664**	0.219*	0.418**	0.456**	0.185	-0.082	0.000	0.560**
5	0.105	0.154	0.491**	0.647**		0.321**	0.354**	0.800**	0.258**	-0.026	0.107	0.882**
6	0.096	0.133	0.077	0.195*	0.297**		0.563**	0.209*	0.351**	-0.051	0.016	0.418**
7	0.093	0.188	0.269**	0.276*	0.245*	0.401**		0.464**	-0.041	-0.062	0.086	0.391**
8	0.178	0.235*	0.247*	0.445**	0.791**	0.190	0.330**		-0.190	0.069	0.298*	0.764**
9	-0.070	0.070	0.206*	0.171	0.244*	0.317**	-0.050	-0.213*		0.450**	-0.199*	0.478**
10	-0.070	0.075	-0.076	-0.074	-0.032	-0.048	-0.043	0.055	0.439**		0.060	0.351**
11	-0.053	0.161	-0.254**	0.003	0.106	0.014	0.58	0.290**	-0.193	0.063		0.133
12	0.098	0.226*	0.365**	0.548**	0.873**	0.385**	0.268**	0.759**	0.461**	0.336**	0.129	

Table 4 Genotypic path for 11 characters among parents used in 10 parental diallel cross in Indian mustard

Characters	1	2	3	4	5	6	7	8	9	10	Genotypic correlation with seed yield
Days to flowering	**0.009**	0.275	-0.128	0.012	0.057	-0.243	-0.145	.662	-0.697	0.078	-0.120
Plant height (cm)	0.007	**0.375**	-0.213	0.005	0.030	-0.21	-0.264	0.583	0.005	-0.058	0.360*
Primary branches/ plant	0.006	0.105	**-0.255**	0.031	0.142	0.021	-0.094	0.712	-1.005	0.199	-0.236
Secondary branches/ plant	0.004	0.065	-0.062	**0.031**	0.246	0.002	-0.17	0.660	-1.152	0.076	-0.262
Siliquae/ main receme	0.001	0.032	-0.018	0.022	**0.351**	0.086	0.076	0.642	-1.178	-0.130	-0.288
Seeds / siliqua	0.000	-0.026	-0.003	0.118	-0.098	**0.300**	-0.308	0.438	0.068	0.005	0.601**
Siliqua length	0.012	0.165	-0.011	0.071	-0.072	0.256	**-0.371**	0.564	0.071	0.041	0.725**
Days to maturity	0.005	0.198	-0.129	0.018	0.204	0.038	-1.189	**1.105**	-0.112	0.089	0.228
1000- seed weight (g)	-0.004	-0.008	1.020	-0.020	-0.271	0.189	-0.114	-0.269	**0.230**	-0.065	0.688**
Oil content (%)	-0.002	0.085	0.082	-0.006	0.008	-0.004	0.939	-0.252	0.039	**-0.389**	0.499**

* Significant at p = 0.05

** Significant at p = 0.01