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Correlation and path analysis in Indian mustard (*Brassica juncea* (L.) Czern & Coss) grown under rainfed condition

D K Kardam & V V Singh[1]

Department of Plant Breeding and Genetics
SKN College of Agriculture
Jobner – 303 329, Rajasthan, India.

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Abstract

The nature and magnitude of associations and path coefficients for 10 characters in 200 F_3 and F_4 progenies of Indian mustard (*Brassica juncea*) obtained from six crosses were studied at Jobner (Rajasthan). Phenotypic correlation coefficients were higher in magnitude compared to genotypic correlation coefficients for most of the traits. Seed yield plant^{-1} was significantly and positively correlated with plant height, primary branches plant^{-1}, number of siliquae plant^{-1}, number of seeds siliqua^{-1} and 1000-seed weight. Highest direct contribution to seed yield was by number of siliquae plant^{-1}, followed by primary branches plant $^{-1}$, 1000-seed weight, number of siliquae on main shoot and number of seeds siliqua^{-1}. Hence, these traits could form a good selection criteria for improvement of seed yield in Indian mustard.

Key words: *Brassica juncea*, correlation and path coefficient analysis, Indian mustard.

Correlations estimated between seed yield and other characters are useful in developing suitable selection criteria for selecting desired plant types and in designing effective breeding programmes. Further, path analysis is useful in selection of characters that have direct and indirect effects on yield. Studies on character associations for different characters in Indian mustard have been made by Khulbe & Pant (1999), Patel *et al.* (2000) and Badsra & Choudhary (2001). The present investigation was conducted on 200 selected single plant progenies (F_3 and F_4 lines) of 6 crosses of Indian mustard (*Brassica juncea* (L.) Czern & Coss). These progenies were evaluated at the Research Farm of SKN College of Agriculture, Jobner (26° 5'N, 75° 20'E, 427 m MSL) (Rajasthan), during *rabi* 2002–03 in an augmented randomized block design. The material was distributed into 5 blocks, each block consisting of 40 progenies and 4 check varieties namely, Pusa Bold, RH-181, Varuna and RH-819, which were common to each block. In each block, progenies and check varieties were sown in two 3 m lines with 30 cm x 10 cm spacing. The crop was unirrigated except for one pre-sowing irrigation. The data on days to 50% flowering and days to maturity were recorded on the basis of whole plot, while 10 plants were randomly selected from each plot to record the data on plant height, primary branches plant^{-1}, number of siliquae on main shoot, number of siliquae plant^{-1}, number of seeds

[1]Corresponding author

siliqua^{-1}, seed yield plant^{-1}, 1000-seed weight and oil content. The genotypic and phenotypic correlations were computed as suggested by Singh & Choudhary (1995) and path coefficient as described by Dewey & Lu (1959).

The analysis of variance revealed that significant variability was present in the progenies for all the characters studied (Table 1). In general, the phenotypic correlation coefficients were slightly higher in direction and magnitude than genotypic correlation coefficients which may result from the modifying effect of environment on character association. The description which follows is therefore, based upon phenotypic correlation coefficient values. Seed yield plant^{-1} had positive and significant association with plant height, primary branches plant^{-1}, number of siliquae plant^{-1}, number of seeds siliqua^{-1} and 1000-seed weight. Significant and positive association of these characters with seed yield have also been reported by Singh & Mishra (2002) in yellow sarson.

Among the various interrelationships between remaining traits, plant height showed positive and significant correlation with primary branches plant^{-1}, number of siliquae on main shoot and number of siliquae plant^{-1}. It also exhibited negative association with number of seeds siliqua^{-1}. Number of siliquae plant^{-1} had positive and significant correlation with number of seeds siliqua^{-1} and 1000-seed weight. Number of seeds siliqua^{-1} also showed positive and significant association with 1000-seed weight. However, number of siliquae on main shoot had negative association with days to maturity, number of seeds siliqua^{-1}, 1000-seed weight and oil content. Oil content showed negative association with most of the characters. Adams (1967) reported that in field bean, negative correlation arised in response to competition between developmentally flexible components.

Association between some characters was non-significant which implies that the two variables are not linearly related (Gomez & Gomez 1980). In the present study, characters which exhibited positive association with seed yield plant^{-1} also exhibited positive association among themselves. Thus, these characters could be simultaneously improved to increase the seed yield.

Path coefficient analysis revealed that the characters, number of siliquae plant^{-1}, primary branches plant^{-1}, 1000-seed weight, number of siliquae on main shoot and number of seeds siliqua^{-1} had positive correlation with seed yield plant^{-1} and exerted positive and direct effect on seed yield (Table 2). This confirmed the role of these characters in determining the seed yield. Similar findings, although in non-segregating generations were reported for these characters in Indian mustard (Khulbe & Pant 1999; Patel *et al.* 2000). The residual effect was of low magnitude at genotypic as well as phenotypic level which indicated that the variables included were sufficient to explain the variation in seed yield plant^{-1}. The study thus indicated that the number of siliquae plant^{-1}, primary branches plant^{-1}, number of siliquae on main shoot and 1000-seed weight are the important characters which should be considered in selection programmes in Indian mustard.

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Table 1. Correlation coefficient on the basis of unadjusted values (phenotypic level) and adjusted values (genotypic level) between different characters of Indian mustard

Character		Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches plant^{-1}	No. of siliquae on main shoot	No. of siliquae plant^{-1}	No. of seeds siliqua^{-1}	Seed yield plant^{-1} (g)	1000-seed weight (g)	Oil content (%)
Days to 50% flowering	P	1.000	0.009	0.031	0.026	0.077	-0.133	-0.002	-0.101	-0.172*	-0.135
	G		-0.154	0.093	0.106	-0.015	-0.094	0.056	-0.107	-0.084	-0.048
Days to maturity	P		1.000	0.087	0.054	-0.066	-0.012	-0.019	0.006	0.165*	-0.069
	G			-0.077	-0.108	-0.076	-0.079	-0.056	-0.121	0.167	-0.034
Plant height (cm)	P			1.000	0.389*	0.200**	0.214**	-0.034	0.214**	0.008	0.026
	G				0.406	0.157	0.164	-0.052	0.178	-0.003	0.073
Primary branches plant^{-1}	P				1.000	0.101	0.204**	-0.067	0.272**	0.049	-0.015
	G					0.078	0.160	-0.025	0.252	0.058	0.076
No. of siliquae on main shoot	P					1.000	0.280**	-0.041	0.288**	-0.029	-0.068
	G						0.276	-0.088	0.310	0.028	-0.105
No. of siliquae plant^{-1}	P						1.000	0.250**	0.935**	0.236-**	0.082
	G							0.069	0.916	0.248	0.016
No. of seeds siliqua^{-1}	P							1.000	0.259**	0.150*	-0.047
	G								0.149	-0.033	-0.044
Seed yield plant^{-1} (g)	P								1.000	0.276**	0.065
	G									0.282	0.003
1000-seed weight (g)	P									1.000	-0.126
	G										-0.133
Oil content (%)	P										1.000
	G										

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

P=Phenotypic correlation coefficient; G=Genotypic correlation coefficient

Table 2. Direct (diagonal) and indirect effect of different characters on seed yield plant^{-1} in Indian mustard at phenotypic and genotypic levels

Character		Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches plant^{-1}	No. of siliquae on main shoot	No. of siliquae plant^{-1}	No. of seeds siliqua^{-1}	1000-seed weight (g)	Oil content (%)	Correlation with seed yield plant^{-1} (g)
Days to 50% flowering	P	0.02470	0.00006	-0.00065	0.00243	0.00278	-0.11831	-0.00008	-0.01063	-0.00131	-0.10101
	G	-0.03674	-0.00135	-0.00111	-0.01256	-0.00113	-0.08018	0.00605	-0.00508	-0.00002	-0.10700
Days to maturity	P	0.00022	0.00674	-0.00181	0.00505	-0.00238	-0.01067	-0.00067	0.01020	-0.00067	0.00601
	G	0.00566	0.00875	0.00092	-0.01230	-0.00571	-0.06739	-0.06052	0.01011	-0.00002	-0.12100
Plant height (cm)	P	0.00077	0.00059	-0.02084	0.03635	0.00722	0.19036	-0.00119	0.00050	0.00025	0.21401**
	G	-0.00342	-0.00067	-0.01195	0.04811	0.01180	0.13990	-0.00562	-0.00018	0.00003	0.17800*
Primary branches plant^{-1}	P	0.00064	0.00036	-0.00811	0.09346	0.00365	0.18146	-0.00235	0.00303	-0.00015	0.27199
	G	-0.00389	-0.00095	-0.00485	0.11985	0.00586	0.13648	-0.00270	0.00351	0.00003	0.25200**
No. of siliquae on main shoot	P	0.00190	-0.00044	-0.00417	0.00944	0.03609	0.24907	-0.00144	-0.00179	-0.00066	0.28800**
	G	0.00055	0.00067	-0.00188	0.00924	0.07518	0.23543	-0.00951	0.00169	-0.00005	0.30998**
No. of siliquae plant^{-1}	P	-0.00328	-0.00008	-0.00446	0.01907	0.01011	0.88952	0.00875	0.01459	0.00080	0.93502**
	G	0.00345	-0.00069	0.00196	0.01896	0.02075	0.85302	0.00746	0.01501	0.00001	0.91601**
No. of seeds siliqua^{-1}	P	-0.00005	-0.00013	0.00071	-0.00626	-0.00148	0.22238	0.03502	0.00927	-0.00046	0.25900**
	G	-0.00206	-0.00490	0.00062	-0.00296	-0.00662	0.05886	0.10808	-0.00200	-0.00002	0.14900*
1000-seed weight (g)	P	-0.00425	0.00111	-0.00017	0.00458	-0.00105	0.20993	0.00525	0.06181	-0.00122	0.27599**
	G	0.00309	0.00146	-0.00004	0.00687	0.00211	0.21155	-0.00357	0.06052	-0.00006	0.28201*
Oil content (%)	P	-0.00333	0.00047	-0.00054	-0.00140	-0.00245	0.07294	-0.00165	-0.00834	0.00969	0.06445
	G	0.00180	-0.00030	-0.00090	0.00900	-0.00790	0.01360	-0.00480	-0.00800	0.00040	0.00290

Genotypic residual effect=0.36222; Phenotypic residual effect=0.32808
* Significant at 5% lelvel, ** Significant at 1% level
P=Phenotypic level; G=Genotypic level

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