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Character Association and Path Analysis among Yield Components in Indian Mustard [*Brassica juncea* (L.) Czern and Coss]

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A B S T R A C T

Present study carried out with thirty eight germplasm accessions of Indian mustard and evaluated for seed yield and its yield components for twelve characters during *rabi* season of 2015-16 at Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, India. The results revealed that number of siliqua per plant and harvest index had highly significant positive association with seed yield per plant. Path coefficient analysis showed high positive and direct influence of harvest index, biological yield, number of siliqua per plant towards seed yield at genotypic level and at phenotypic level path coefficient analysis showed high positive and direct influence of harvest index and biological yield per plant towards seed yield in Indian mustard.

Introduction

Indian mustard (*Brassica juncea*) belongs to the family cruciferae. The Indian mustard is commonly known as *rai*. Cytologically, *Brassica juncea* is an amphidiploid (2n=36) derived from interspecific cross of *Brassica nigra* (2n=16) and *Brassica campestris* (2n=20). Mustard is the major *rabi* oilseed crop of India. In India area under mustard is 5762 thousand hectare, production of 6821 thousand tones and productivity is 1184 kg per hectare. (Source: Directorate of Economics and Statistics, Ministry of Agriculture, 2015-2016). Yield is a complex trait, polygenic in inheritance, more prone to environmental fluctuations than ancillary traits such as branches/plant, seeds/siliquae, main shoot length and 1000-seed weight. Thus, comprehensive selection based on seed yield via the component traits is more effective. Hence, knowledge of association of the yield component traits with each other would be of great help in formulating a selection criterion useful in crop improvement. Correlation provides the degree of association of the characters while path coefficient analysis which is a standard partial regression coefficient, measures the direct influence of one variable upon another and permits the separation of correlation coefficient into components of direct and indirect effects

(Dewey and Lu, 1959). Hence, the present investigation is carried out to assess the inter-relationships and contribution towards seed yield to generate high yielding recombinants for the development of high yielding cultivar(s) in Indian mustard adapted to this region for the benefit of farmers.

Materials and Methods

The field trail was carried out at APEDA centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, during *rabi* season 2015-16. The experimental material consisted of thirty eight diverse genotypes/ lines of mustard. The experiment was conducted in Randomized Complete Block Design in three replications. Each genotype was grown in a plot of 4.0 m^2 area. Each genotype was seeded in 2 rows of 5 m length spaced 40cm apart with plant to plant distance of 15 cm by proper thinning. All cultural practices essential for the good crop of mustard were applied for obtaining healthy and competitive crop stand. Five randomly selected competitive plants from each genotype in each replication were used for the purpose of recording the observations on twelve characters. The data recorded on 12 characters viz; days to 50% flowering, days to maturity, number of primary branches per plant (cm), number of secondary branches per plant (cm), number of siliquae per plant (cm), plant height (cm), number of seeds per siliquae, length of the siliqua (cm), biological yield per plant, harvest index (%) and seed yield per plant (g) and 1000 seed weight (g). The phenotypic and genotypic correlation coefficients were estimated from the analysis of variance and covariance as suggested by Searle (1961). The direct and indirect effects both at genotypic and phenotypic level were estimated by taking seed yield as dependent variable using path coefficient analysis suggested by Wright (1921) and Dewey and Lu (1959).

Results and Discussion

For proper exploitation of the available variability, the primary goal must be to identify and select superior genotypes with desirable character from a broad array of breeding material. In the present investigation the correlation coefficients were estimated among twelve characters at phenotypic and genotypic levels. To accomplish this, the knowledge of inter relationship of seed yield and yield components is a prerequisite. To analyze the extent of mutual relationship among different traits, study of correlation coefficient would be quite beneficial in formulating a suitable selection criterion. Correlation resulting from linkage or pleiotropy is the overall effect of the gene that affects both the characters (positive correlation) where as other increase one and decreases other (negative correlation).

Correlation coefficients showed highly significant positive correlation of seed yield with siliqua per plant and harvest index at phenotypic level, and at genotypic level the correlation values were also at par or above the phenotypic level (Table 1). Thus, it can be inferred that by improving these traits through selection either alone or in combination, will result in improvement of yield in mustard. In the present study, number of siliqua per plant and harvest index exhibited a highly significant positive correlation, which might be due to linkage of genes determining these characters. These results are in general agreement with the finding of Kumar and Shrivastava (2000) and Singh *et al.*, (2011). Days to 50% flowering showed highly significant positive correlation with days to maturity (0.523), number of primary branches per plant (0.526) and plant height (0.493). Days to maturity showed highly significant positive correlation with 1000seed weight (0.278). Number of siliquae per plant showed highly significant positive correlation with harvest index (0.738) and seed yield per plant (0.834). Plant height showed highly significant positive correlation with biological yield per plant (0.455). Number of seed per siliqua exhibited highly positive significant correlation with siliqua length (0.343). Harvest index exhibited highly significant positive correlation with seed yield per plant (0.767). Thus, it can be inferred that by improving these traits through selection either alone or in combination, will result in improvement of yield in mustard. Similar results were also reported by Roy *et al.*, (2015) and Vermai *et al.*, (2016).

Days to 50% flowering showed positive significant correlation with biological yield per plant. Days to maturity exhibited significant positive association with plant height and biological yield per. Number of primary branches per plant exhibited positive significant correlation with plant height. Number of secondary branches per plant recorded positive and significant correlation with number of seeds per siliqua. Selection for these characters could definitely be yielded towards productivity as they exhibited correlated response with seed yield. Similar results were also reported by Roy *et al.*, (2015) and Vermai *et al.*, (2016).

Highly significant negative correlation of seed yield with length of siliqua was observed; days to 50% flowering with number of secondary branches per plant; days to maturity with number of secondary branches per plant and harvest index was observed; plant height with harvest index; length of the siliqua with harvest index and seed yield per plant; biological yield per plant with harvest index was observed. Based on the estimates of genotypic and phenotypic correlations, the breeder would be able to decide the method of breeding to be followed so that the useful correlation could be exploited and the undesirable one could be modified by generating fresh variability to obtain new recombinants. The undesirable correlations or linkage could be broken by triple test cross and biparental matings.

Table.1 Estimates of correlation coefficient for genotypic (G) and phenotypic (P) correlation coefficient among 12 characters in Indian mustard

Character		Days to 50 % Flowering	Days to Maturity	No. of primary branches per plant	No. of secondary branches per plant	No. of siliquae per plant	Plant height (cm)	No. of seeds per siliqua	Siliqua length (cm)	Biological yield per plant (g)	Harvest index (%)	Seed yield per plant (g)	1000- seed weight (g)
Days to 50 % flowering	G	**1.000**	0.652	0.573	-0.521	-0.162	0.553	-0.109	0.052	0.241	-0.206	-0.059	0.137
	P	**1.000**	0.523***	0.526***	-0.483***	-0.157	0.493***	-0.097	0.030	0.231*	-0.185*	-0.043	0.124
Days to maturity	G		**1.000**	0.018	-0.303	-0.162	0.245	-0.237	-0.122	0.277	-0.264	-0.084	0.303
	P		**1.000**	0.000	-0.241**	-0.133	0.216*	0.192*	-0.123	0.233*	-0.248**	-0.113	0.278**
No. of primary branches per plant	G			**1.000**	-0.179	-0.126	0.366	0.132	-0.023	0.074	-0.062	-0.039	0.082
	P			**1.000**	-0.154	-0.113	0.336***	0.131	-0.017	0.074	-0.065	-0.042	0.060
No. of secondary branches per plant	G				**1.000**	-0.069	-0.211	0.252	0.068	0.148	-0.054	0.071	-0.223
	P				**1.000**	-0.053	-0.213*	0.226*	0.067	0.128	-0.035	0.075	-0.208*
No. of siliquae per plant	G					**1.000**	-0.112	-0.158	-0.436	-0.151	0.781	0.926	-0.134
	P					**1.000**	-0.101	-0.150	-0.405***	-0.149	0.738***	0.834***	-0.124
Plant height (cm)	G						**1.000**	-0.102	-0.024	0.491	-0.382	-0.080	-0.023
	P						**1.000**	-0.087	-0.029	0.455***	-0.330***	-0.058	-0.013
No. of seeds per siliqua	G							**1.000**	0.363	-0.037	-0.070	-0.218	-0.089
	P							**1.000**	0.343***	-0.034	-0.061	-0.186*	-0.086
Siliqua length (cm)	G								**1.000**	0.104	-0.301	-0.317	-0.138
	P								**1.000**	0.089	-0.263**	-0.269**	-0.133
Biological yield per plant (g)	G									**1.000**	-0.680	-0.045	0.054
	P									**1.000**	-0.650***	-0.037	0.058
Harvest index (%)	G										**1.000**	0.745	-0.150
	P										**1.000**	0.767***	-0.116
Seed yield per plant(g)	G											**1.000**	-0.160
	P											**1.000**	-0.106
1000- seed weight	G												**1.000**
	P												**1.000**

*, ** significant at 5% and 1% level, respectively

Table.2 Path coefficient analysis showing the direct and indirect effect of eleven characters on the seed yield at genotypic level in Indian mustard

Character	Days to 50 % flowering	Days to maturity	No. of primary branches per plant	No. of secondary branches per plant	No. of siliquae per plant	Plant height (cm)	No. of seeds per siliqua	Siliqua length (cm)	Biological yield per plant (g)	Harvest index (%)	1000-seed weight (g)	Correlation with seed yield per plant (g)
Days to 50 % flowering	**0.0789**	0.0515	0.0452	-0.0411	-0.0128	0.0437	-0.0086	0.0041	0.0191	-0.0163	0.0108	-0.0591
Days to maturity	0.0216	**0.0331**	0.0006	-0.0100	-0.0054	0.0081	-0.0078	-0.0041	0.0092	-0.0087	0.0100	-0.0842
No. of primary branches per plant	0.0196	0.0006	**0.0341**	-0.0061	-0.0043	0.0125	0.0045	-0.0008	0.0025	-0.0021	0.0028	-0.0391
No. of secondary branches per plant	-0.0782	-0.0455	-0.0269	**0.1502**	-0.0104	-0.0318	0.0380	0.0103	0.0222	-0.0082	-0.0336	0.0718
No. of siliquae per plant	-0.0662	-0.0665	-0.0516	-0.0282	**0.4085**	-0.0461	-0.0647	-0.1783	-0.0620	0.3194	-0.0547	0.9269
Plant height (cm)	-0.0102	-0.0045	-0.0067	0.0039	0.0021	**-0.0184**	0.0019	0.0005	-0.0090	0.0070	0.0004	-0.0806
No. of seeds per siliqua	0.0153	0.0332	-0.0185	-0.0354	0.0222	0.0144	**-0.1399**	-0.0509	0.0052	0.0098	0.0125	-0.2189
Siliqua length (cm)	0.0051	-0.0120	-0.0023	0.0067	-0.0427	-0.0024	0.0356	**0.0979**	0.0102	-0.0296	-0.0135	-0.3174
Biological yield per plant (g)	0.1264	0.1451	0.0389	0.0774	-0.0794	0.2567	-0.0194	0.0546	**0.5228**	-0.3559	0.0287	-0.0451
Harvest index (%)	-0.1714	-0.2194	-0.0521	-0.0452	0.6492	-0.3172	-0.0583	-0.2507	-0.5653	**0.8304**	-0.1253	0.7456
1000- seed weight (g)	0.0001	0.0003	0.0001	-0.0002	-0.0001	0.0000	-0.0001	-0.0001	0.0001	-0.0001	**0.0010**	-0.1609

Residual values (G) = 0.1516
Bold values indicate direct effect
*, ** Significant at 5% and 1% level,

Table.3 Path coefficient analysis showing the direct and indirect effect of eleven characters on the seed yield at phenotypic level in Indian mustard

Character	Days to 50 % flowering	Days to Maturity	No. of primary branches per plant	No. Of secondary branches per plant	No. of siliquae per plant	Plant height (cm)	No. of seeds per siliqua	Siliqua length (cm)	Biological yield per plant (g)	Harvest index (%)	1000-seed weight (g)	Correlation with seed yield per plant (g)
Days to 50 % flowering	**0.0445**	0.0233	0.0234	-0.0215	-0.0070	0.0220	-0.0043	0.0013	0.0103	-0.0083	0.0055	-0.0437
Days to maturity	0.0010	**0.0018**	0.0000	-0.0004	-0.0002	0.0004	-0.0004	-0.0002	0.0004	-0.0005	0.0005	-0.1132
No. of primary branches per plant	-0.0069	0.0000	**-0.0131**	0.0020	0.0015	-0.0044	-0.0017	0.0002	-0.0010	0.0009	-0.0008	-0.0420
No. of secondary branches per plant	-0.0324	-0.0162	-0.0104	**0.0671**	-0.0036	-0.0143	0.0152	0.0045	0.0086	-0.0024	-0.0140	0.0755
No. of siliquae per plant	-0.0065	-0.0055	-0.0047	-0.0022	**0.0412**	-0.0042	-0.0062	-0.0167	-0.0062	0.0305	-0.0051	0.8342
Plant height (cm)	0.0023	0.0010	0.0016	-0.0010	-0.0005	**0.0047**	-0.0004	-0.0001	0.0021	-0.0015	-0.0001	-0.0580
No. of seeds per siliqua	0.0097	0.0191	-0.0130	-0.0224	0.0150	0.0087	**-0.0991**	-0.0340	0.0034	0.0061	0.0085	-0.1860
Siliqua length (cm)	0.0011	-0.0045	-0.0006	0.0024	-0.0148	-0.0011	0.0125	**0.0364**	0.0033	-0.0096	-0.0049	-0.2691
Biological yield per plant (g)	0.1730	0.1746	0.0559	0.0959	-0.1118	0.3398	-0.0254	0.0667	**0.7468**	-0.4856	0.0433	-0.0373
Harvest index (%)	-0.2299	-0.3081	-0.0814	-0.0435	0.9149	-0.4095	-0.0757	-0.3266	-0.8053	**1.2384**	-0.1447	0.7674
1000- seed weight (g)	0.0006	0.0013	0.0003	-0.0010	-0.0006	-0.0001	-0.0004	-0.0006	0.0003	-0.0005	**0.0047**	-0.1069

Residual values (P) = 0.1784
Bold values indicate direct effects
*, ** Significant at 5% and 1% level,

The path coefficient analysis was done by the method as advocated by Dewey and Lu (1959). Partitioning of the correlation coefficient of the various characters under study was done with the help of the path coefficient analysis to express the direct and indirect effect of all these characters on seed yield. The path coefficient analysis was done for both the genotypic and phenotypic path. In the present investigation, seed yield per plant was considered as dependent variable and rest of eleven traits were taken as independent or contributing variables (Table 3).

Partitioning of the correlation coefficients in to direct and indirect effects were done at the genotypic level and the results are presented in (Table 2). A critical perusal of result in the table revealed that harvest index had maximum direct effect on seed yield per plant followed by biological yield per plant (0.5228), number of siliquae per plant (0.4085), number of secondary branches per plant (0.1502) and length of siliqua (0.0979), days to 50% flowering (0.0789), number of primary branches per plant (0.0341) and days to maturity (0.0331).

At phenotypic level harvest index (1.2384) displayed maximum order of direct positive effect on seed yield per plant followed by biological yield per plant (0.7468), number of secondary branches per plant (0.0671), days to 50% flowering (0.0445), number of siliquae per plant (0.0412), length of siliqua per plant (0.0364), plant height (0.0047), 1000seed weight (0.0047) and days to maturity(0.0018). Similar results were also reported by Bind *et al.*, (2014) and Roy *et al.*, (2015). Days to 50% flowering showed indirect positive effect via biological yield per plant. Days to maturity with positive direct effect showed indirect positive effect via biological yield per plant. Harvest index with positive direct effect showed indirect positive effect via number of siliqua per plant. Similar results were also reported by Patel *et al.*, (2000) and Tahira *et al.*, (2011).

The contribution of residual effects that influenced seed yield was very low at both genotypic and phenotypic levels indicating that the characters included in the present investigation were sufficient enough to account for the variability in the dependant character i.e. seed yield per plant. A perusal of the above results revealed that harvest index, biological yield per plant, number of secondary branches per plant, number of siliquae per plant and length of siliqua per plant had direct high or moderate positive effect on seed yield. Therefore in order to exercise a suitable selection programme it would be worth to concentrate on these characters for improvement in yield of mustard. Indirect contribution of the traits is mainly due to indirect effects of the character through other component traits. Indirect selection through such traits having high or moderate positive effect on seed yield would also be rewarding in yield improvement.

References

Anonymous 2011. Agricultural statistics at a glance 2015. Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of agriculture, Government of India.

Bind, D., Singh, D. and Dwivedi, V. K. 2014. Genetic variability and character association in Indian mustard [*Brassica juncia* (L.) czerns and cross]. *Agric. Sci. Digest.*, 34(3):183 – 188.

Dewey, D. R. and Lu, K. H. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Argon. J.*, 51: 515-518.

Kumar, N. and Shrivastava, S. 2000. Plant ideotype of Indian mustard (*Brassica* *juncea*) for late sown condition. *Indian J. Genet. Plant Breed.*, 63(4): 355.

Kumar, N. and Shrivastava, S. 2000. Plant ideotype of Indian mustard (*Brassica juncea*) for late sown condition. *Indian J. Genet. & Plant Breed.*, 63(4): 355.

Patel, K. M., Patel, P. G. and Pathak, H. C. 2000. Path analysis in Indian mustard [*Brassica juncea* (L.) Czern and Coss]. *Madras Agri. J.*, 87(4): 330-331.

Roy, S. K., Kale, V. A. and Nagnathwar, V. A. 2015. Assessment of genetic variability of rapeseed-mustard germplasm under Terai region of West Bengal. *Electronic Journal of Plant Breeding*, 6(4): 1132-1136.

Roy, S. K., Kale, V. A. and Nagnathwar, V. A. 2015. Assessment of genetic variability of rapeseed-mustard germplasm under Terai region of West Bengal. *Electronic Journal of Plant Breeding*, 6(4): 1132-1136.

Searle, S. R. 1961. Phenotypic, genotypic and environmental correlations. *Biometrics,* 47: 474-480.

Singh, M., Tomar, A., Mishra, C. N. and Srivastava, S. B. L. 2011. Genetic parameters and character association studies in Indian mustard. *Journal of Oilseed Brassica*, 2(1): 35-38.

Tahira, M., Tahir, M. S., Saleem, U., Hussain, M. and Saqib, M. 2011. The estimation of heritability, association and selection criteria for yield component in mustard (*Brassica juncea*). *Pak. J. Agri. Sci.*, 48(4): 251-254.

Vermai, U., Thakral, N. K. and Neeru. 2016. Genetic diversity analysis in Indian mustard [*Brassica juncea* (L.) Czern and Coss]. *International Journal of Applied Mathematics & Statistical Sciences (IJAMSS)*, 6(2): 2319-3980.

Wright, S. 1921. Correlation and causation. *J. Agric. Res.*, 20: 557-558.

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