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Research Article

Path and correlation analysis for yield and its contributing traits in mustard (*Brassica juncea* L.)

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Abstract Correlation coefficient and path analysis, genetic variability, heritability and genetic advance were studied in 40 genotypes for thirteen important traits *viz.* days to first flowering, days to 50% flowering, number of primary branches/plant, number of secondary branches/plant, plant height (cm), number of siliquae/plant, siliqua length (cm), days to maturity, number of seeds/siliqua, biological yield/plant, seed yield/plant, harvest index (%) and test weight (g) in Indian mustard (*Brassica juncea* L.). The analysis of variance worked out for seed yield and its components in Indian mustard indicated that the mean sum of squares due to genotypes were highly significant for all the characters. Results of phenotypic correlation coefficient revealed that the seed yield/plant (g) had significant positive correlation with biological yield/plant. In present investigation the high heritability was recorded for the characters seed yield/plant (77.9%), harvest index and biological yield. High heritability estimates in broad sense along with high genetic advance as percent of mean was observed for seed yield/plant, harvest index, biological yield. The high PCV and GCV were observed for number of siliqua/plant whereas, moderate PCV and GCV was recorded seed yield/plant, harvest index, biological yield and days to first flowering.

Keywords: *Brassica juncea*, Genetic Variability, correlation, path coefficient and heritability

Introduction

Brassica juncea is an amphidiploid (2n=20) derived from interspecific cross of *Brassica nigra* (2n=16) and *Brassica campestris* (2n=20) (Rout *et al.,* 2018). Mustard is the third most important source of edible oil of the world after soyabean and palm. In India it ranks second in acreage superseded by groundnut only. Mustard crop is grown both in tropical and subtropical countries (Shekhawat *et al.,* 2012). Its growth is most vigorous in the temperature between 10°C and 30°C.In India mustard is normally cultivated as a winter season crop. Vegetable oil and fats are valuable food ingredients in human diet and contains saturated and unsaturated fatty acids and are stored in the form of oil bodies in the cell and called "oleosomes". Edible oils are the chief source of fats and proteins, fatty acids. In human body fats and oils acts as a transport medium for vitamins A, D, E and K (Reed 1976). Mustard oil contains a high amount of selenium and magnesium, which gives it anti- inflammatory properties.

It also helps in stimulating sweat glands and helps in lowering body temperature. In traditional medicines, it is used to relieve the pain associated with arthritis, muscle sprains and strains. Seed paste applied on wounds whereas paste of leaf said to heal cattle wounds (Sood *et al.,* 2010).

Materials and Methods

Forty genotypes of Indian Mustard; namely, IC 589686, IC 405235, IC 589690, IC 447111, IC 571630, IC 355856, IC 571627, IC 571661, IC 571630, IC 589686, IC 571662, IC 311734, IC 571697, IC 589680, IC 589670, IC 597919, IC 335858, IC 538719, IC 571678, IC 571648, IC 317548, IC 401560, IC 311734, IC 393232, IC 597879, IC

589690, IC 424414, IC 976789, IC 335852, IC 571655, IC 589681, IC 571649, IC 339953, IC 571668, IC 589662, IC 589669, IC 598692, IC 599679, IC 342777, IC 338586 were sown in randomized block design with two replications at Research Farm, Department of Agriculture, Mata Gujri College, Fatehgarh Sahib during *Rabi* season of 2018-19. Observations were recorded on five competitive plants randomly selected from each plot while flowering was recorded on row basis. Analysis of variance was calculated using MS Excel software using MSTAT-C software. The phenotypic and genotypic variance was evaluated by Johnson *et al.* (1955). The genotypic (GCV) and phenotypic (PCV) coefficient of variation was computed by Burton. Heritability and genetic advance were determined as described by many researchers. The simple correlation coefficient was obtained by the method and path coefficient analysis was carried out by Dewey and Lu (1957).

Result and Discussion

Heritability and Genetic Advance

Analysis of variance revealed significant differences for all the thirteen traits studied. Estimation of different genetic variability parameters are presented in table 1. Among the yield and yield contributed traits high PCV and GCV shown (table 2.) by seed yield per plant (47.78 and 46.99) followed by harvest index (41.60 and 40.46), number of siliqua per plant (39.36 and 38.45). These results were well sported by similar findings by Mondal & Khajuria (2000), Kumar *et al.,* (2006), Singh *et al.,* (2011) and Shekhawat *et al.,* (2012). The result indicating that PCV as higher than respective GCVs for all the traits denoting environmental factors influencing their expression to some degree or other. The high heritability exhibited for days to first flowering (98.03%) followed by days to 50% flowering (97.53%), yield per plant (96.72%) and biological yield per plant (96.11%). The high heritability shows that most of the variation is caused by genotype and very small due to environment, therefore simple selection procedure would be helpful in environment of these traits. Low heritability recorded in number of seeds per siliqua (79.55%) which shows that this trait is moderately affected by environmental agencies than genotypic differences The high heritability was reported by Chaudhry and Sharma, 1982. Estimation of genetic advance was maximum for number of siliqua per plant (150.44) followed by biological yield per plant (111.73). Genetic advance as percent of mean was maximum result recorded for seed yield per plant (95.19) followed by harvest index (81.08) and number of siliqua per plant (77.39). Similar finding were also observed by Upadhyay and Kumar (2009), Tele *et al*. (2014), Akabari and Niranjana (2015) and Maurya *et al*. (2018).

Correlation and Coefficient Analysis

Correlation coefficient analysis was first used by Karl Pearson in 1902. It is a statistical method of measurement, which analyses the degree and indirection of association between two or more variables. In general, positive correlation is important for plant breeder because it helps in simultaneous improvement of both characters were, negative correlation with hinder the simultaneous expression of both characters with high value (Table 3 & 4).

Phenotypic correlation

Phenotypic correlation presented in (table 3) Days to first flowering shows highest significant positive correlation with days to 50% flowering (0.978) followed by number of primary branches (0.371), days to maturity (0.265), number of secondary branches (0.220) and plant height (0.180). Number of primary branches shows significant positive correlation with number of secondary branches (0.639) followed by biological yield per plant (0.188). Plant height shows positive correlation with number of seeds/silique (0.107) and silique length (0.051) and number of seeds per siliqua (0.375). Number of siliqua per plant shows significant positive correlation with biological yield per plant (0.827) followed by seed yield/plant (0.470), test weight (0.290) and silique length (0.255).

Days to first flowering shows significant negative correlation with biological yield per plant (-0.199), test weight (-0.224), siliqua length (-0.309), number of silique/plant (-0.311). Number of primary branches shows significant negative correlation with test weight (-0.252) followed by harvest index (-0.306). Plant height shows significant negative correlation with number of silique/plant (-0.192) followed by biological yield per plant (-0.206), test weight (-0.207) and seed yield/plant (-0.210). Number of siliqua per plant shows significant negative correlation with harvest index (-0.212) and days to maturity (-0.257). Our results agree with the previous correlation recorded by Gupta *et al*. (2018).

Genotypic Correlation

Genotypic correlation presented in (table 4) Days to first flowering shows highest significant positive correlation with days to 50% flowering (0.983) followed by number of primary branches/plant (0.415), siliqua length (0.351), number of silique/plant (-0.311), days to maturity (0.284), number of secondary branches (0.247) and plant height (0.196). Number of primary branches shows significant positive correlation with number of secondary branches (0.704) followed by biological yield per plant (0.224). Plant height shows positive correlation with number of seeds/silique (0.153) and silique length (0.107) number of seeds per siliqua (0.375). Number of siliqua per plant shows significant positive correlation with biological yield per plant (0.846) followed by seed yield/plant (0.473), test weight (0.306) and silique length (0.248). Number of seeds per siliqua shows significant positive correlation with test weight (0.185). Biological yield per plant shows significant positive correlation with seed yield/plant (0.589) and test weight (0.238).

Days to first flowering shows significant negative correlation with biological yield/ plant (-0.204) and test weight (-0.242). Number of primary branches shows significant negative correlation with number of seeds/silique (-0.193) followed by test weight (-0.308) harvest index (-0.343). Plant height shows significant negative correlation with number of silique/plant (-0.204) followed by biological yield per plant (-0.216), seed yield/plant (-0.233) and test weight (-0.234). Number of siliqua per plant shows significant negative correlation with harvest index (-0.228) and days to maturity (-0.272). Number of seeds per siliqua shows negative correlation with seed yield/plant (-0.056) and harvest index (-0.123). Biological yield per plant shows significant negative correlation with harvest index (-0.279). Harvest index show negative correlation with test weight (-0.126). Similar findings have been given by the following authors Singh *et al,.* (2011), Yadav *et al.,* (2011) and Shweta and Om Prakash (2014).

Path Analysis

Path coefficient analysis measures the indirect and indirect involvement of different independent characters on a dependent character in table (5 & 6) presented.

Direct effect at phenotypic level

Analysis of direct effect at phenotypic level revealed that highest positive direct effect on seed yield per plant recorded (Table 5) by biological yield per plant (0.875) followed by days to 50% flowering (0.237), number of primary branches (0.091), plant height (0.057), number of primary branches (0.037) while, harvest index (-0.007), test weight (-0.080), siliqua length (-0.093), number of siliqua per plant (-0.117), days to maturity (-0.117, number of seeds/siliqua (-0.125) and days to first flowering (-0.328), shows highly negative direct effect on seed yield per plant. Similar results have been found by Mekonnen *et al*., (2014) and Kumar *et al*., (2016).

Indirect effect at phenotypic level

Days to first flowering the highest positive indirect effect for seed yield per plant recorded (Table 5) by days to 50% flowering (0.232), number of seeds per siliqua (0.166), number of siliqua per plant (0.036), number of primary branches (0.034), siliqua length (0.029), plant height (0.010) and number of secondary branches (0.008) whereas, negative indirect effect recorded by harvest index (-0.013), days to maturity (-0.031), test weight (-0.163) and biological yield per plant(-0.174).

Number of primary branches the highest positive indirect effect for seed yield per plant recorded by number of seeds per siliqua(0.190), biological yield per plant(0.164), days to 50% flowering (0.080), number of secondary branches (0.024) and number of siliquae per plant (0.003) whereas, negative indirect effect recorded by plant height (-0.004), siliqua length (-0.005), harvest index (-0.015), days to maturity (-0.017), test weight (-0.204).

Plant height the highest positive indirect effect for seed yield per plant recorded by days to 50% flowering (0.050), number of siliquae per plant (0.022), days to maturity (0.008) and number of secondary branches (0.000) whereas, negative indirect effect recorded by siliqua length (-0.005), number of primary branches (-0.006), harvest index (-0.012), number of seeds/siliqua (-0.134) and biological yield/plant (-0.184).

Number of siliquae/plant the highest positive indirect effect for seed yield per plant recorded by biological yield/plant (0.723), test weight (0.470), days to first flowering (0.102), days to maturity (0.030), harvest index (0.017) and number of secondary branches (0.012) whereas, negative indirect effect recorded by number of primary branches (-0.002), plant height (-0.011), siliqua length (-0.021), days to 50% flowering (-0.076) and number of seeds/siliqua (-0.122).

Biological yield/plant the highest positive indirect effect for seed yield per plant recorded by test weight (0.575), days to first flowering (0.065), days to maturity (0.030), number of primary branches (0.017), number of secondary branches (0.012) and harvest index (0.013) whereas, negative indirect effect recorded by plant height (-0.012), siliqua length (-0.023), number of seeds/siliqua (-0.049), days to 50% flowering (-0.054) and number of siliquae/plant (-0.097).

Harvest index the highest positive indirect effect for seed yield per plant recorded by test weight (0.554), number of seeds/siliqua (0.125), number of siliquae/plant (0.025) and days to 50% flowering (0.002) whereas, negative indirect effect recorded by plant height (-0.006), number of secondary branches (-0.011), days to first flowering (-0.012), siliqua length (-0.016), days to maturity (-0.022), number of primary branches (-0.028) and biological yield/plant (-0.250).

Test weight the highest positive indirect effect for seed yield per plant recorded by days to first flowering (0.073) and biological yield/plant (0.196) whereas, negative indirect effect recorded by days to maturity (-0.002), siliqua length (-0.004), number of secondary branches (-0.006), plant height (-0.012), number of primary branches (-0.023), number of siliquae/plant (-0.034), days to 50% flowering (-0.062) and number of seeds/siliquae/plant (-0.231). These results are in conformity with the findings of Sirohi *et al*., (2004), Kumar and Pandey (2014) and Roy *et al*., (2018).

Path Analysis at Genotypic Level

Phenotypic path coefficient of yield and yield contributing characters discussed here under which were the table presented 6.

Direct effect genotypic level

Analysis of direct effect at genotypic level revealed that highest positive direct effect on seed yield per plant recorded by biological yield per plant (0.847) followed by days to 50% flowering (0.579), number of primary branches (0.334), plant height (0.157) and test weight (0.092) and number of seeds/siliqua (0.058) while, harvest index (-0.020), number of secondary branches (-0.049), number of siliquae/plant (-0.050), days to maturity (-0.170), siliqua length (-0.213), days to first flowering (-0.762) shows highly negative direct effect on seed yield per plant.

Indirect effect at genotypic level

Days to first flowering the highest positive indirect effect for seed yield per plant recorded by days to 50% flowering (0.569), number of primary branches (0.138), siliqua length (0.075), plant height (0.031) and number of siliqua per plant (0.016), whereas, negative indirect effect recorded by number of seeds per siliqua (-0.008), number of secondary branches(-0.012), days to maturity (-0.048), harvest index (-0.039), test weight (-0.168) and biological yield per plant(-0.173).

Number of primary branches the highest positive indirect effect for seed yield per plant recorded by days to 50% flowering (0.216), biological yield per plant(0.190) and and number of siliquaper plant (0.001)whereas, negative indirect effect recorded by number of seeds per siliqua(-0.011), siliqua length (-0.012), plant height (-0.019), days to maturity (-0.028), number of secondary branches (-0.035), harvest index (-0.049) and test weight (-0.064).

Plant height the highest positive indirect effect for seed yield per plant recorded by days to 50% flowering (0.132), days to maturity (0.015), number of siliqua per plant (0.010), number of seeds/siliqua (0.009) and number of secondary branches (0.001) whereas, negative indirect effect recorded by siliqua length (-0.023), number of primary branches (-0.040), harvest index (-0.037), biological yield/plant (-0.183) and test weight (-0.233).

Number of siliquae/plant the highest positive indirect effect for seed yield per plant recorded by biological yield/plant (0.716), test weight (0.473), days to first flowering (0.247), harvest index (0.049), days to maturity (0.046) and number of seeds/siliqua (0.006) whereas, negative indirect effect recorded by number of primary branches (-0.007), number of secondary branches (-0.017), plant height (-0.032), siliqua length(-0.053) and days to 50% flowering (-0.196).

Number of seeds/siliqua the highest positive indirect effect for seed yield per plant recorded by days to first flowering (0.109), biological yield/plant (0.043), harvest index (0.029), plant height (0.024) and siliqua length (0.002) whereas, negative indirect effect recorded by number of secondary branches (-0.001), days to maturity (-0.008), number of siliquae/plant (-0.005), days to maturity (-0.015), days to 50% flowering (-0.054), test weight (-0.056), number of primary branches (-0.064).

Biological yield/plant the highest positive indirect effect for seed yield per plant recorded by test weight (0.589), days to first flowering (0.156), number of primary branches (0.075), days to maturity (0.045), harvest index (0.038) and number of seeds/siliqua (0.003) whereas, negative indirect effect recorded by number of secondary branches (-0.017), plant height (-0.034), number of siliquae/plant (-0.042), siliqua length (-0.061) and days to 50% flowering (-0.136).

Test weight the highest positive indirect effect for seed yield per plant recorded by biological yield/plant (0.202), days to first flowering (0.184),harvest index (0.159), number of seeds/siliqua (0.011) and number of secondary branches (0.009), whereas, negative indirect effect recorded by days to maturity (-0.005), siliqua length (-0.010), number of siliquae/plant (-0.015), plant height (-0.037), number of primary branches (-0.103) and days to 50% flowering (-0.166). Similar result also reported by Shanlni *et al.,* (2000), Mahla *et al*., (2003), Singh and Singh (2010), and Kumar *et al.,* (2016).

Table 1. Analysis of variance for yield and yield traits in 40 genotypes of mustard

Source of variation	DF	Days to first flowering	Days to 50% flowering	No. of primary branches	No. of secondary branches	Plant height (cm)	No. of silique/ plant	Silique length (cm)
Replication	2	40.62	67.88	2.13	0.87	202.41	945.72	0.65
Treatment	39	579.98	544.72	3.75	93.81	814.04	17032.26	1.08
Error	78	3.86	4.56	0.28	3.04	37.74	267.28	0.09

Conti……

Source of variation	DF	No. of seeds per siliqua	Days to maturity	Biological yield/plant (g)	Seed yield /plant(g)	Harvest index (%)	Test weight(g)
Replication	2	1.71	93.32	201.96	17.48	2.01	0.11
Treatment	39	16.59	511.31	9305.33	644.33	237.81	9.27
Error	78	1.03	10.28	123.82	7.20	4.44	0.30

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

Table 2. Estimates of genetic parameters for various traits of 40 Mustard genotypes

Characters	Mean	GCV (%)	PCV (%)	Heritability (%)	Genetic Advance	Genetic Advance as % mean
Days to first flowering	51.09	27.13	27.40	98.03	28.26	55.33
Days to 50% flowering	65.33	20.54	20.80	97.53	27.30	41.79
No. of primary branches	5.89	18.26	20.35	80.50	1.99	33.74
No. of secondary branches	22.79	24.14	25.32	90.88	10.80	47.40
Plant height (cm)	183.18	8.78	9.40	87.27	30.96	16.90
No. of silique per plant	194.40	38.45	39.36	95.44	150.44	77.39
Silique length (cm)	4.35	13.24	14.84	79.55	1.06	24.32
No. of seeds per siliqua	14.46	15.75	17.24	83.40	4.28	29.63
Days to maturity	139.22	9.28	9.56	94.20	25.84	18.56
Biological yield/plant (g)	148.84	37.17	37.91	96.11	111.73	75.06
Seed yield/plant(g)	31.02	46.99	47.78	96.72	29.52	95.19
Harvest index (%)	21.80	40.46	41.60	94.60	17.67	81.08
Test weight (g)	4.85	35.67	37.39	90.99	3.40	70.08

Table 3. Phenotypic correlation for yield and yield traits among 40 genotypes of Mustard (*Brassica juncea* L.)

Characters	Days to first flowering	Days to 50% flowering	No. of primary branches	No. of secondary branches	plant height (cm)	No. of silique/ plant	silique length (cm)	No. of seeds/ siliqua	Days to maturity	Biological yield/ plant (g)	seed yield/ plant (g)	Harvest index (%)	Test weight (g)
Days to first flowering	1.000	0.978**	0.371**	0.220*	0.180*	-0.311**	-0.309**	-0.133	0.265**	-0.199*	-0.163	0.036	-0.224*
Days to 50% flowering		1.000	0.339**	0.213*	0.209*	-0.322**	-0.320**	-0.090	0.279**	-0.227*	-0.204*	0.007	-0.260**
No. of primary branches			1.000	0.639**	-0.070	-0.022	0.049	-0.152	0.148	0.188*	-0.067	-0.306**	-0.252**
No. of secondary branches				1.000	0.010	0.330**	-0.021	0.017	0.139	0.311**	0.014	-0.307**	-0.171
Plant height (cm)					1.000	-0.192*	0.051	0.107	-0.065	-0.206*	-0.210*	-0.096	-0.207*

No. of silique per plant						1.000	0.225*	0.098	-0.257**	0.827**	0.470**	-0.212*	0.290**
Silique length (cm)							1.000	-0.053	-0.116	0.247**	0.300**	0.176	0.040
No. of seeds/siliqua								1.000	0.068	0.039	-0.055	-0.100	0.184*
Days to maturity									1.000	-0.252**	-0.138	0.188*	0.013
Biological yield/plant (g)										1.000	0.575**	-0.286**	0.224*
Seed yield/plant (g)											1.000	0.554**	0.080
Harvest index (%)												1.000	-0.117
Test weight (g)													1.000

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

Table 4. Genotypic correlation for yield and yield traits among 40 genotypes of Mustard (*Brassica juncea* L.)

Characters	**Days to first flowering**	**Days to 50% flowering**	**No. of primary branches**	**No. of secondary branches**	**plant height (cm)**	**No. of silique/plant**	**silique length (cm)**	**No. of seeds /silique**	**Days to maturity**	**Biological yield/plant (g)**	**seed yield/plant (g)**	**Harvest index**	**Test weight (g)**
Days to first flowering	1.000	0.983**	0.415**	0.247**	0.196*	-0.324**	-0.351**	-0.143	0.284**	-0.204*	-0.168	0.037	-0.242**
Days to 50% flowering		1.000	0.374**	0.237**	0.228*	-0.338**	-0.378**	-0.094	0.298**	-0.235**	-0.211*	0.009	-0.286**
No. of primary branches			1.000	0.704**	-0.120	-0.021	0.056	-0.193*	0.163	0.224*	-0.064	-0.343**	-0.308**
No. of secondary branches				1.000	-0.017	0.354**	-0.034	0.017	0.139	0.340**	0.026	-0.327**	-0.185*
Plant height (cm)					1.000	-0.204*	0.107	0.153	-0.086	-0.216*	-0.233*	-0.114	-0.234*
No. of silique per plant						1.000	0.248**	0.107	-0.272**	0.846**	0.473**	-0.228*	0.306**
Silique length (cm)							1.000	-0.010	-0.150	0.287**	0.337**	0.199*	0.046
No. of seeds/siliqua								1.000	0.087	0.051	-0.056	-0.123	0.185*
Days to maturity									1.000	-0.267**	-0.142	0.211*	0.029
Biological yield/ plant (g)										1.000	0.589**	-0.279**	0.238**
Seed yield/plant(g)											1.000	0.548**	0.092
Harvest index (%)												1.000	-0.126
Test weight (g)													1.000

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

Table 5. Direct and Indirect effects (phenotypic) of 13 component characters for yield and yield traits among 40 genotypes of mustard

Characters	Days to first flowering	Days to 50% flowering	No. of primary branches	No. of secondary branches	plant height (cm)	No. of silique/plant	silique length (cm)	No. of seeds/siliqua	Days to maturity	Biological yield/plant (g)	Harvest index (%)	Test weight (g)
Days to first flowering	**-0.328**	0.232	0.034	0.008	0.010	0.036	0.029	0.166	-0.031	-0.174	-0.013	-0.163
Days to 50% flowering	-0.321	**0.237**	0.031	0.008	0.012	0.038	0.030	0.113	-0.033	-0.198	-0.015	-0.204*
No. of primary branches	-0.122	0.080	**0.091**	0.024	-0.004	0.003	-0.005	0.190	-0.017	0.164	-0.015	-0.067
No. of secondary branches	-0.072	0.051	0.058	**0.037**	0.001	-0.039	0.002	-0.021	-0.016	0.272	-0.010	0.014
Plant height (cm)	-0.059	0.050	-0.006	0.000	**0.057**	0.022	-0.005	-0.134	0.008	-0.180	-0.012	-0.210*
No. of silique per plant	0.102	-0.076	-0.002	0.012	-0.011	**-0.117**	-0.021	-0.122	0.030	0.723	0.017	0.470**
Silique length (cm)	0.101	-0.076	0.005	-0.001	0.003	-0.026	**-0.093**	0.067	0.014	0.216	0.002	0.300**
No. of seeds/siliqua	0.043	-0.021	-0.014	0.001	0.006	-0.011	0.005	**-0.125**	-0.008	0.034	0.011	-0.055
Days to maturity	-0.087	0.066	0.014	0.005	-0.004	0.030	0.011	-0.085	**-0.117**	-0.221	0.001	-0.138
Biological yield/plant (g)	0.065	-0.054	0.017	0.012	-0.012	-0.097	-0.023	-0.049	0.030	**0.875**	0.013	0.575**
Harvest index (%)	-0.012	0.002	-0.028	-0.011	-0.006	0.025	-0.016	0.125	-0.022	-0.250	**-0.007**	0.554**
Test weight (g)	0.073	-0.062	-0.023	-0.006	-0.012	-0.034	-0.004	-0.231	-0.002	0.196	0.058	**0.080**
seed yield/plant (g)	0.032	0.006	-0.268	-0.270	-0.084	-0.186	0.154	-0.088	0.165	-0.251	0.878	-0.103

Residual effect = 0.0852

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

Table 6. Direct and Indirect effects (genotypic) of 13 component characters for yield and yield traits among 40 genotypes of mustard

Characters	Days to first flowering	Days to 50% flowering	No. of primary branches	No. of secondary branches	plant height (cm)	No. of silique/ plant	silique length (cm)	No. of seeds/ siliqua	Days to maturity	Biological yield/plant (g)	Harvest index	Test weight (g)
Days to first flowering	**-0.762**	0.569	0.138	-0.012	0.031	0.016	0.075	-0.008	-0.048	-0.173	-0.039	-0.168
Days to 50% flowering	-0.749	**0.579**	0.125	-0.012	0.036	0.017	0.081	-0.005	-0.051	-0.199	-0.046	-0.211*

No. of primary branches	-0.316	0.216	**0.334**	-0.035	-0.019	0.001	-0.012	-0.011	-0.028	0.190	-0.049	-0.064
No. of secondary branches	-0.188	0.137	0.235	**-0.049**	-0.003	-0.018	0.007	0.001	-0.024	0.288	-0.029	0.026
Plant height (cm)	-0.149	0.132	-0.040	0.001	**0.157**	0.010	-0.023	0.009	0.015	-0.183	-0.037	-0.233*
No. of silique per plant	0.247	-0.196	-0.007	-0.017	-0.032	**-0.050**	-0.053	0.006	0.046	0.716	0.049	0.473**
Silique length (cm)	0.267	-0.219	0.019	0.002	0.017	-0.012	**-0.213**	-0.001	0.026	0.243	0.007	0.337**
No. of seeds per siliqua	0.109	-0.054	-0.064	-0.001	0.024	-0.005	0.002	**0.058**	-0.015	0.043	0.029	-0.056
Days to maturity	-0.216	0.172	0.054	-0.007	-0.013	0.013	0.032	0.005	**-0.170**	-0.226	0.005	-0.142
Biological yield/plant (g)	0.156	-0.136	0.075	-0.017	-0.034	-0.042	-0.061	0.003	0.045	**0.847**	0.038	0.589**
Harvest index (%)	-0.029	0.005	-0.114	0.016	-0.018	0.011	-0.042	-0.007	-0.036	-0.236	**-0.020**	0.548**
Test weight (g)	0.184	-0.166	-0.103	0.009	-0.037	-0.015	-0.010	0.011	-0.005	0.202	0.159	**0.092**
seed yield/plant (g)	0.038	0.009	-0.347	-0.330	-0.116	-0.230	0.201	-0.124	0.213	-0.282	-0.128	1.011

Residual effect = 0.0753

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

Conclusion

The studies among the yield and yield contributed traits revealed that high PCV and GCV shown by seed yield per plant. Estimation of genetic advance was maximum for number of siliqua per plant and high heritability was exhibited for days to first flowering. Days to first flowering shows highest significant positive correlation with days to 50% flowering at phenotypic level as well as at genotypic level. Path coefficient studies revealed that analysis of direct effect at both phenotypic and genotypic level revealed that highest positive direct effect on seed yield per plant recorded by biological yield per plant.

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