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Interrelationship and multivariate analysis of floral and fruit attributes in brinjal

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ABSTRACT

An experiment was conducted during autumn winter seasons 2014-2016 for evaluation of 21 brinjal genotypes for 21 characters. It was found that genotypic correlations were higher than the phenotypic correlation indicating a strong inherent association among the variables at genotypic level. Considering these traits as selection criteria, direct selection may be done to avoid indirect effects of the other characters for developing high yielding varieties. Both at the genotypic and phenotypic level, yield per plant had highly significant positive correlation with fruit weight, productive: non-productive flower ratio, number of primary branches per plant, fruit length, fruit peduncle length, number of fruits per plant, fruit diameter and plant circumference. The maximum positive direct effect was observed by fruit weight followed by plant circumference, number of fruits per plant. These traits influenced other components also towards yield per plant indirectly and may be considered for any future improvement programme for yield in brinjal. The first six PCs accounted for 79.7% cumulative variance. The PC1 added highly 25.5% to the total variability with significant loading of shoot tip circumference, ovary diameter, ovary weight and fruit diameter. BCB 4, BCB 8, BCB 9, BCB 10 and BCB 18 were found as genetically distant genotypes from others.

Key words: *Solanum melongena*, correlation, path analysis, principal components.

INTRODUCTION

Brinjal, (*Solanum melongena* L.) is the most popular and widely cultivated warm season vegetable crop in India. Being of Indian Origin, brinjal has a vast diversity in this country. India is one of the largest brinjal producing countries in the world covering an area of 0.71 million hectares with a production of 13.56 million tonnes. Among the Indian states, West Bengal covers maximum area (0.16 million ha) with a production of 2.98 million tonnes (Anonymous, 3). The crop is mainly raised through local cultivars and landraces. However, yield of these local cultivars or varieties is lower compared to that of hybrids. Since yield is a complex character, the selection therefore is based upon its component characters. Bansal and Mehta(4) reported that yield/ plant had strong positive association with plant height, plant spread, branches/ plant, leaves/ plant and fruits/ plant at the genotypic level. Path analysis revealed that fruits per plant had maximum direct positive effect on yield. Followed by fruit weight, days to 50% flowering, leaves per plant and per cent fruit set. Hence, there is a need for studying the association of various component characters with yield to formulate effective selection criteria. Association among various yield components facilitates the simultaneous selection for two associated traits. Path coefficient analysis reveals that there is direct and indirect effects of various components characters on yield. It also says whether the association of a trait with yield is due to its own direct effect or indirectly through another character. Reshmika (14) reported that emphasis must be given to the characters having high direct and positive effect on yield like number of fruits/plant and fruit weight. Thus, the correlation and path analysis studies are helpful in formulating effective selection criteria. With this view, the present study was undertaken to assess correlation and path coefficients in brinjal for formulating breeding programme.

MATERIALS & METHODS

The field experiment was carried out at AB Seed Farm of Bidhan Chandra Krishi Viswavidyalaya, Kalyani Simanta, Nadia, West Bengal during autumn winter seasons 2014-2015 and 2015-2016. Twenty one brinjal genotypes collected from different parts of west Bengal were planted in a randomized block design with three replications at a spacing of 75 × 75 cm accommodating 12 plants for each genotype in each replication maintaining plot size of 3.0 × 2.5 m. Standard crop husbandry practices were followed to raise the crop. Observations were recorded on 21 characters, namely plant height, plant circumference, number of primary branches, shoot tip

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circumference, days to floral bud initiation, days to 50% flowering, days to fruit initiation, fruit peduncle length, days from pollination to fertilization, days from pollination to fruit set, days from pollination to fruit maturity, style length, ovary diameter, ovary weight, productive(Long+medium styled): non-productive (Pseudo short+ short styled) flower ratio, fruit weight, fruit length, fruit diameter, number of seeds per fruit, number of fruits per plant and yield per plant from randomly selected 5 plants in each genotype in each replication. Mean data had been pooled over the years. Both genotypic and phenotypic coefficients of correlation between two characters were determined by using the variance and covariance components as suggested by Al-Jibouri *et al.* (2). Path coefficient analysis was carried out using genotypic correlation values of yield components on yield as suggested by Wright (15) and illustrated by Dewey and Lu (8). The Principal Components (PCs) were calculated from the correlation matrix by using the mean values as input (Hotelling 9). The Principal Component Analysis (PCA) was done using MINITAB v.16 software.

RESULTS AND DISCUSSION

For most of the characters genotypic correlations were higher than the phenotypic (Table-1), which revealed that there was a strong inherent association among the variables at genotypic level. At both phenotypic and genotypic level, yield per plant had highly significant positive correlation with fruit weight, productive: non-productive flower ratio, number of primary branches per plant, fruit length, fruit peduncle length, fruit diameter and plant circumference. It exhibited significant positive association with number of fruits per plant at genotypic level only. Moreover, it was negatively associated with style length, days to fruit initiation and days to floral bud initiation at genotypic level, whereas at phenotypic level it had negative association with style length only. Similar trend has been reported by Bansal and Mehta (4); Patel *et al.*(13); Nayak and Nagre(12) and Chaudhary *et al.* (6).

Plant and shoot tip circumference had positive significant correlation with ovary weight, ovary diameter and productive:non-productive flower ratio. Fruit peduncle length had significant positive correlation with fruit length. Days from pollination to maturity was significantly and positively correlated with ovary diameter, ovary weight and fruit weight. Ovary diameter was positively and significantly correlated with ovary weight and these two had also significant positive correlation with fruit weight and fruit diameter, but negative significant correlation with fruit length and number of fruits per plant. Fruit length had significant positive correlation with number of fruits per plant, but negative with number of seeds per fruit. Fruits per plant had significant positive correlation with fruit yield per plant.

Residual value 0.02 means that the characters under study are explaining 98% of the variation and remaining 2 % may be due to other factors which are not included in present study.

The path analysis was carried out at genotypic level (Table 2) to assess the direct and indirect effect of different characters on fruit yield. The maximum positive direct effect was observed by fruit weight followed by plant circumference, number of fruits per plant, days to floral bud initiation, shoot tip circumference, number of primary branches per plant, number of seeds per fruit, days to 50% flowering and productive: non-productive flower ratio. The same trend was reported earlier by Nayak and Nagre (12). High negative direct effect was noted in fruit diameter followed by ovary diameter, plant height, style length, days to fruit initiation, fruit length, days from pollination to fruitset, days from pollination to fertilization, fruit peduncle length, days from pollination to maturity and ovary weight. These findings are in line with those of Patel *et al.* (13), Bansal and Mehta (4) and Chaudhary *et al.* (6).

Days to floral bud initiation had positive direct effect on fruit yield/ plant. Its negative correlation with yield, however, was due to the indirect effect through days to fruiting and fruit weight. Likewise, the positive correlation of fruit length with yield/ plant was because of the indirect effect through ovary diameter and fruit diameter. Despite having negative direct effect, fruit weight was having positive association with yield/ plant. It was explained by its indirect effect via fruit weight. Similarly, fruits/ plant and plant circumference indirectly contributed to the positive correlation of peduncle length with yield/ plant.

Overall perusal of the path analysis suggested that fruit weight, plant circumference and number of fruits/ plant are the major traits that contribute to the fruit yield/ plant directly through their high direct and indirectly effects. Hence, emphatic selection based on these characters may be rewarding in brinjal.

The Eigen values, per cent contribution of variance and cumulative variance of six PCs were presented in Table 3. It was observed from the perusal of Table 3 that the first six PCs accounted for 79.7% cumulative variance were considered and the remaining were discarded because of having low Eigen values (<1) as per Kaiser (10). Thus, the reduced dimensionality descriptor space was six and the characters associated with these should be used in differentiating the brinjal accessions. Caguiat and Hautea (5) also identified nine PCs based on morphological data cumulatively contributing 83.52% variation.

The PC1 added highly 25.5% to the total variability with significant loading of shoot tip circumference

Table 1. Genotypic (below diagonal) and Phenotypic (above diagonal) correlations among yield and its attributes of brinjal.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1		0.672**	-0.161	0.423**	-0.253*	0.091	-0.137	0.196	-0.005	-0.008	0.059	0.011	0.274*	0.229	0.021	0.122	-0.22	0.175	-0.004	-0.133	0.06
2	0.714**		-0.087	0.356**	-0.208	0.025	-0.116	0.235	0.055	0.128	-0.074	0.096	0.365**	0.307*	0.301*	0.056	-0.033	0.185	-0.047	0.051	0.261*
3	-0.156	-0.09		-0.223	-0.248*	-0.19	-0.306*	0.095	-0.117	-0.266*	-0.336**	-0.091	-0.325**	-0.24	-0.23	-0.003	0.390**	-0.154	-0.318**	0.246*	0.376**
4	0.493**	0.408**	-0.282*		-0.062	0.207	0.035	0.08	0.219	0.031	0.235	0.004	0.554**	0.462**	0.338**	0.475**	-0.432**	0.699**	-0.087	-0.385**	0.118
5	-0.291*	-0.225	-0.287*	-0.068		0.614**	0.854**	0.108	-0.043	-0.332**	-0.182	0.166	0.142	0.051	-0.051	-0.2	-0.393**	0.07	0.09	-0.097	-0.242
6	0.087	0.047	-0.218	0.281*	0.669**		0.549**	0.101	0.059	-0.225	-0.006	0.178	0.185	0.008	-0.15	-0.068	-0.465**	0.197	0.139	-0.226	-0.121
7	-0.178	-0.142	-0.397**	-0.007	0.945**	0.646**		0.065	-0.103	-0.296*	-0.079	0.257*	0.185	0.052	-0.01	-0.149	-0.346**	0.103	0.023	-0.084	-0.228
8	0.237	0.269*	0.072	0.101	0.131	0.128	0.135		0.215	-0.128	-0.409**	0.111	-0.1	-0.103	0.185	0.135	0.293*	0.072	-0.213	0.305*	0.298*
9	-0.006	0.069	-0.133	0.257*	-0.054	0.074	-0.133	0.245*		0.582**	0.088	-0.011	0.031	0.118	0.453**	-0.056	0.091	0.058	-0.141	0.248*	0.034
10	-0.005	0.128	-0.278*	0.028	-0.371**	-0.243	-0.377**	-0.143	0.596**		0.608**	-0.197	0.119	0.121	0.445**	0.104	0.163	-0.044	0.15	0.267*	0.15
11	0.057	-0.084	-0.362**	0.242	-0.218	0.008	-0.125	-0.454**	0.092	0.626**		-0.203	0.365**	0.323**	0.076	0.327**	-0.300*	0.144	0.157	-0.270*	-0.063
12	0.03	0.193	-0.054	-0.126	0.477**	0.312*	0.336**	0.154	-0.04	-0.341**	-0.328**		-0.132	-0.399**	-0.113	-0.257*	0.047	-0.161	0.032	0.005	-0.269*
13	0.318**	0.450**	-0.420**	0.842**	0.02	0.24	0.094	-0.078	0.038	0.164	0.411**	-0.019		0.796**	0.371**	0.434**	-0.536**	0.597**	0.313*	-0.314*	0.176
14	0.279*	0.369**	-0.308*	0.767**	-0.002	0.102	0.097	-0.034	0.163	0.152	0.370**	-0.271*	0.929**		0.401**	0.434**	-0.479**	0.572**	0.142	-0.319**	0.156
15	0.015	0.354**	-0.264*	0.346**	0.029	-0.225	0.054	0.258*	0.523**	0.499**	0.084	-0.385**	0.610**	0.633**		0.281*	0.014	0.452**	0.114	0.201	0.360**
16	0.134	0.066	0.001	0.592**	-0.265*	-0.067	-0.222	0.119	-0.057	0.111	0.350**	-0.465**	0.521**	0.529**	0.390**		-0.028	0.770**	0.001	-0.406**	0.543**
17	-0.24	-0.034	0.409**	-0.506**	-0.429**	-0.561**	-0.413**	0.334**	0.095	0.181	-0.313*	0.025	-0.693**	-0.561**	-0.007	-0.031		-0.355**	-0.406**	0.590**	0.369**
18	0.175	0.193	-0.177	0.809**	0.093	0.227	0.155	0.079	0.072	-0.044	0.145	-0.216	0.753**	0.698**	0.466**	0.834**	-0.386**		0.077	-0.533**	0.289*
19	-0.001	-0.049	-0.334**	-0.104	0.104	0.155	0.032	-0.238	-0.145	0.15	0.162	0.056	0.391**	0.174	0.125	0	-0.430**	0.079		-0.162	-0.181
20	-0.142	0.062	0.261*	-0.503**	-0.1	-0.269*	-0.118	0.390**	0.269*	0.287*	-0.303*	-0.007	-0.482**	-0.451**	0.176	-0.428**	0.656**	-0.594**	-0.173		0.376**
21	0.069	0.318**	0.432**	0.142	-0.321**	-0.144	-0.347**	0.384**	0.032	0.178	-0.049	-0.486**	0.168	0.179	0.456**	0.580**	0.417**	0.330**	-0.206	0.331	

Table 2: Path Coefficient (Genotypic) values of various characters showing direct (Bold) and indirect effects on fruit yield per plant.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	x
1	**-0.503**	0.612	-0.035	0.203	-0.120	0.011	0.047	-0.015	0.001	0.001	-0.002	-0.008	-0.163	-0.002	0.002	0.169	0.055	-0.101	-0.001	-0.080	0.069
2	-0.359	**0.858**	-0.020	0.167	-0.093	0.006	0.038	-0.018	-0.006	-0.012	0.003	-0.052	-0.231	-0.003	0.033	0.082	0.008	-0.112	-0.007	0.035	0.318
3	0.078	-0.077	**0.225**	-0.116	-0.118	-0.028	0.105	-0.005	0.012	0.026	0.014	0.015	0.215	0.002	-0.025	0.001	-0.094	0.102	-0.047	0.147	0.432
4	-0.248	0.350	-0.063	**0.411**	-0.028	0.036	0.002	-0.007	-0.023	-0.003	-0.009	0.034	-0.432	-0.005	0.033	0.744	0.116	-0.467	-0.015	-0.283	0.142
5	0.146	-0.193	-0.064	-0.028	**0.413**	0.085	-0.250	-0.009	0.005	0.035	0.008	-0.129	-0.010	0.001	0.003	-0.334	0.098	-0.054	0.014	-0.056	-0.321
6	-0.044	0.041	-0.049	0.116	0.276	**0.127**	-0.171	-0.008	-0.007	0.023	0.001	-0.085	-0.123	-0.001	-0.021	-0.084	0.129	-0.131	0.020	-0.151	-0.144
7	0.089	-0.122	-0.089	-0.003	0.390	0.082	**-0.265**	-0.009	0.012	0.035	0.005	-0.091	-0.048	-0.001	0.005	-0.279	0.095	-0.090	0.005	-0.067	-0.347
8	-0.119	0.231	0.016	0.041	0.054	0.016	-0.036	**-0.065**	-0.022	0.013	0.017	-0.042	0.040	0.001	0.024	0.149	-0.076	-0.046	-0.034	0.219	0.384
9	0.003	0.059	-0.030	0.106	-0.023	0.009	0.035	-0.016	**-0.088**	-0.056	-0.003	0.011	-0.020	-0.001	0.049	-0.072	-0.022	-0.042	-0.021	0.151	0.032
10	0.003	0.110	-0.063	0.011	-0.153	-0.031	0.100	0.009	-0.053	**-0.093**	-0.024	0.092	-0.084	-0.001	0.047	0.140	-0.041	0.025	0.021	0.162	0.178
11	-0.029	-0.072	-0.081	0.100	-0.090	0.001	0.033	0.030	-0.008	-0.058	**-0.038**	0.089	-0.211	-0.003	0.008	0.440	0.072	-0.084	0.023	-0.171	-0.049
12	-0.015	0.165	-0.012	-0.052	0.197	0.039	-0.089	-0.010	0.004	0.032	0.012	**-0.272**	0.010	0.002	-0.036	-0.584	-0.006	0.125	0.008	-0.004	-0.486
13	-0.160	0.386	-0.094	0.346	0.008	0.030	-0.025	0.005	-0.003	-0.015	-0.016	0.005	**-0.513**	-0.006	0.058	0.655	0.159	-0.435	0.055	-0.272	0.168
14	-0.140	0.316	-0.069	0.315	-0.001	0.013	-0.026	0.002	-0.014	-0.014	-0.014	0.074	-0.477	**-0.007**	0.060	0.665	0.128	-0.403	0.025	-0.254	0.179
15	-0.008	0.303	-0.059	0.142	0.012	-0.028	-0.014	-0.017	-0.046	-0.047	-0.003	0.105	-0.313	-0.004	**0.095**	0.490	0.002	-0.269	0.018	0.099	0.456
16	-0.068	0.056	0.000	0.243	-0.110	-0.008	0.059	-0.008	0.005	-0.010	-0.013	0.126	-0.267	-0.004	0.037	**1.257**	0.007	-0.482	0.000	-0.241	0.580
17	0.121	-0.029	0.092	-0.208	-0.177	-0.071	0.109	-0.022	-0.008	-0.017	0.012	-0.007	0.356	0.004	-0.001	-0.039	**-0.229**	0.223	-0.061	0.369	0.417
18	-0.088	0.166	-0.040	0.332	0.039	0.029	-0.041	-0.005	-0.006	0.004	-0.005	0.059	-0.386	-0.005	0.044	1.048	0.088	**-0.578**	0.011	-0.334	0.330
19	0.001	-0.042	-0.075	-0.043	0.043	0.020	-0.009	0.016	0.013	-0.014	-0.006	-0.015	-0.201	-0.001	0.012	-0.001	0.098	-0.046	**0.142**	-0.097	-0.206
20	0.072	0.053	0.059	-0.207	-0.041	-0.034	0.031	-0.025	-0.024	-0.027	0.011	0.002	0.248	0.003	0.017	-0.537	-0.150	0.343	-0.025	**0.563**	0.331

1=plant height; 2= plant circumference; 3= number of primary branches; 4=, shoot tip circumference ; 5= days to floral bud initiation; 6= days to 50% flowering; 7= days to fruit initiation; 8= fruit peduncle length; 9= days from pollination to fertilization; 10= days from pollination to fruit set; 11= days from pollination to fruit maturity ; 12= style length ; 13=ovary diameter ; 14= ovary weight ; 15= productive(Long+medium styled) : non-productive(Pseudo short+ short styled) flower ratio; 16= fruit weight; 17= fruit length; 18=fruit diameter; 19= number of seeds per fruit ; 20= number of fruits per plant ; 21= yield per plant ; X = correlations with yield per plant; Residual value = 0.02062; * and ** indicates significant of values at P=0.05 and 0.01, respectively.

Table 3. Eigen values, percentage of variation and cumulative variation and the attributes associated with six PCs.

PCs	Eigen value	Proportion of variation	Cumulative variation (%)	Attributes associated
1	5.348	25.5	25.5	shoot tip circumference (0.358), ovary diameter (0.398), ovary weight (0.373), fruit diameter (0.359)
2	3.866	18.4	43.9	days to floral bud initiation (-0.399), days to 50% flowering (-0.327), days to fruit initiation (-0.383), fruit length (0.313), yield per plant (0.348)
3	2.484	11.8	55.7	fruit peduncle length (0.501), days from pollination to fruit maturity (-0.421)
4	2.138	10.2	65.9	number of primary branches (-0.328), days from pollination to fertilization (0.473) days from pollination to fruit set (0.433), productive to non-productive flower ratio (0.347), number of fruits per plant (0.335)
5	1.767	8.4	74.3	plant height (-0.562), style length (-0.273), fruit weight (0.278)
6	1.131	5.4	79.7	number of seeds per fruit (-0.616)

(0.358), ovary diameter (0.398), ovary weight (0.373) and fruit diameter (0.359). Hence, it could be said that these traits contributed maximum to the total variance. The PC 2 contributed 18.4% to the total variance having positive correlation with fruit length (0.313) and yield per plant (0.348) while the negative association with days to floral bud initiation (-0.399), days to 50% flowering (-0.327) and days to fruit initiation (-0.383). PC 3 donated 11.8% variance to the total variance. The characters fruit peduncle length (0.501) and days from pollination to fruit maturity (-0.421) were loaded significantly with PC 3. PC 4 loaded and correlated positively with days from pollination to fertilization (0.473), days from pollination to fruit set (0.433), productive to non-productive flower ratio (0.347), number of fruits per plant (0.335) whereas negatively with number of primary branches (-0.328) and these traits contributed 10.2% of total variation. PC 5 with 8.4% of total variation was significantly loaded with plant height (-0.562), style length (-0.273) and fruit weight (0.278). PC 6 made least contribution of 5.4% to the total variance among six PCs. Number of seeds/ fruit (-0.616) was significantly loaded and negatively correlated with PC 6. PCA was used to estimate genetic diversity in eggplant previously by Ahmed *et al*. (1), Devi *et al*. (7) and Karim *et al*. (11).

The outliers plot (Fig. 1) showcases the Mahalanobis distances *i.e.*, the distance from

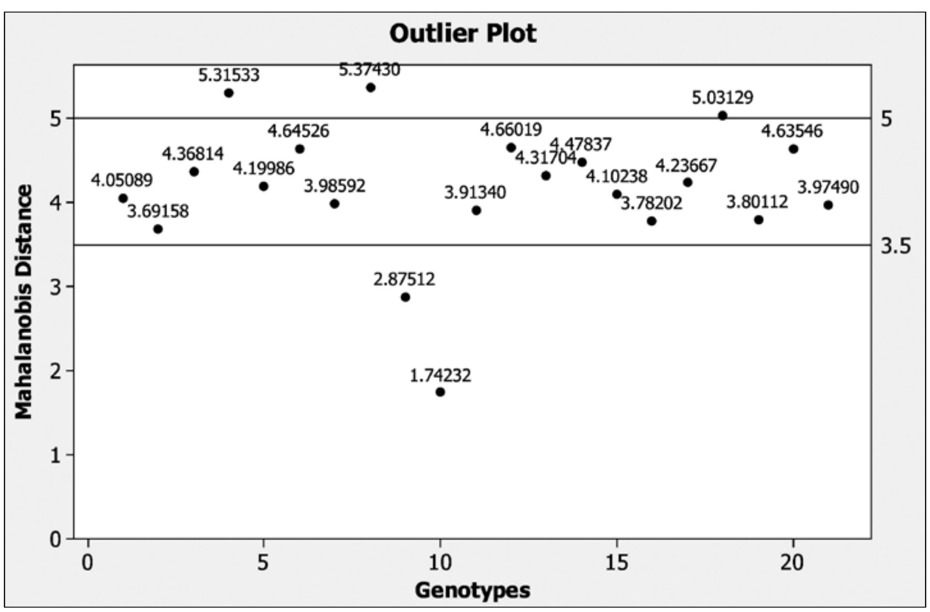

Fig. 1. Outlier plot based on Mahalanobis distances (Y-axis) of genotypes (X-axis)

(On X-axis 1= BCB-1; 2=BCB-2; 3= BCB-3; 4=BCB-4; 5=BCB-5; 6=BCB-6; 7=BCB-7; 8=BCB-8; 9=BCB-9; 10=BCB-10; 11=BCB-11; 12=BCB-12; 13=BCB-13; 14=BCB-14; 15=BCB-15; 16=BCB-16; 17=BCB-17; 18=BCB-18; 19=BCB-21; 20=BCB-22; 21=BCB=27).

the centroid to the each genotype. In the present experiment, majority of the genotypes were having a genetic distance between the critical distances (5.00 and 3.50). However, BCB 4, BCB 8 and BCB 18 were having the Mahalanobis distance above 5.00 indicating their diverse nature. Similarly, BCB 9 and BCB 10 had distance lesser than 3.50 falling distantly from others on the graph. These five genotypes genetically differed from the others based on various floral and fruit attributes.

CONCLUSION

The yield/ plant had highly significant positive correlation with fruit weight, productive: non-productive flower ratio, number of primary branches per plant, fruit length, fruit peduncle length, number of fruits per plant, fruit diameter and plant circumference at both genotypic and phenotypic level. The maximum positive direct effect was observed by fruit weight followed by plant circumference, number of fruits per plant. These traits also influenced other components also towards yield per plant indirectly. Principal component analysis revealed that shoot tip circumference, ovary diameter, ovary weight and fruit diameter had maximum variation among all the traits under study. Therefore, these parameters should be considered while implementing any breeding programme for yield in brinjal. Outliers plot suggested the genetic diverse nature of the BCB 4, BCB 8, BCB 9, BCB 10 and BCB 18, which can be exploited in future breeding programmes.

REFERENCES

1. Ahmed, A., Singh, S.R., Lal, S., Mir, K.A., Amin, A., Habib, K. and Salmani, M. 2014. Assessment of genetic diversity in brinjal genotypes using multivariate analysis. *Indian J. Hort*. **71**: 494–98.
2. AL-Jibouri, H.A., Miller, P.A. and Robinson, H.F. 1958. Genotypic and environmental variances and co-variances in an upland cotton cross of interspecific origin. *Agron. J*. **50**: 633- 36.
3. Anonymous, 2015. Horticultural Statistics at a glance, National Horticulture Board, Ministry of Agriculture, Government of India, Gurugram, Haryana, India.
4. Bansal, S. and Mehta, A.K. 2008. Genotypic correlation and path analysis in brinjal(*Solanum melongena* L.). *Natl. J. Pl. Improv*. **10**: 34-36.
5. Caguiat, X.G.I. and Hautea, D.M. 2014. Genetic Diversity Analysis of Eggplant (*Solanum melongena* L.) and Related Wild Species in The Philippines Using Morphological and SSR Markers. *SABRAO J. Breed*. *Genet*. **46**: 183-201.
6. Chaudhary, P., Kumar, S. and Verma, P.P.S. 2013.Correlation and path coefficient analysis in brinjal(*Solanum melongena* L.). *HortFlora Res. Spect.* **2**: 346-51.
7. Devi, C.P., Munshi, A.D., Behera, T.K., Choudhary, H. and Saha, P. 2016. Characterisation of cultivated breeding lines of eggplant (*Solanum melongena* L.) and related wild *Solanum* species from India. *J. Hort. Sci. Biotech*. **91**: 87-92.
8. Dewey, D.R. and Lu, K.H. 1959. A correlation and path coefficient analysis of component of crested wheatgrass seed production. *Agron. J*. **52**: 515-18.
9. Hotelling, H. 1933. Analysis of a complex of statistical variables into principal components. *J. Edu. Psych*. **24**: 417-41.
10. Kaiser, H.F. 1960. The application of electronic computers to factor analysis. *Edu. Psych. Measure*. **20**: 141-51.
11. Karim, M.R., Rahman, M.M. and Quamruzzaman, A.K.M. 2016. Genetic Divergence in Eggplant (*Solanum melongena* L.) Genotypes. *Bangladesh J. Agri. Res*. **41**: 433-39.
12. Nayek, B.R. and Nagre, P.K. 2013. Genetic variability and correlation studies in brinjal (*Solanum melongena* L.). *Int. J. Appl. Biol. Pharm*. **4**: 211-14.
13. Patel, K., Patel, N.B., Patel, A.I., Rathod, H. and Patel, D. 2015. Study of variability, correlation and path analysis in brinjal(*Solanum melongena* L.). *Bioscan*, **10**: 2037-42.
14. Reshmika, P.K. 2015. Genetic variability, divergence and correlation Studies in brinjal. *Int. J. Agri. Sci*. **5**: 103-10.
15. Wright, S. 1921. Correlation and causation. *J. Agri. Res.* **20**: 557-85.

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