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RESEARCH ARTICLE

Delineating the genetic variability, correlation, path and principal component analysis in brinjal genotypes

KA Shanmugasundaram[1*], I Muthuvel[1] & R Kousalya[2]

[1]Department of Fruit Science, Tamil Nadu Agricultural University, Coimbatore 641 003, India

[2]Department of Vegetable Science, Tamil Nadu Agricultural University, Coimbatore 641 003, India

*Email: kassundaram@gmail.com

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Abstract

An experiment was conducted to evaluate 25 different brinjal genotypes for growth and yield-contributing traits. Variability analysis, association studies and Principal Component Analysis (PCA) were performed to explore the relationships among traits and identify significant factors influencing performance. In the present study, high genotypic and phenotypic coefficient of variation values were observed for fruit breadth, fruit weight gram per fruit, number of fruits per plant and fruit weight gram per plant. In contrast, traits such as days to fifty per cent flowering, plant height, number of branches per plant, branch length, fruit length and fruit borer infestation exhibited medium GCV and PCV values. High heritability coupled with high GAM was noticed for all the traits. Correlation analysis on the number of fruits per plant recorded a positive and significant association with fruit weight per gram. The higher magnitude of a positive direct effect on fruit yield was exerted by the number of fruits per plant followed by fruit weight gram per fruit, plant height and fruit breadth. Principal component analysis showed three principal components with unity eigenvalues, accounting for 78.647 % of total variance. Principal Component 1 (PC1) contributed a high proportion of total variance (42.282) with an eigenvalue of 4.228. PC2 and PC3 showed total variance percentages of 24.045 and 12.32 with the eigenvalues 2.404 and 1.232, respectively.

Keywords

brinjal; correlation; GCV; heritability; PCA; PCV

Introduction

Brinjal (*Solanum melongena* L.) belongs to Solanaceae family. Eggplant is a non-woody annual plant that produces purple to white flowers and enlarged lobed leaves with bushy foliage. Eggplant is mainly grown for vegetables and medicinal purposes. Eggplant produces various secondary metabolites like glycol-alkaloids, antioxidant compounds and vitamins, which have a role in keeping good health (1). A primary phenolic compound, chlorogenic acid (5- O- caffeoyl- quinic acid; CGA), is found in fruit skin and works as an anti-obesity, anti-inflammatory, anti-diabetic agent and also has cardioprotective functions (2-3). It is one of the significant vegetables commonly grown in Tamil Nadu and India, next to tomato and is called Poor Mans' vegetable. India is regarded as the centre of origin and diversity of brinjal (4-6). Immature fruits are used as vegetables and extensively used in various culinary preparations. Fruits are a rich source of minerals like Ca, Mg, P and fatty acids.

India is the leading producer of brinjal in the world and it grows in an area of 0.68 million ha, with an estimated annual production of 12.81 million tonnes and a productivity of 18.82 tonnes per ha. In Tamil Nadu, the production was 277160 tonnes from 21340 ha (Ministry of Agriculture and Farmers Welfare, 2024). Being Indians' centre of origin, brinjal has a substantial genetic divergence in our country, offering much scope for improvement through selection. Besides, due to the high local peoples' preferences for colour, shape and taste, many specific brinjal genotypes are grown in particular localities. It is not possible to have one common cultivar to suit different localities. It is, therefore, required to improve the yield potential of local brinjal types grown in various regions through simultaneous selection without losing the original special characters of the local kind. Variability studies in plant breeding are key to harnessing genetic diversity, optimizing selection processes and achieving sustainable crop productivity and quality improvements. Hence, understanding genetic variability and the relationship between yield and related traits is essential for selecting and developing superior varieties.

Materials and Methods

Twenty-four accessions were collected from in and around Tiruvannamalai, Villupuram, Vellore, Krishnagri and Kanchipuram Districts in the northeastern parts of Tamil Nadu, India. The local brinjal types like the Purple type with the white background (eight numbers), Bhavani type (eight numbers), One Yenthal type brinjal (dark purple with green background near calyx clasping with strong long pedicel attachment), Four Sillukodi type (uniform dark purple oblong/round) and three Hosur type (light purple & oblong) with white background was collected to improve yield, fruit and shoot borer tolerance in local types (Table 1.). The study was conducted in the college orchard of Agricultural College and Research Institute, Vazhavachanur, Tiruvannamalai District, with three replications in a randomized block design. The standard package of practices was adopted uniformly. The following observations were made: Days to 50 % flowering from transplanting, Plant height (cm), Number of primary branches (No.), Length of primary branch (cm), Bearing nature: Single or cluster, fruit length (cm), fruit breadth (cm), fruits number per plant (No.), fruit weight (g), Yield: weight per plant (g/plant) and fruit and shoot borer incidence (in percentage). The number of fruits infested by borer and total number of fruits harvested per plant were recorded from five randomly selected plants and the percentage of fruit borer infestation was worked out. Based on mean fruit damage percentage, genotypes were categorized into different categories. Grades 1: immune (0% infestation); 2: highly resistant (1-10 % infestation); 3: moderately resistant (11-20 %), 4: tolerant 21-30 %, 5: susceptible (31-40 %), 6: highly susceptible (above 40 %) were assigned for the shoot and fruit damage based on the rating (7). Variability parameters, heritability and genetic advances as a percentage of the mean were estimated as per (8). The R software version 4.2.1 was used to perform an ANOVA on each quantitative trait (9). Treatment mean squares were then examined for significance at the 5% and 1% probability levels. Using this method, the coefficient of variation at the genotypic and phenotypic levels was computed (10).

The phenotypic and genotypic variance and the heritability (h^2) in percentage were determined (11). The heritability percentage was classified (12). Using the corresponding variance and covariance components, the standard method was applied to estimate the correlation coefficients at the phenotypic and genotypic levels (13). The path coefficient analysis determines the direct and indirect effects of different components on yield (14). The principal component analysis identifies the variable or characteristic that clusters or groups a population. Using the Grapes 1.1.0 tool, a principal component analysis was carried out.

Table 1. List of purple-type brinjals collected and used for evaluation

S. No.	Accessions	Shape	Colour	Local name & place of collection
1	SM 1	Long	Purple white	Ujala type - Siruvachur, Perambalur Dt
2	SM 2	Long	Purple white	Ujala type - Siruvachur, Perambalur Dt
3	SM 3	Long	Purple white	Ujala type, Tiruvallur Dt
4	SM 4	Oblong	Purple white	Ujala type, Tiruvallur Dt
5	SM 5	Oblong	Purple white	Ujala type, Tiruvallur Dt
6	SM 6	Oblong	Purple white	Ujala type, Tiruvallur Dt
7	SM 7	Oblong	Purple white	Ujala type, Tindivanam Dt
8	SM 8	Oblong	Purple white	Ujala type, Tindivanam Dt
9	SM 9	Long	Purple green	Bhavani purple type, Kallakurichi Dt
10	SM 10	Long	Purple green	Bhavani purple type, Kallakurichi Dt
11	SM 11	Oblong	Purple green	Bhavani purple type, Kallakurichi Dt
12	SM 12	Oblong	Purple green	Bhavani purple type, Kallakurichi Dt
13	SM 13	Oblong	Purple green	Bhavani purple type, Kallakurichi Dt
14	SM 14	Oblong	Purple green	Bhavani purple type, Kallakurichi Dt
15	SM 15	Oblong	Purple green	Bhavani purple type, Kallakurichi Dt
16	SM 16	Oblong	Purple green	Bhavani purple type, Kallakurichi Dt
17	SM 17	Oblong	Purple type	Yenthal purple type, Tiruvannmalai Dt
18	SM 18	Round	Dark purple	Sillukkudi type, Tiruvannmalai Dt
19	SM 19	Round	Dark purple	Sillukkudi type, Tiruvannmalai Dt
20	SM 20	Oblong	Dark purple	Sillukkudi type, Tiruvannmalai Dt
21	SM 21	Oblong	Dark purple	Sillukkudi, type, Tiruvannmalai Dt
22	SM 22	Oblong	Purple	Hosur type, Krishnagiri Dt
23	SM 23	Oblong	Purple	Hosur type, Krishnagiri Dt
24	SM 24	Oblong	Purple	Hosur type, Krishnagiri Dt
25	SM 25	Oblong	Purple green	VRM.1– purple type

Results and Discussion

The mean performance of brinjal germplasm for growth and yield attributing traits were analyzed and given in Table 2. It was significant at 5 % and 1 % probability levels. The days to 50 % flowering ranged from 45.84 (SM 22) to 62.00 (SM 4). The highest plant height was observed in SM 9 (120.45), while the lowest was in SM 2 (71.25). The number of primary branches was higher in SM 9 (8.82). Whereas, less in SM 24 (4.93). Branch length ranged from 49.42 (SM 23) to 101.76 (SM 9). Maximum fruit length was observed in SM 9 (8.87) and the minimum in SM 4 (5.44). Fruit breadth ranged from 2.62 (SM 3) to 5.36 (SM 15). Fruit weight per fruit was higher in SM 10(65.96) and lower in SM 3 (21.22). Number of fruits per plant ranged from 15.80 (SM 23) to 63.97 (SM 6). Fruit borer infestation was about 16.37 (SM 16) to 26.21 (SM 22). Fruit weight per plant ranged from 839.22 (SM 22) to 1773.622 (SM 6). Similar kind of evaluation studies in brinjal were carried out (15,16)

The results of variability parameters *viz.,* heritability and genetic advance as percent of the mean are projected in Table 3. The traits under investigation showed a significantly higher phenotypic coefficient of variation (PCV) than the genotypic coefficient of variation (GCV), indicating that both genetic and environmental factors influenced the expression of the traits. These findings are in agreement (17,18). There are three categories for the coefficient of variation: high (more than 20 %), medium (between 10 % and 20%) and low (less than 10 %) at the phenotypic and genotypic level (19). In the present study, high GCV and PCV values were observed for fruit breadth, fruit weight gram per fruit, number of fruits per plant and fruit weight gram per plant. High GCV and PCV values suggest that a trait has substantial variability and may be amenable to improvement. The traits such as days to fifty per cent flowering, plant height, number of branches per plant, branch length, fruit length and fruit borer infestation exhibited medium GCV and PCV values (20).

Large genetic gain may arise from a higher proportion of additive genetic variability, leading to high heritability and genetic advancement. Heritability values help estimate the potential progress that could be achieved through selection. The classified heritability values under 40 % were low, those between 40 and 59 % were medium, and those between 60 and 80 % were high (21). In this study, heritability and genetic advance as a percent of the mean ranges between 93.90 %-99.64 % and 21.85-88.30, respectively. All the traits also fall in the category of high heritability since all values fall above 80 %. Similar findings were reported (22). GAM was divided into three classes *viz.,* 0-10 % as low, 10-20 % as moderate and more than 20 % as high (8). This study showed high heritability coupled with high GAM ranging from 21.85 % to 88.30 %. Heritability and genetic advancement as a percentage of mean data supported the idea that additive effects account for most variation, allowing selection to improve the traits further. Similar reports on high heritability and GAM were reported (23).

Table 2. Performance of purple local type brinjal types for important traits

Genotypes	DTFPF	PH	PB	BL	FL	FB	FW	NFPP	FBI	FYPP
SM 1	60.17	78.07	6.51	65.05	8.28	3.11	27.01	42.94	20.53	956.66
SM 2	59.34	71.25	5.22	53.09	7.27	2.84	24.99	42.20	20.22	879.22
SM 3	61.34	84.47	5.78	80.09	7.15	2.62	21.22	51.83	20.19	968.73
SM 4	62.00	73.04	5.22	59.62	5.44	3.47	22.07	61.26	18.10	1262.49
SM 5	60.84	84.93	5.33	68.62	5.89	3.08	32.00	42.20	18.90	1199.73
SM 6	50.84	76.82	5.96	68.98	7.48	3.16	30.24	63.97	17.36	1773.62
SM 7	59.50	79.98	5.11	70.40	5.63	2.99	24.14	44.68	17.97	980.55
SM 8	57.67	87.91	7.53	77.51	5.48	3.17	28.82	44.74	18.64	1202.34
SM 9	46.50	120.45	8.82	101.76	8.87	3.41	49.86	25.69	20.23	1296.69
SM 10	47.17	119.16	8.47	94.24	8.00	3.21	65.96	16.46	19.17	1085.73
SM 11	49.84	98.11	5.47	73.49	8.70	4.08	40.10	38.16	16.81	1529.11
SM 12	52.00	98.05	5.69	75.24	7.98	3.96	42.78	32.82	18.26	1419.62
SM 13	51.33	101.09	6.76	72.80	7.48	4.57	46.12	27.58	19.74	1276.23
SM 14	53.00	105.71	6.22	77.60	7.76	4.44	51.52	24.33	18.38	1250.02
SM 15	54.67	106.76	7.93	67.91	8.50	5.36	48.50	21.77	20.25	1056.32
SM 16	54.50	108.40	8.51	85.18	7.78	4.65	44.63	37.99	16.37	1703.04
SM 17	61.34	119.09	7.38	72.93	5.84	3.83	38.60	22.14	24.03	849.48
SM 18	47.84	80.69	6.27	66.02	5.48	3.94	42.79	25.66	24.12	1136.84
SM 19	46.17	88.44	5.65	68.93	6.08	3.71	48.02	19.79	24.28	1012.63
SM 20	46.83	88.02	7.38	76.42	6.03	4.61	44.99	20.45	23.91	950.12
SM 21	46.17	86.45	7.49	73.31	6.40	5.01	42.31	22.18	23.64	953.90
SM 22	45.84	95.84	6.93	55.62	6.92	5.27	44.22	22.84	26.21	1040.20
SM 23	47.84	93.67	7.04	49.42	8.61	4.98	64.75	15.80	23.59	1064.39
SM 24	46.34	99.07	4.93	70.96	7.74	4.50	48.86	16.63	24.02	839.22
SM 25	55.83	102.75	6.40	70.76	8.71	5.68	57.13	23.73	21.22	1329.67
SEd	0.85	1.34	0.10	1.12	0.10	0.07	0.73	0.48	0.32	17.68
CD (5%)	2.43	3.80	0.29	3.18	0.28	0.19	2.06	1.36	0.92	50.25
CV%	2.79	2.46	2.73	2.70	2.35	2.94	3.05	2.57	2.73	2.64

DTFPF - Days to 50 % flowering PH - Plant height PB - Number of primary branches per plant BL - Branch length

FL - Fruit length FB - Fruit breadth FW - Fruit weight NFPP - Number of fruit/ plant

FBI - Fruit borer incidence FYPP - Fruit yield per plant

Table 3. Variability parameters, broad sense heritability and genetic advance as percent of the mean of the traits in brinjal genotypes

Traits	GCV (%)	PCV (%)	h² (heritability)	GA as % of mean
DFPF	10.95	11.30	93.90	21.85
PH	15.10	15.30	97.41	30.70
NBPP	17.48	17.69	97.62	35.58
BL	15.85	16.08	97.19	32.19
FL	16.24	16.41	97.95	33.11
FB	21.97	22.17	98.25	44.86
FWGPF	30.09	30.25	98.99	61.67
NFPP	42.94	43.02	99.64	88.30
FBI	13.42	13.69	96.04	27.09
FWGPP	21.45	21.61	98.51	43.85

DTFPF - Days to 50 % flowering PH - Plant height PB - Number of primary branches per plant BL - Branch length
FL - Fruit length FB - Fruit breadth FW - Fruit weight NFPP - Number of fruit/ plant
FBI - Fruit borer incidence FYPP - Fruit yield per plant

Estimates of the correlation coefficients on the phenotypic and genotypic levels between yield and yield-related traits in all conceivable combinations are furnished in Table 4. The correlation matrix among 10 traits is shown in Fig. 1. Days to fifty percent flowering showed a significant positive correlation with several fruits per plant (0.6397). In contrast, fruit breadth (-0.4729) and weight gram per fruit (-0.6976) were significant but negatively correlated. Plant height is significant and positively correlated with number of branches per plant (0.6521), branch length (0.6222), fruit length (0.4736) and fruit weight gram per fruit (0.6962). However, this trait was significant and negatively correlated with the number of fruits per plant (-0.6165). The number of branches per plant significantly correlated significantly with branch length (0.5393) and fruit weight per gram per fruit (0.4908). Branch length had a significant negative association with fruit borer infestation (-0.3357). Fruit length is positively associated with fruit breadth (0.3223) and weight per gram per fruit (0.5067). Fruit breadth is positively associated with fruit weight gram per fruit (0.6442) and fruit borer infestation (0.4053). It had a significant negative association with the number of fruits per plant (-0.6309). Fruit

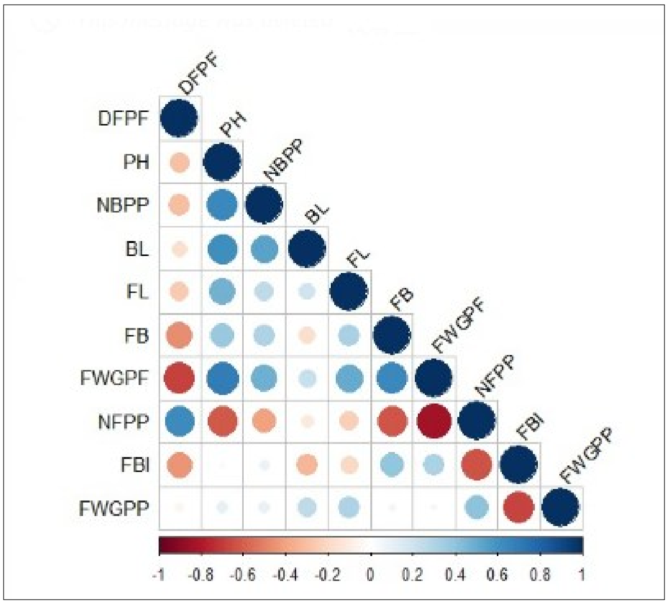

Fig. 1. Correlation matrix illustrating the relationships between the characters. (The colour blue indicates a positive correlation, while the colour red indicates a negative correlation).

Table 4. Genotypic and phenotypic correlation coefficient among important quantitative traits in brinjal genotypes

Genotypes		DFPF	PH	NBPP	BL	FL	FB	FWGPF	NFPP	FBI	FWGPP
DFPF	G	1	– 0.3019	– 0.3069	– 0.1736	– 0.2602	– 0.4729*	– 0.6976**	0.6397**	– 0.4508*	– 0.0625
	P		– 0.2949	– 0.2920	– 0.1693	– 0.2507	– 0.4590*	– 0.6729**	0.6182**	– 0.4311*	– 0.0563
PH	G		**1**	0.6521**	0.6222**	0.4736*	0.3789	0.6962**	– 0.6165**	0.0264	0.1092
	P			0.6307**	0.6072*	0.4627*	0.3754	0.6851*	– 0.6083*	0.0284	0.1039
NBPP	G			1	0.5393*	0.2566	0.3032	0.4908*	– 0.4115	0.0817	0.0942
	P				0.5197*	0.2485	0.2983	0.4832*	– 0.4064	0.0870	0.0969
BL	G				1	0.1980	– 0.1807	0.2264	– 0.1194	– 0.3357*	0.2626
	P					0.1970	– 0.1813	0.2226	– 0.1177	– 0.3218*	0.2533
FL	G					1	0.3223*	0.5067*	– 0.2477	– 0.2090	0.3060
	P						0.3184*	0.4979*	– 0.2434	– 0.2044	0.2987
FB	G						1	0.6442**	– 0.6309**	0.4053*	0.0500
	P							0.6369**	– 0.6228**	0.3887	0.0508
FWGPF	G							1	– 0.8406**	0.3173	0.0397
	P								– 0.8350**	0.3099	0.0442
NFPP	G								1	– 0.6438**	0.4092*
	P									– 0.6292**	0.4052*
FBI	G									1	– 0.6772**
	P										– 0.6561**
FWGPP											1

DTFPF– Days to 50 % flowering PH– Plant height PB– Number of primary branches per plant BL– Branch length
FL– Fruit length FB– Fruit breadth FW– Fruit weight NFPP– Number of fruit/ plant
FBI– Fruit borer incidence FYPP– Fruit yield per plant

weight gram per fruit showed a significant negative association with number of fruits per plant (-0.8406). The number of fruits per plant positively correlated with fruit weight gram per plant (0.4092). However, it had a significant negative association with fruit borer infestation (-0.6438). Fruit borer infestation showed a significant negative association with fruit weight gram per plant (-0.6772). This suggests that as the level of fruit borer infestation increases, the fruit weight per plant tends to decrease (24, 25)

Correlation coefficient estimation does not depict the direct and indirect effects of various yield attributes on yield; instead, path analysis helps perform this operation. The direct and indirect effects of different characters on fruit yield are presented in Table 5. The higher magnitude of a positive direct effect on fruit yield was exerted by the number of fruits per plant (1.3099) followed by fruit weight gram per fruit (0.4879), plant height (0.4367) and fruit breadth (0.3794). The negative direct effect on yield was shown by days to fifty per cent flowering (-0.5095), number of branches per plant (-0.0393), branch length (-0.0728), fruit length (-0.1416) and fruit borer infestation (-0.4335). Such kinds of studies were also performed (26-28). The estimate of the residual factor was very low (0.3462). Hence, from the above finding, it may be concluded that selection for the number of fruits per plant, fruit weight gram per fruit, plant height (0.4367) and fruit breadth should be given importance in a selection programme to increase fruit yield.

Principal component analysis was used to understand the source and structure of variation and the role of observed characteristics in overall variability (29). PCA showed three principal components with unity eigenvalues, accounting for 78.647 % of total variance (Table 6.). Among the PCs, PC1 contributed a high proportion of total variance (42.282) with an eigenvalue of 4.228. Principal components, PC2 and PC3, showed a total variance percentage of 24.045 and 12.32 with the eigenvalues 2.404 and 1.232, respectively. The remaining components from PC4 to PC10 had little or no variation.

Eigenvalues of ten PCs have been shown in the scree plot (Fig. 2). The PC bi–plot (Fig. 3) showed the genotype distribution and variables, as well as the gap between traits concerning PC 1 and PC 2, which showed how these traits contributed to genotype variation. Eigenvectors (loadings) of the three PCs were presented in Table 7. In PC1, characters contributed positively for plant height (0.382), number of branches per plant (0.314), branch length (0.164), fruit length (0.241), fruit breadth (0.339), fruit weight (0.452) and fruit borer infestation (0.203). In PC2, all the traits showed negative contribution except fruit breadth (0.149) and fruit borer infestation (0.54). In PC3, characters such as days to fifty per cent flowering (0.165), plant height (0.23), number of branches per plant (0.338), branch length (0.49) and fruit borer infestation (0.133) showed positive contribution.

Table 5. Path analysis showing direct and indirect effect of yield component traits on yield in brinjal genotypes

	DFPF	PH	NBPP	BL	FL	FB	FWGPF	NFPP	FBI	FWGPP
DFPF	– 0.5095	– 0.1318	0.0158	0.0126	0.0368	– 0.1794	– 0.3404	0.8380	0.1954	– 0.0625
PH	0.1538	0.4367	– 0.0335	– 0.0453	– 0.0671	0.1437	0.3397	– 0.8075	– 0.0114	0.1092
NBPP	0.1564	0.2848	– 0.0393	– 0.0514	– 0.0363	0.1150	0.2395	– 0.5390	– 0.0354	0.0942
BL	0.0885	0.2717	– 0.0277	– 0.0728	– 0.0280	– 0.0686	0.1105	– 0.1564	0.1455	0.2626
FL	0.1326	0.2069	– 0.0132	– 0.0144	– 0.1416	0.1223	0.2472	– 0.3244	0.0906	0.3060
FB	0.2410	0.1655	– 0.0156	0.0132	– 0.0456	0.3794	0.3143	– 0.8264	– 0.1757	0.0500
FWGPF	0.3555	0.3041	– 0.0252	– 0.0165	– 0.0717	0.2444	0.4879	– 1.1011	– 0.1375	0.0397
NFPP	– 0.3260	– 0.2692	0.0212	0.0087	0.0351	– 0.2393	– 0.4101	1.3099	0.2791	0.4092
FBI	0.2297	0.0115	– 0.0042	0.0244	0.0296	0.1537	0.1548	– 0.8433	– 0.4335	– 0.6772

Residual effect: 0.3462

DTFPF– Days to 50 % flowering PH– Plant height PB– Number of primary branches per plant BL– Branch length

FL– Fruit length FB– Fruit breadth FW– Fruit weight NFPP– Number of fruit/ plant

FBI– Fruit borer incidence FYPP– Fruit yield per plant

Table 6. Eigenvalues and percentage of variation for different principal components genotypes of brinjal

Principal Component	Eigenvalue	Percentage of variance	Cumulative percentage of variance
PC1	4.228	42.282	42.282
PC2	2.404	24.045	66.327
PC3	1.232	12.32	78.647
PC4	0.713	7.128	85.775
PC5	0.593	5.93	91.705
PC6	0.381	3.807	95.512
PC7	0.2	1.998	97.51
PC8	0.151	1.514	99.024
PC9	0.069	0.689	99.714
PC10	0.029	0.286	100

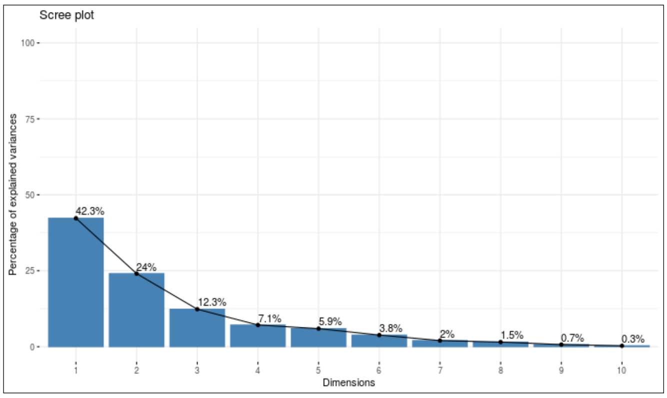

Fig. 2. Scree plot constructed using 10 principal components.

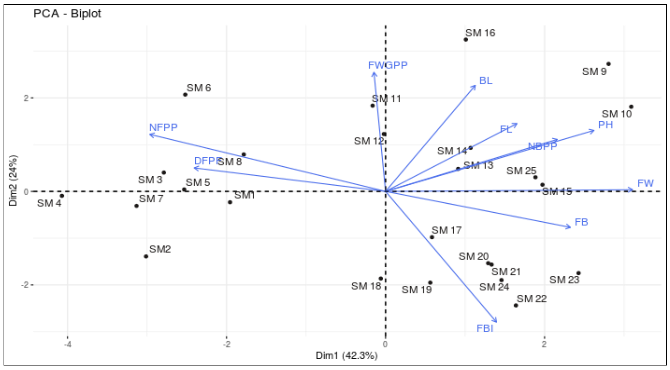

Fig. 3. Biplot of 25 brinjal genotypes.

Table 7. Contribution of the first three principal component axes to variation

Variables	PC1	PC2	PC3
Days to fifty per cent flowering	– 0.351	– 0.097	0.165
Plant height	0.382	– 0.252	0.23
Number of branches per plant	0.314	– 0.215	0.338
Branch length	0.164	– 0.438	0.49
Fruit length	0.241	– 0.28	– 0.391
Fruit breadth	0.339	0.149	– 0.415
Fruit weight	0.452	– 0.007	– 0.139
Number of fruits per plant	– 0.432	– 0.235	– 0.103
Fruit weight gram per plant	– 0.021	– 0.492	– 0.44
Fruit borer infestation	0.203	0.54	0.133
Eigenvalue	4.228	2.404	1.232
Per cent variation	42.282	24.045	12.32
Cumulative variation	42.282	66.327	78.647

Conclusion

The phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of variation (GCV), indicating that both genetic and environmental factors influenced the expression of the traits, and also, the characters fall in the category of high heritability. High heritability coupled with high GAM was noticed for all the traits. This supported the idea that those additive effects account for most variation, allowing selection to improve the traits further. Correlation analysis on the number of fruits per plant recorded a positive and significant association with fruit weight gram per plant. The higher magnitude of a positive direct effect on fruit yield was exerted by the number of fruits per plant followed by fruit weight gram per fruit, plant height and fruit breadth. Hence, selecting these traits in a selection programme should be necessary to increase fruit yield. In PCA analysis, characters with positive values in each PC are the most critical yield contributors, so weight should be given to these characters during selection to develop high-yielding brinjal cultivars.

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Authors' contributions

KAS conducted the research experiments and RK and KA wrote the manuscript. IM helped in conducting the experiments. KA designed the study and supervised it. RK helped to perform statistical analysis. KAS and IM helped correct and revise the manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interest to declare.

Ethical issues: None

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