VARIABILITY AND GENETIC DIVERSITY STUDIES IN BRINJAL (*Solanum melongena* L.) GENOTYPES

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By

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C E R T I F I C A T E

This is to certify that the thesis entitled **"VARIABILITY AND GENETIC DIVERSITY STUDIES IN BRINJAL (*Solanum melongena* L.)"** submitted in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (HORTICULTURE)** in **VEGETABLE SCIENCE** to the University of Horticultural Sciences, Bagalkot, is a record of research work carried out by **VITTAL L. MANGI** under my guidance and supervision and that no part of the thesis has been submitted for the award of any degree, diploma, associateship, fellowship or other similar titles.

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BAGALKOT

SEPTEMBER, 2014 **(VITTAL L. MANGI)**

Affectionately

Dedicated to

Shri. Laxman, Smt. Kasturi,

Brothers, Sisters, Teachers

and Friends

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1. INTRODUCTION

Brinjal (*Solanum melongena* L.) is an important and popular vegetable crop of India. It belongs to the family Solanaceae and is native of Indo-Berma region and China (Vavilov, 1926). Solanum is a very large and important genus comprising between 1000 and 1400 described species of which at least 150 are tuberous, the rest being non-tuberous (Daunay and Lester, 1988). Brinjal is a herbaceous with erect or semi spreading habits. It is mainly self pollinated, but a certain percentage of cross pollination also occurs. It is a warm season crop and tolerant to heat, drought and grows under wide range of soil and climatic conditions. There is an increasing demand for its varieties for different culinary purposes. It is considered as brain food and poor man's caviar. The immature fruit is primarily used as cooked vegetable and utilized in the preparation of various dishes like sliced bhaji, stuffed curry, bertha, chutney, vangibath and pickles in different parts of the world. Brinjal is quite high in nutritive value as compared with tomato (Choudhary, 1976). It is an important source of carbohydrate (4.0 g), protein (1.4 g), fibre (1.3 g), vitamin A (124 IU), phosphorus (47 mg), potassium (2.0 mg) and iron (0.3 mg) and recommended for diabetes, asthma, cholera, bronchitis and it protects the brain cell membranes from damage. It can also cure toothache if fried brinjal fruit in til oil is taken and act as an excellent remedy for those suffering from liver complaints (Chauhan, 1981).

Brinjal is an important vegetable crop grown in India and it stands second in area and production after China. In India, it occupies an area of 7.22 lakh hectares with an annual production of 134.43 lakh metric tonnes and an average productivity of 18.6 metric tonnes per hectare (Anon, 2013a). West Bengal, Karnataka, Orissa, Andrha Pradesh, Gujarath and Bihar are the leading brinjal producing states in India. In Karnataka, brinjal occupies an area of 16.10 thousand hectares with an annual production of 4.21 lakh metric tonnes and an average productivity of 26.2 metric tonnes per hectare.

Brinjal has more regional preferences for specificity of fruits trait ranging from round to long fruit with green, purple, pink, white and stripped multicolours. Considering the potentiality of this crop, there is a prime need for improvement and to develop varieties suited to specific agro-ecological conditions and also for specific use. The role of genetic variability in crops is of paramount importance in selecting

the best genotypes for making rapid improvement in yield and related characters as well as to select the most potential parents for making the hybridization programme successful.

The success of any crop improvement programme largely depends upon the nature and magnitude of the genetic variability existing in breeding material with which plant breeder is working (Prabhu *et al.*, 2009). The phenotypic expression of the plant character is mainly controlled by the genetic makeup of the plant and environment, in which it is grown and the interaction between the genotype and environment. Further, the genetic variance of any quantitative trait is composed of additive variance (heritable) and non additive variance (non heritable), which include dominance and epistasis (non allelic interaction). Therefore, it becomes necessary to partition the observed phenotypic variability into its genotypic (partly heritable) and environmental (non heritable) components with suitable parameters, such as phenotypic and genotypic coefficient of variation and heritability in broad sense. Further, genetic advance can be used to predict the efficiency of selection. Effectiveness of selection directly depends on the amount of heritability and genetic advance as per cent of mean for that character.

Improvement made in crop varieties is concentrated on increasing yield and yield attributing characters. A study of correlation between different quantitative characters provides an idea of association. It could be effectively exploited to formulate selection strategies for improving yield and quality. Association of characters like yield, its components, and other economical traits is important for making selection in the breeding programme. It suggests the advantage of a scheme of selection for more than one character at a time (Kalloo. 1994). Further in order to have more clear picture of yield components for effective selection progamme, it would be desirable to consider the relative magnitude of association of various characters with yield. The path coefficient technique developed by Wright (1921) helps in estimating direct and indirect contribution of various components in building up the total correlation towards yield. On the basis of these studies, the quantum importance of individual character will facilitate the selection programme for better gains.

Generally, diverse germplasms are expected to give hybrid vigour (Harington, 1940) and hence, study of genetic divergence among the existing genetic stocks provides an opportunity for selecting the diverse parents for hybridization. Such parents are expected to produce superior segregants in combination with others and thus are most valuable for breeders. The D^2 statistics developed by Mahalanobis (1930) provides a measure of magnitude of divergence between two genotypes under comparison. Grouping of genotypes based on D^2 analysis will be useful in choosing suitable parental lines for heterosis breeding which inturn can help farmers by making available the elite varieties.

With this background, the present investigation to evaluate the genetic variability for different characters to understand the scope for selection and diversity of genotypes for identification of suitable parents for hybridization to improve yield and yield attributing characters is undertaken with following objectives.

1. To study the nature and extent of genetic variability in brinjal germplasm for productivity and quality traits.

2. To study the character association and path analysis for different traits in brinjal germplasm.

3. To study the extent of genetic diversity in brinjal germplasm.

2. REVIEW OF LITERATURE

Vegetable breeder is primarily concerned with the improvement of both quantitative and qualitative plant characters. Hence, adequate knowledge on genetics of various traits is very essential in vegetable breeding programme for obtaining dependable results in succeeding generation. However, the success of vegetable breeding depends on the extent and the magnitude of variability existing in the germplasm. At the same time, improvement is possible on the basis of heritable variation. In the present investigation, an attempt has been made to study the genetic variability, divergence, heritability, character association and path coefficient analysis in brinjal. The available literature pertaining to the investigation on brinjal has been presented in this chapter under following headings.

2.1 Genetic variability, heritability and genetic advance

2.2 Correlation and path analysis

2.3 Genetic divergence

2.1 Genetic variability, heritability and genetic advance

The success of breeding progamme depends upon the magnitude of variability existing in the germplasm. Variability may be defined as the amount of variation present among the members of population or species for one or more characters at genotypic or phenotypic levels. A comprehensive summary method for estimating genetic variance was presented by Cockerham (1963). Where phenotypic variability is observable and includes both genotypic and environmental variation and therefore, also called total variation. While, genotypic variation refers to genetic or inherent variability, which remains unaltered by environmental conditions. It is measured in terms of genotypic variance and consists of additive, dominance and epistatic components. Environmental variance is measured in terms of error mean variance. Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) are derived from standard deviation divided by mean and are used to assess the extent of variation.

Heritability is the transmissibility of characters from parent to off-spring. Heritability in broad sense is the ratio of genotypic variance to total phenotypic variance generally expressed in percentage. Effectiveness of selection of genotypes depends on heritability. Genetic advance (GA) is the improvement over the base population that can be potentially achieved from selection. It is a function of the heritability of the trait the breeder uses. High heritability is accompanied with high genetic advance indicates predominance of additive gene effects and selection may be effective. When low heritability is accompanied with low genetic advance, it indicates predominance environmental effects and selection would be ineffective. High heritability with low genetic advance indicates the importance of non-additive gene action, the high heritability is being exhibited due to favorable influence of environment rather than genotype and selection for such traits may not be rewarding, while low heritability with high genetic advance, reveals that the character is governed by additive gene effects. The low heritability is being exhibited due to high environmental effects and selection may be effective in such cases.

Variability for growth, earliness, yield and its components in brinjal has been reported by several workers. The review of literature on variance and its components, heritability, genetic advance and genetic advance over mean for various characters are presented in tabular form as under (Table 1).

2.2 Correlation and path analysis

Association of economically important quantitative characters which is statistically determined by correlation coefficient has been quite useful as a basis of selection. Correlation studies provide information that the selection for one character will result in progress for all other positively correlated characters. The study of simple correlation does not provide an exact picture of relative importance of direct and indirect influence of each of the component character towards the desired character. So this can be overcome by path coefficient analysis technique by further partitioning the correlation coefficient into direct and indirect effects.

Sinha (1983) reported that brinjal yield was positively correlated with fruits per plant, plant height and branches per plant at the phenotypic and genotypic levels, and with fruit length:circumference ratio at the genotypic level. Path analysis indicated that fruits per plant and fruit length:circumference ratio had the maximum direct effect on yield.

Table 1. Review of literature on mean, range, components of variance, heritability, genetic advance and genetic advance over mean in brinjal

Sl. No.	Character	Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)	References
A.	**Growth parameters**										
1.	Plant height (cm)	85.68	65.7-117.5	183.47	170.73	15.80	15.24	93.05	96.30	-	Devi and Sankar (1990)
		85.70	60.3-105.1	125.10	108.40	13.00	12.10	86.60	19.90	23.20	Mishra and Mishra (1990)
		48.53	29.5-59.5	-	-	17.8	14.02	64.26	11.14	23.14	Prakash *et al.* (1994)
		78.80	60.0-107.7	104.70	100.70	13.00	12.70	96.00	20.20	25.70	Pramanick *et al*. (1994)
		92.10	44.40-143.9	-	121.00	23.02	21.50	88.00	41.55	-	Singh and Gopalakrishnan (1995)
		95.03	62.5-119.7	323.03	231.88	18.84	16.08	72.80	26.87	28.27	Sharma and Swaroop (2000)
		90.73	72.6-117.6	-	-	14.16	11.19	62.50	-	18.22	Mahaveerprasad *et al*. (2004)
		60.33	50.10-73.50	40.31	34.08	10.52	9.67	84.54	11.05	18.32	Patel *et al.* (2004)
		73.15	-	143.94	137.84	16.40	16.10	95.71	23.66	32.35	Kushwah and Bandhyopadhya (2005)
	60 DAT	41.64	33.90-68.40	6.63	5.75	14.28	12.40	75.37	10.29	22.17	Naik (2005)
	90 DAT	61.94	49.90-77.45	7.92	5.40	12.79	8.72	46.53	7.59	12.26	Naik (2005)

Contd……

Table 1. Continued…

Sl. No.	Character	Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)	References
A.	**Growth parameters**										
1.	Plant height	-	43.29-77.41	-	-	17.88	13.81	59.60	12.90	21.97	Golani *et al.* (2007)
	(cm)	80.60	48.23-123.18	230.27	221.73	18.82	18.47	96.29	30.10	37.14	Sherly and Shanthi (2008)
		-	-	40.76	27.93	10.87	9.00	68.50	-	15.33	Sao and Mehta (2009)
		77.8	56.70-88.53	-	-	8.66	8.34	92.79	-	-	Dahatonde *et al.* (2010)
		73.08	56.5-89.5	-	-	12.04	11.63	0.93	16.91	-	Das *et al.* (2010)
		-	-	276.88	272.13	18.89	18.72	98.29	33.69	38.24	Muniappan *et al.* (2010)
		102.34	87.60-117.09	-	-	10.113	10.095	99.7	26.624	-	Kumar *et al.* (2011)
		-	100.74-149.97	-	-	9.75	9.61	97.23	-	19.53	Kumar *et al.* (2012)
		98.96	80.44-118.15	-	-	10.63	7.61	51.00	11.11	11.21	Shekar *et al.* (2012)
		-	-	276.88	272.13	18.89	18.72	98.29	33.69	38.24	Arunkumar *et al.* (2013)
		91.97	-	-	-	13.93	10.21	53.74	-	15.42	Kumar *et al.* (2013b)
		50.82	27.75-77.20	-	-	24.75	24.31	96.49	-	49.20	Lokesh *et al.* (2013)
	30 DAT	26.50	22.86-30.60	-	-	8.906	7.67	74.00	-	-	Nayak and Nagre (2013)
	60 DAT	51.00	44.42-61.40	-	-	9.221	8.96	95.00	-	-	Nayak and Nagre (2013)
	90 DAT	68.71	61.66-74.00	-	-	5.847	5.70	95.1	-	-	Nayak and Nagre (2013)
	120 DAT	84.52	75.83-111.60	-	-	10.141	10.11	99.4	-	-	Nayak and Nagre (2013)

Contd……

Table 1. Continued…

Sl. No.	Character	Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)	References
A.	**Growth parameters**										
2.	Plant spread (cm)	97.20	63.0-141.5	-	-	15.25	14.75	94.00	29.51	-	Singh and Gopalakrishnan (1995)
		70.79	64.67-82.48	67.25	13.94	11.58	5.27	20.73	3.50	4.94	Patel *et al.* (2004)
	60 DAT	42.89	29.95-54.70	4.37	4.27	9.52	9.30	95.38	8.59	18.71	Naik (2005)
		-	54.70-71.07	-	-	8.72	3.99	21.00	2.36	3.76	Golani *et al.* (2007)
		106.25	88.87-125.80	-	-	10.51	10.17	93.64	-	-	Dahatonde *et al.* (2010)
		140.93	25.02-265.27	-	-	39.68	39.66	99.89	-	81.65	Lokesh *et al.* (2013)
	30 DAT	33.71	29.53-37.93	-	-	7.808	7.57	94.2	-	-	Nayak and Nagre (2013)
	60 DAT	54.29	46.16-61.70	-	-	9.565	9.47	96.9	-	-	Nayak and Nagre (2013)
	90 DAT	77.97	71.96-84.63	-	-	5.265	5.15	95.9	-	-	Nayak and Nagre (2013)
	120 DAT	105.57	90.7-120.86	-	-	9.318	9.28	99.6	-	-	Nayak and Nagre (2013)
3.	Number of primary branches	13.91	8.00-18.67	13.99	9.53	26.89	22.19	68.10	52.50	-	Devi and Sankar (1990)
		10.30	5.20-17.0	8.20	6.40	27.70	24.40	77.50	4.60	44.30	Mishra and Mishra (1990)
		8.75	4.8-11.50	-	-	24.69	19.09	59.74	2.66	30.40	Prakash *et al.* (1994)
		6.90	4.50-10.20	-	-	20.65	16.95	66.00	27.99	-	Singh and Gopalakrishnan (1995)

Contd……

Table 1. Continued…

Sl. No.	Character	Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)	References
A.	**Growth parameters**										
3.	Number of primary branches	7.40	4.17-9.83	2.90	1.45	24.95	16.25	42.40	1.61	21.80	Sharma and Swaroop (2000)
		4.22	3.07-6.13	-	-	27.09	8.56	10.00	5.68	-	Mahaveerprasad *et al.* (2004)
	60 DAT	3.78	1.90-5.25	0.79	0.68	20.98	17.99	73.54	1.20	31.78	Naik (2005)
	90 DAT	7.57	4.50-9.55	1.22	1.20	16.30	16.02	96.59	2.43	32.44	Naik (2005)
		7.76	5.80-10.60	1.44	0.96	15.50	12.64	66.46	1.64	21.22	Sherly and Shanthi (2008)
		-	-	1.22	0.86	18.94	15.90	70.50	-	27.52	Sao and Mehta (2009)
		4.26	3.40-5.00	-	-	14.68	9.62	42.96	-	-	Dahatonde *et al.* (2010)
		4.66	3.58-5.74	-	-	16.643	10.00	36.1	0.756	-	Kumar *et al.* (2011)
		-	4.55-10.94	-	-	26.45	26.05	97.00	-	52.85	Kumar *et al.* (2012)
		14.58	8.40-17.20	-	-	14.31	12.88	81.00	3.48	23.88	Shekar *et al.* (2012)
	30 DAT	1.66	0.70-2.36	-	-	31.541	30.38	92.8	-	-	Nayak and Nagre (2013)
	60 DAT	1.99	1.39-2.81	-	-	23.663	19.24	66.1	-	-	Nayak and Nagre (2013)
	90 DAT	2.54	2.17-2.92	-	-	8.443	7.44	77.7	-	-	Nayak and Nagre (2013)
	120 DAT	4.11	3.4-4.8	-	-	11.009	9.82	79.6	-	-	Nayak and Nagre (2013)

Contd……

Table 1. Continued…

Sl. No.	Character	Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)	References
A.	**Growth parameters**										
4.	Stem girth (cm)	5.00	3.50-6.50	0.90	0.50	19.40	14.90	58.40	11.00	23.40	Mishra and Mishra (1990)
	60 DAT	0.11	0.93-1.25	0.09	0.062	8.90	5.61	39.79	0.08	7.29	Naik (2005)
	90 DAT	1.88	1.70-2.08	0.10	0.068	5.60	3.63	42.75	0.09	4.91	Naik (2005)
5.	Leaf area (cm^2)	2.14	1.01-3.27	1.57	1.55	58.62	58.24	99.02	255.74	-	Devi and Sankar (1990)
		74.40	48.10-145.60	447.10	428.10	28.90	27.60	95.70	41.70	56.30	Pramanick *et al*. (1994)
		203.34	-	1483.47	1152.81	18.94	16.69	77.76	61.65	30.32	Kushwah and Bandhyopadhya (2005)
	60 DAT	41.06	28.68-65.71	7.61	5.99	18.54	14.57	61.82	9.69	23.61	Naik (2005)
	90 DAT	51.10	39.4-74.85	6.73	5.47	13.16	10.71	66.27	9.26	18.11	Naik (2005)
		5.02	3.14-7.39	-	-	28.85	28.49	98.00	2.91	57.95	Shekar *et al.* (2012)

Contd……

Table 1. Continued…

Sl. No.	Character	Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)	References
B.	**Earliness parameters**										
6.	Days to first flowering	67.80	42.50-81.80	-	-	16.92	16.28	92.67	21.89	32.28	Prakash *et al.* (1994)
		37.60	22.70-57.30	27.20	23.40	13.90	12.90	85.90	9.20	24.50	Pramanick *et al*. (1994)
		41.00	32.80-48.20	-	-	9.91	7.83	62.00	12.62	-	Singh and Gopalakrishnan (1995)
		88.29	63.00-96.73	-	-	8.83	8.26	87.60	15.93	-	Mahaveerprasad *et al*. (2004)
		41.80	39.00-45.50	1.90	1.14	4.53	2.72	36.10	1.40	3.36	Naik (2005)
		50.36	22.60-67.50	69.13	68.76	16.50	16.46	99.46	17.03	33.82	Sherly and Shanthi (2008)
		79.51	66.20-86.40	-	-	7.53	7.50	99.20	-	-	Dahatonde *et al.* (2010)
		49.78	39.73-56.93	-	-	9.43	9.30	97.00	9.41	18.90	Shekar *et al.* (2012)
		-	75.00-85.00	-	-	3.35	3.06	83.19	-	5.75	Kumar *et al.* (2012)
		80.30	-	-	-	5.70	5.18	81.46	-	9.64	Kumar *et al.* (2013b)
		73.00	67.36-79.40	-	-	5.999	5.65	89.00	-	-	Nayak and Nagre (2013)

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Table 1. Continued…

Sl. No.	Character	Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)	References
B.	**Earliness parameters**										
7.	Days to 50 per cent flowering	69.20	65.30-75.30	12.14	9.27	5.03	4.39	76.35	548.02	-	Devi and Sankar (1990)
		65.20	54.00-77.60	38.30	33.60	9.50	8.80	87.60	11.10	17.10	Mishra and Mishra (1990)
		40.09	33.00-48.30	13.40	9.57	9.08	7.68	71.40	5.36	13.36	Sharma and Swaroop (2000)
		-	28.23-50.83	-	-	14.17	10.71	57.16	-	16.69	Baswana *et al.* (2002)
		54.79	48.25-65.25	41.91	13.42	11.82	6.69	32.02	4.27	7.79	Patel *et al.* (2004)
		53.75	-	82.32	78.45	16.87	16.43	95.21	17.81	33.13	Kushwah and Bandhyopadhya (2005)
		49.61	46.50-54.00	2.02	1.55	4.08	3.10	57.86	2.41	4.86	Naik (2005)
		-	-	14.44	12.74	6.57	6.17	88.25	6.91	11.94	Muniappan *et al.* (2010)
		58.76	53.22-64.31	-	-	5.542	5.402	95.00	8.176	-	Kumar *et al.* (2011)
		-	-	14.44	12.74	6.57	6.1	88.25	6.91	11.94	Arunkumar *et al.* (2013)
		45.47	33.00-60.00	-	-	13.91	13.28	91.13	-	26.11	Lokesh *et al.* (2013)
8.	Days to first fruit maturity	75.30	56.70-93.20	62.00	55.30	10.40	9.90	89.20	14.50	19.20	Pramanick *et al.* (1994)
		62.90	50.30-66.90	-	-	16.38	13.93	72.00	24.29	-	Singh and Gopalakrishnan (1995)
		79.11	-	70.73	56.86	10.63	9.53	80.32	13.92	17.60	Kushwah and Bandhyopadhya (2005)
		68.90	64.06-71.50	2.00	1.80	2.94	2.64	80.63	3.32	4.90	Naik (2005)
		56.74	29.05-73.10	71.27	70.42	14.87	14.78	98.81	17.18	30.28	Sherly and Shanthi (2008)
		-	-	40.04	34.96	5.94	5.55	87.30	-	10.68	Sao and Mehta (2009)
		99.23	83.60-118.80	-	-	9.07	9.05	99.63	-	-	Dahatonde *et al.* (2010)
		69.49	57.00-76.93	-	-	7.17	7.05	97.00	9.91	14.27	Shekar *et al.* (2012)

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Table 1. Continued…

Sl. No.	Character	Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)	References
C.	**Yield parameters**										
9.	Fruit length (cm)	7.86	5.62-14.11	9.76	6.61	30.61	25.25	67.68	435.63	-	Devi and Sankar (1990)
		12.50	7.30-21.50	10.00	8.30	25.10	22.80	82.70	5.40	42.90	Mishra and Mishra (1990)
		10.50	5.30-16.00	-	-	22.30	20.90	88.34	4.26	40.57	Prakash *et al.* (1994)
		9.90	4.50-19.90	-	-	34.95	32.78	88.00	63.30	-	Singh and Gopalakrishnan (1995)
		11.70	-	-	-	21.40	21.33	99.36	43.80	-	Sanwal *et al.* (1998)
		10.18	5.00-60.33	11.87	11.32	33.92	33.11	95.30	6.78	66.55	Sharma and Swaroop (2000)
		11.90	6.83-21.17	-	-	32.70	28.07	73.70	49.62	-	Mahaveerprasad *et al.* (2004)
		8.18	3.58-23.8	12.5	12.49	43.22	43.21	99.80	7.27	88.88	Patel *et al.* (2004)
		12.31	-	12.92	12.30	29.19	28.49	95.24	7.05	57.29	Kushwah and Bandhyopadhya (2005)
		13.40	6.25-20.00	2.90	2.83	21.50	21.14	96.94	5.74	42.88	Naik (2005)
		-	7.25-26.65	-	-	40.65	38.51	89.80	11.18	75.18	Golani *et al.* (2007)
		15.88	12.23-27.18	10.87	10.57	20.76	20.46	97.20	6.60	41.56	Sherly and Shanthi (2008)
		-	-	13.16	11.88	24.12	22.92	90.30	-	43.83	Sao and Mehta (2009)
		8.9	7.20-14.12	-	-	18.47	18.27	97.76	-	-	Dahatonde *et al.* (2010)

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Table 1. Continued…

Sl. No.	Character	Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)	References
C.	**Yield parameters**										
9.	Fruit length (cm)	11.72	5.5-22.5	-	-	29.24	27.72	90.00	6.34	-	Das *et al*. (2010)
		-	-	1.23	1.21	22.37	22.24	99.83	2.26	45.54	Muniappan *et al*. (2010)
		15.41	10.21-20.61	-	-	21.928	21.604	97.1	9.367	-	Kumar *et al.* (2011)
		9.03	5.80-13.83	-	-	23.32	23.19	99.00	4.29	47.50	Shekar *et al.* (2012)
		-	5.32-12.64	-	-	20.99	17.95	73.14	-	31.62	Kumar *et al.* (2012)
		-	-	1.23	1.21	22.37	22.24	99.83	2.26	45.54	Arunkumar *et al.* (2013)
		7.67	4.58-10.40	-	-	15.58	15.49	98.77	-	31.70	Lokesh *et al.* (2013)
		6.43	-	-	-	21.02	20.61	96.11	-	41.63	Kumar *et al*. (2013b)
		13.28	9.26-15.2	-	-	11.068	10.99	98.7	-	-	Nayak and Nagre (2013)
10.	Fruit diameter (cm)	4.30	2.40-9.70	-	-	23.80	21.16	79.00	38.79	-	Singh and Gopalakrishnan (1995)
		3.50	-	-	-	28.40	28.10	96.87	57.15	-	Sanwal *et al.* (1998)
		4.81	2.50-7.53	1.67	1.49	26.87	25.4	89.50	2.38	49.40	Sharma and Swaroop (2000)
		14.92	6.07-29.23	-	-	37.16	32.43	76.20	58.31	-	Mahaveerprasad *et al*. (2004)
		3.72	2.15-6.7	0.66	0.65	21.91	21.67	97.90	1.65	44.35	Patel *et al.* (2004)
		5.82	-	5.49	5.38	40.25	39.85	98.00	4.73	81.27	Kushwah and Bandhyopadhya (2005)
		13.45	8.00-19.50	2.60	2.08	19.13	15.50	65.65	3.48	25.87	Naik (2005)
		-	11.80-24.30	-	-	24.92	23.35	87.80	7.32	45.10	Golani *et al.* (2007)
		18.35	13.36-27.92	11.00	10.80	18.07	17.90	98.18	6.71	36.55	Sherly and Shanthi (2008)
		-	-	10.59	9.77	20.90	20.07	92.20	-	39.73	Sao and Mehta (2009)
		6.34	2.63-8.40	-	-	23.51	23.10	96.51	-	-	Dahatonde *et al.* (2010)
		6.55	2.2-14.5	-	-	31.43	29.78	90.00	3.81	-	Das *et al*. (2010)
		-	-	0.84	0.83	25.08	24.99	99.34	1.88	51.32	Muniappan *et al*. (2010)
		4.50	2.42-6.59	-	-	25.075	22.588	81.1	2.658	-	Kumar *et al.* (2011)
		3.80	2.13-6.61	-	-	25.27	24.92	97.00	1.92	50.62	Shekar *et al.* (2012)
		-	10.39-20.31	-	-	15.96	11.77	54.45	-	17.90	Kumar *et al.* (2012)

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Table 1. Continued…

Sl. No.	Character	Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)	References
C.	**Yield parameters**										
10.	Fruit diameter (cm)	-	-	0.84	0.83	25.08	24.999	99.34	1.88	51.32	Arunkumar *et al.* (2013)
		4.36	3.15-7.20	-	-	20.68	20.43	97.55	-	41.56	Lokesh *et al.* (2013)
		11.57	-	-	-	14.84	14.19	90.88	-	27.86	Kumar *et al.* (2013b)
		7.78	6.36-9.40	-	-	10.385	10.35	99.3	-	-	Nayak and Nagre (2013)
11.	Fruit length-diameter ratio	1.04	0.32-1.61	0.28	0.25	27.60	24.55	80.01	0.47	45.37	Naik (2005)
12.	Average fruit weight (g)	14.12	5.60-26.80	283.73	236.35	33.92	30.96	83.30	2890.40	-	Devi and Sankar (1990)
		73.30	38.90-231.10	1010.40	995.10	43.30	42.90	98.40	64.40	87.80	Mishra and Mishra (1990)
		102.80	28.24-289.10	6463.10	2780.10	78.20	51.30	43.00	71.20	69.30	Pramanick *et al.* (1994)
		80.60	28.00-235.40	-	-	44.45	43.12	94.40	86.07	-	Singh and Gopalakrishnan (1995)
		38.90	-	-	-	25.18	25.13	99.60	51.67	-	Sanwal *et al.* (1998)
		93.56	34.33-203.6	237.28	20.88	52.00	48.86	88.10	88.38	94.45	Sharma and Swaroop (2000)
		-	13.33-271.67	-	-	81.51	80.19	96.79	-	162.50	Baswana *et al.* (2002)
		101.93	48.10-299.70	-	-	44.15	42.46	89.40	78.23	-	Mahaveerprasad *et al.* (2004)
		69.96	32-142.5	631.77	630.83	35.93	35.90	99.90	51.69	73.89	Patel *et al.* (2004)
		181.91	-	8121.50	8055.65	49.55	49.33	99.15	184.03	101.18	Kushwah and Bandhyopadhya (2005)
		94.40	64.00-139.00	17.53	16.91	18.57	17.91	93.00	3.60	33.60	Naik (2005)
		-	320-983.33	-	-	48.36	45.98	90.40	963.61	90.07	Golani *et al.* (2007)

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Table 1. Continued…

Sl. No.	Character	Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)	References
C.	**Yield parameters**										
12.	Average fruit weight (g)	54.25	32.50-96.00	306.40	288.63	32.26	31.31	94.20	33.96	62.60	Sherly and Shanthi (2008)
		-	-	1377.61	1236.69	28.55	27.05	89.80	-	52.79	Sao and Mehta (2009)
		150.26	44.99-320.06	-	-	56.65	56.26	99.91	-	-	Dahatonde *et al.* (2010)
		125.22	25.6-478.5	-	-	62.19	61.99	99.00	159.42	-	Das *et al*. (2010)
		-	-	28.06	27.86	26.78	26.68	99.28	10.83	54.77	Muniappan *et al*. (2010)
		174.92	65.56-284.29	-	-	42.258	42.225	100.00	141.686	-	Kumar *et al.* (2011)
		56.62	44.63-70.19	-	-	15.47	7.61	24.00	4.37	7.72	Shekar *et al.* (2012)
		-	29.86-105.94	-	-	35.68	35.54	99.27	-	72.96	Kumar *et al.* (2012)
		-	-	28.06	27.86	26.78	26.68	99.28	10.83	54.77	Arunkumar *et al.* (2013)
		38.38	17.90-85.20	-	-	31.94	31.92	99.88	-	65.72	Lokesh *et al*. (2013)
		50.38	-	-	-	15.93	15.51	94.74	-	31.10	Kumar *et al.* (2013b)
		228.62	134.26-609.0	-	-	44.045	42.09	91.3	-	-	Nayak and Nagre (2013)
13.	Number of fruits per cluster	2.25	1.00-4.50	-	-	49.12	38.88	62.65	1.43	63.55	Prakash *et al.* (1994)
		2.60	1.80-3.70	0.10	0.10	25.40	22.50	78.60	0.60	41.30	Pramanick *et al*. (1994)
		2.41	1.00-4.00	2.50	2.19	42.12	35.35	70.00	1.48	11.47	Sharma and Swaroop (2000)
		1.76	1.00-3.15	0.48	0.29	39.36	30.60	60.42	0.86	48.86	Patel *et al.* (2004)
		1.85	-	0.87	0.78	50.48	47.86	89.90	1.73	93.52	Kushwah and Bandhyopadhya (2005)
		1.43	1.00-3.00	0.74	0.73	31.32	51.33	97.64	1.49	104.49	Naik (2005)
		-	-	0.89	0.88	66.72	66.03	88.00	-	135.21	Sao and Mehta (2009)
		1.63	1.00-3.53	-	-	63.91	63.67	99.23	-	-	Dahatonde *et al.* (2010)
		1.87	1.10-2.64	-	-	34.782	20.751	35.6	0.606	-	Kumar *et al.* (2011)
		1.78	1.04-2.82	-	-	21.72	21.18	95.07	-	45.23	Lokesh *et al*. (2013)

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Table 1. Continued…

Sl. No.	Character	Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)	References
C.	**Yield parameters**										
14.	Number of fruits per plant	49.66	28.16-79.80	40.59	30.31	45.12	38.99	74.69	982.71	-	Devi and Sankar (1990)
		19.40	5.70-48.00	60.80	51.80	40.10	36.90	85.10	13.60	70.20	Mishra and Mishra (1990)
		6.26	2.80-17.50	-	-	48.05	47.00	95.66	6.22	94.48	Prakash *et al.* (1994)
		20.20	5.50-65.80	108.30	89.20	51.50	46.80	82.30	17.60	87.40	Pramanick *et al*. (1994)
		17.30	1.20-62.30	-	-	60.90	54.80	81.00	101.65	-	Singh and Gopalakrishnan (1995)
		20.20	-	-	-	62.39	61.67	97.70	125.56	-	Sanwal *et al.* (1998)
		12.92	6.73-31.20	46.10	40.63	52.52	49.30	88.10	12.33	95.36	Sharma and Swaroop (2000)
		-	0.06-8.28	-	-	89.99	86.04	91.64	-	169.67	Baswana *et al.* (2002)
		8.06	2.59-18.09	-	-	45.37	39.57	76.10	71.09	-	Mahaveerprasad *et al.* (2004)
		11.6	8.33-17.96	7.85	6.13	24.15	21.35	78.17	4.51	38.39	Patel *et al.* (2004)
		5.46	-	9.39	9.29	56.12	55.80	98.83	6.24	114.31	Kushwah and Bandhyopadhya (2005)
		16.60	6.57-32.60	5.60	5.06	33.60	30.51	82.31	9.45	56.96	Naik (2005)
		61.35	36.20-92.70	252.27	220.82	25.88	24.22	87.53	28.64	46.68	Sherly and Shanthi (2008)
		-	-	16.78	12.94	24.56	21.56	77.10	39.02	-	Sao and Mehta (2009)
		13.10	6.00-32.80	-	-	67.83	67.62	99.38	-	-	Dahatonde *et al.* (2010)
		31.63	2.00-110.00	-	-	74.415	72.72	95.5	46.31	-	Das *et al*. (2010)
		-	-	48.79	36.69	50.42	43.73	75.19	10.82	78.12	Muniappan *et al*. (2010)
		-	11.54-50.95	-	-	29.66	28.46	92.08	-	56.27	Kumar *et al.* (2012)
		17.76	11.00-30.33	-	-	28.47	26.93	89.00	9.32	52.48	Shekar *et al.* (2012)
		-	-	48.79	36.69	50.42	43.73	75.19	10.82	78.12	Arunkumar *et al.* (2013) \
		26.54	-	-	-	22.52	21.88	94.39	-	43.79	Kumar *et al.* (2013b)
		15.75	10.60-23.10	-	-	18.00	17.65	96.23	-	35.68	Lokesh *et al.* (2013)
		7.79	5.10-14.56	-		28.175	26.48	88.4	-	-	Nayak and Nagre (2013)

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Table 1. Continued…

Sl. No.	Character	Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)	References
C.	**Yield parameters**										
15.	Total yield per plant (kg)	0.619	0.369-0.812	29938.70	21056.0	27.91	23.41	70.33	25068.2	-	Devi and Sankar (1990)
		1.178	0.774-1.623	80827.30	58160.3	24.10	20.40	71.90	421.40	35.70	Mishra and Mishra (1990)
		0.453	0.207-0.770	-	-	29.11	27.02	86.14	234.33	51.66	Prakash *et al.* (1994)
		1.581	0.425-3.076	263406.7	122311.9	32.50	22.10	46.40	490.90	31.00	Pramanick *et al.* (1994)
		0.856	0.132-2.279	-	-	57.12	52.67	85.00	106.06	-	Singh and Gopalakrishnan (1995)
		0.710	-	-	-	54.28	53.51	97.44	108.65	-	Sanwal *et al.* (1998)
		0.57	0.15-1.03	0.09	0.07	50.99	48.04	88.80	0.54	93.21	Sharma and Swaroop (2000)
		-	0.14-0.583	-	-	87.25	80.54	85.22	-	153.16	Baswana *et al.* (2002)
		0.75	0.26-1.59	-	-	41.37	37.81	83.50	72.00	-	Mahaveerprasad *et al.* (2004)
		1.36	0.37-2.18	0.28	0.27	38.02	38.01	99.25	1.05	77.21	Patel *et al.* (2004)
		0.80	-	0.05	0.05	30.19	29.31	94.28	0.47	58.60	Kushwah and Bandhyopadhya (2005)
		1.54	0.66-2.81	0.54	0.50	32.20	32.40	85.03	0.95	61.63	Naik (2005)
		3.31	1.64-7.37	1.40	1.23	35.67	33.55	88.47	2.15	65.00	Sherly and Shanthi (2008)
		-	-	27844.19	22341.67	28.24	25.30	80.20	-	-	Sao and Mehta (2009)
		1.612	0.531-2.752	-	-	38.88	37.97	95.37	-	-	Dahatonde *et al.* (2010)
		2.77	0.52-6.14	-	-	47.12	44.34	89.00	2.38	-	Das *et al.* (2010)
		-	-	21706.02	15667.42	53.43	45.39	72.18	219.06	79.44	Muniappan *et al.* (2010)
		1.79	0.63-2.95	-	-	47.763	47.064	97.1	2.169	-	Kumar *et al.* (2011)
		-	0.76-1.93	-	-	22.91	21.99	92.13	-	43.48	Kumar *et al.* (2012)
		0.99	0.59-1.54	-	-	27.06	24.66	83.00	0.46	46.29	Shekar *et al.* (2012)
		-	-	21706.02	15667.42	53.43	45.39	72.18	219.06	79.44	Arunkumar *et al.* (2013)
		0.61	0.24-1.3	-	-	37.26	37.07	99.01	-	75.98	Lokesh *et al.* (2013)
		1.43	-	-	-	26.61	25.84	94.26	-	51.68	Kumar *et al.* (2013b)
		1.72	1.04-3.10	-	-	33.495	32.61	94.8	-	-	Nayak and Nagre (2013)

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Table 1. continued…

Sl. No.	Character	Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)	References
C.	**Yield parameters**										
16.	Yield per hectare (tonnes)	25.34	11.65-43.01	7.77	7.00	30.66	27.64	81.25	13.00	51.32	Naik (2005)
		-	28.19-47.01	-	-	15.37	8.87	33.30	37.90	10.55	Golani *et al.* (2007)
		44.86	14.75-76.45	-	-	38.88	37.97	95.37	-	-	Dahatonde *et al.* (2010)
		22.11	13.14-34.30	-	-	27.08	24.62	83.00	10.19	46.10	Shekar *et al.* (2012)
		61.59	36.16-97.60	-	-	29.801	29.48	97.9	-	-	Nayak and Nagre (2013)
D.	**Quality parameters**										
17.	Per cent dry matter in fruit	93.44	67.73-119.70	259.60	201.86	17.24	15.20	77.75	2580.70	-	Devi and Sankar (1990)
		12.95	8.34-16.76	1.95	1.75	15.08	13.55	80.66	3.24	25.06	Naik (2005)
18.	Phenol content (mg/100g)	120.49	93.57-156.96	314.67.67	310.77	14.72	14.62	98.76	36.08	29.94	Sherly and Shanthi (2008)
		61.07	-	-	-	23.21	23.05	98.67	-	47.18	Kumar *et al.* (2013b)
19.	Fruit and shoot borer Incidence (%)	7.50	1.50-25.50	36.20	35.30	38.00	37.50	97.30	12.00	76.30	Mishra and Mishra (1990)
		4.63	1.10-8.20	-	-	52.53	38.39	53.40	-	-	Dahatonde *et al.* (2010)
	Shoot borer Incidence (%)	17.17	0.00-50.00	-	-	90.06	74.05	67.60	-	125.41	Lokesh *et al.* (2013)
	Fruit borer Incidence (%)	17.81	7.42-38.05	-	-	37.06	36.24	95.64	-	73.00	Lokesh *et al.* (2013)
	Fruit and shoot borer incidence (%)	4.72	1.26-8.09	-	-	49.86	49.73	99.5	-	-	Nayak and Nagre (2013)

GV = Genotypic variance PV = Phenotypic variance GCV = Genotypic coefficient of variance GA= Genetic advance h^2 = Heritability (broad sense) PCV =Phenotypic coefficient of variance GAM = Genetic advance (per cent mean) DAT= Days after transplanting

According to Devi and Sankar (1990) marketable yield per plant showed a highly significant positive correlation with total dry matter production and number of fruits per plant and also correlated with number of branches per plant. Similarly, high positive correlations of number of branches per plant with leaf area index, total dry matter production and fruit breadth was observed. These observations clearly indicated the complexity of yield character. The fruit weight showed highly significant positive correlation with fruit breadth and dry matter production and highly significant negative association with number of fruits per plant at phenotypic level.

Nainar *et al.* (1900) repoted that fruit per plant, fruit weight and fruit length had positive association with yield.

Ushakumari *et al.* (1991) analysed for genotypic and phenotypic correlation among ten yield components in 54 genotypes of aubergine and found that the number of fruits had the highest positive correlation followed by number of branches with yield. Similarly plant spread and fruits per plant also showed significant positive correlation with yield per plant (Gautham and Srinivas, 1992).

Randhawa *et al.* (1993) reported that fruits per plant and branches per plant had the highest direct effect on yield in brinjal.

Seventeen brinjal genotypes were evaluated by Ponnuswami and Irulappan (1994) and found that yield per plant had significant and positive correlation with plant height, branches per plant, fruit weight, fruit length and fruits per plant. The intercorrelation among fruits per plant, fruit length and branches per plant were all positive and significant.

According to Narendrakumar (1995) yield per plant showed significant positive association with fruit length, primary branches per plant and fruits per plant. Most of the environmental correlations were not significant. Thus the characters, fruit length, primary branches per plant, fruits per plant and early yield could form a sound basis for selection.

Mohanty (1999) evaluated 15 genotypes of brinjal and found that the genotypic correlation coefficients were higher than corresponding phenotypic ones for most character combinations. Yield displayed positive and significant genotypic and phenotypic association with plant height and number of fruits per plant. Path coefficient studies revealed that number of fruits per plant and plant height exerted maximum positive direct effect on yield.

Sharma and Swaroop (2000) evaluated 27 brinjal accessions and found that fruits per plant, mean fruit weight and diameter of fruits were positively correlated with yield, while days to 50 per cent flowering showed no relation. Path analysis revealed that fruits per plant had maximum direct effect on yield at genotypic level yield and hence direct selection could be made for this character for improving yield, while maximum direct effect at phenotypic level was showed by fruits per plant, mean fruit weight and diameter of fruits. Branches per plant, plant height and length of fruit had positive indirect effect towards yield per plant via fruits per plant and hence simultaneous selection for these characters can be made for the improvement of yield.

Pratibha *et al.* (2004) reported that early yield per plant exhibited phenotypically significant positive correlation with number of fruits per plant and total yield per plant in brinjal.

Kushwah and Bandhyopadhya (2005) reported that fruits per plant (0.46), fruit diameter (0.38) and number of pickings (0.38) had significant positive correlation with yield per plant at genotypic level. At phenotypic level, the positive significant correlation was recorded for number of pickings (0.34), fruit diameter (0.36) and fruits per plant (0.45) with fruit yield. A negative significant association of fruit yield per plant (-0.38) was observed with days to first picking at genotypic level.

Path analysis study by Praneetha (2006) revealed that the characters like number of fruits per plant, number of branches per plant, single fruit weight, fruit length and ascorbic acid content were the most important yield determinants because of their direct effects and high indirect effects via many of other characters. The indirect effect also showed that most of the characters influenced the yield through number of fruits per plant and single fruit weight.

Senapati and Senapati (2006) reported that brinjal fruit yield was significantly and positively correlated with fruit number per plant and it had negative correlation with fruit diameter.

Lohakare *et al.* (2008) studied correlation and path analysis using 23 genotypes of green fruited brinjal and reported that yield per plant was closely associated with fruits per cluster, fruit index, average fruit weight and fruits per plant. Path analysis revealed that positive direct effect of fruits per plant, average fruit weight, fruit index, days to first harvest, primary branches and plant spread on fruit yield per plant.

Prabhu and Natarajan (2008) reported that marketable yield and yield per plant had positive correlation with plant height (0.736), branches per plant (0.478), mean fruit weight (0.941), fruit length (0.743) and fruit number per plant (0.383). The path analysis exhibited the positive direct effect of branches per plant (0.0545), mean fruit weight (0.4210), fruit length (0.4731) and number of fruits per plant (0.0671) on marketable yield. While, plant height and fruit girth had negative direct effect on marketable yield.

Jadhao *et al.* (2009) reported that the yield contributing characters *viz.*, plant height, primary branches per plant, days to last picking, fruit weight and fruits per plant showed positive significant correlation with fruit yield per plant. Path coefficient analysis revealed that plant height, primary branches per plant, days to first flowering, days to first picking, days to last picking, fruit length and fruit weight showed positive direct relation with yield per plant.

Dahatonde *et al.* (2010) carried out correlation and path analysis with twenty genotypes of purple fruited brinjal and indicated that fruit yield per plant was closely associated with diameter of fruit, number of fruits per plant and average fruit weight. Path analysis revealed positive direct effect on fruit yield per plant by average fruit weight and number of fruits per plant. Hence, these characters may be given consideration while making selection for improvement of brinjal.

Muniappan *et al.* (2010) reported that brinjal fruit yield per plant had highly significant and positive correlation with number of branches per plant, fruit breadth, number of fruits per plant and average fruit weight, both at genotypic as well as

phenotypic levels. Inter correlation was positive and significant for days to 50 per cent flowering with fruit breadth and average fruit weight. Plant height showed significant positive association with number of branches per plant, fruit length, fruit breadth and average fruit weight. Number of branches per plant showed significant association with average fruit weight, while the fruit length showed positive correlation with fruit breadth, fruit breadth expressed significant positive association with average fruit weight. Number of fruits per plant (0.86198) and average fruit weight (0.45390) had high positive direct effect on yield. The indirect effect on fruit yield per plant via average fruit weight was expressed by number of branches per plant and fruit breadth.

Praneetha and Veeraragavathathum (2011) evaluated eighty one brinjal genotypes for 14 characters and results showed that marketable yield per plant had significant positive association at both genotypic and phenotypic level with many characters studied *viz.*, plant height, number of branches per plant, fruit girth, calyx length, number of fruits per plant, single fruit weight, protein content and total phenol content. It had significant negative association both at genotypic and phenotypic level with shoot and fruit borer infestation and it also showed negative significant association at phenotypic level with earliness. The plant height exhibited the maximum significant positive relationship with number of branches per plant. The fruit length registered positive significant correlation of genotypic and phenotypic with fruit girth. Fruit girth had positive significant association with single fruit weight. The earliness showed positive association with fruit borer infestation at both genotypic and phenotypic level. The shoot borer infestation showed negative relation with ascorbic acid content, protein content of fruit and total phenol content at vegetable maturity.

Danquash and Ofori (2012) reported that brinjal fruit weight showed significant positive association with fruit diameter and fruit length. Days to flowering registered significant positive correlations with height at flowering and fruit length at both phenotypic and genotypic levels. The most striking result was significant negative correlation between number of seeds per fruit and fruit length. Thus suggesting that selection for accessions with long fruit will lead to reduction in seed content of the fruits.

Thangamani and Jansirani (2012) studied twenty five hybrids in brinjal and reported that yield per plant showed positive correlation with number of branches per plant, percentage of long styled flowers, number of fruits per plant, fruit dry matter content and ascorbic acid content. A significant negative correlation of yield was observed with days to first flowering. Fruit borer incidence had a significant positive association with calyx length and fruit girth while, significant negative correlation with total phenols, ascorbic acid content and dry matter content. The path analysis study revealed that the number of fruits per plant is the most important yield determinant, because of its high direct effect and indirect influence through number of branches per plant and fruit weight. Fruit girth, fruit length and dry matter content also influence the yield moderately via many other yield improving characters. Emphasis must be given to characters having high direct effect like number of fruits per plant, while exercising selection to improve the yield.

The genotypic path coefficient analysis by Ahmed *et al.* (2013) revealed that highest positive direct effect on fruit yield by number of fruits per plant followed by plant spread, fruit width and fruit length. Whereas, plant height showed negative direct effect on fruit yield per plant. Overall the path analysis confirmed the direct effect of fruit weight, number of fruits per plant, plant spread, fruit width, fruit length and number of primary branches on fruit yield per plant.

Arunkumar *et al.* (2013) recorded that brinial fruit yield per plant was significantly and positively correlated with number of branches per plant, fruit breadth, number of fruits per plant and average fruit weight both at genotypic as well as phenotypic levels. Correlation for days to 50 per cent flowering with fruit breadth and average fruit weight was positive and significant. Plant height showed significant positive association with number of branches per plant, fruit length, fruit breadth and average fruit weight. Number of branches per plant showed significant association with average fruit weight, while fruit length showed positive correlation with fruit breadth. Fruit breadth expressed significant positive association with average fruit weight. Fruit length recorded significant positive association with fruit breadth and average fruit weight. Number of fruits per plant had high positive direct effect on fruit yield per plant followed by average fruit weight. Average fruit weight had positive and direct effect on number of fruits per plant followed by fruit breadth and days to

50 per cent flowering. Fruit length had negative direct effect of fruit yield per plant. Fruit breadth had high positive indirect effect on fruit yield per plant via average fruit length, number of fruits per plant, days to 50 per cent flowering and number of branches per plant.

Dhaka and Soni (2014) reported that brinjal fruit yield per plant showed significant positive correlation with average weight of fruit (0.746 and 0.727) followed by plant height (0.612 and 0.573), leaves per plant (0.463 and 0.422), fruits per plant (0.409 and 0.399) and branches per plant (0.223 and 0.208) at genotypic and phenotypic level, respectively and number of picking (0.153) was significant only at genotypic level.

2.3 Genetic divergence

For getting high heterosis or for recovering transgressive segregants, parents chosen for hybridisation need to be genetically diverse or distant. The cultivars from widely separated localities have been usually included in the hybridisation programme, presuming the presence of genetic divergence and maximum likelihood of recovering promising segregants. As per expectations, in practice, this has not yielded very satisfactory and consistent results. Eco-geographical diversity has been regarded as a reasonable index of genetic diversity (Vavilov, 1926; Moll *et al*., 1962 and Ram and Panwar, 1970). However, it was reported later that, there does not exist any parallelism between geographic distribution and genetic diversity (Sachan and Sharma, 1971 and Peter, 1975 in tomato).

Multivariate analysis has been put to good use enabling quantification of degree of divergence between populations (Michener and Sokal, 1957; Morishina and Oka, 1960 and Murty and Qadri, 1966). Several methods of divergence analysis based on quantitative traits have been proposed to suit various objectives, of which Mahalanobis generalised distance technique (Mahalanobis, 1936) occupy a unique place in plant breeding. It is a very sensitive and potent biometrical tool in quantifying the degree of divergence between biological populations and also to assess the relative contribution of different components to the total divergence both at inter and intra cluster levels (Khanna and Misra, 1977; Suyambhulingam and Jobarani, 1978 and Singh and Singh, 1980). The concept of Mahalanobis D^2 statistic is based on the

technique of utilising the measurements in respect of aggregate of characters. The D^2 statistic as a measure of genetic divergence was used for the first time in the field of plant breeding by Nair and Mukherjee (1960) in the classification of natural and plantation teak and later by several workers in other crops. The studies on the analysis of genetic divergence in brinjal are presented here under.

Pramanick *et al.* (1992) studied genetic divergence in thirty eight lines or varieties of eggplant collected from different sources for eighteen characters. On the basis of D^2 values, thirty eight genotypes were grouped into nine clusters which were homogenous within and heterogenous between. Minimum intra-cluster divergence was observed between genotypes falling in cluster VI and maximum divergence was observed in cluster III. Maximum inter-cluster divergence was observed between the cluster I and IX. The clustering pattern showed different behaviour irrespective of their geographical locations. On the basis of the mean performance of different clusters, varieties having acceptable yield were placed under cluster I and II.

Thambe *et al.* (1993) studied genetic divergence on the basis of D^2 analysis for twenty five varieties and were grouped into five clusters with substantial genetic divergence between them. Cluster E had ten entries, cluster A had seven entries, cluster B had four entries and cluster C and D had two entries each. Maximum inter-cluster distance was observed between cluster D and E (57.58), while minimum distance was recorded between cluster A and B (16.35). The cluster mean for the character yield per plot was the highest in the cluster D (37.13 kg) and the lowest in cluster E (28.42 kg). The geographical distribution did not follow clustering pattern of these entries did not follow the geographical distribution.

Using Mahalonobis D^2 statistics, sixty five genotypes were grouped into fourteen clusters with no relationship between clustering pattern and ecological distribution of the genotypes (Singh *et al.*, 1995).

In a collection of forty diverse brinjal genotypes, Mahalonobis D^2 statistics was used for ten quantitative characters which resulted in grouping them into nine clusters. The maximum genetic distance was observed between cluster VI and IX in one year and II and IX in another year (Yadav *et al.*, 1996).

The genetically divergent forty accessions of brinjal were grouped into six clusters with multivariate analysis for seventeen characters (Rajeshkumar *et al.*, 1998). The highest inter-cluster distance was observed between cluster IV and VI. Higher cluster mean values were recorded for plant height, leaf area, plant spread E-W, days to first flowering, fruit picking and fruit width.

Bahera *et al.* (1999) studied genetic divergence in *Solanum* spp for resistance to shoot and fruit borer using D^2 analysis by Tocher's method. Altogether, four clusters were formed. The genotype *Solanum indicum* appearing in cluster III was highly resistant and the genotypes *Solanum gilo, Solanum incanum* and *Solanum anomolum* appearing in cluster I were resistant. The cultivars *Solanum melongena*, Pusa Purple cluster, Bhagyamathi, Annamalai, APAU-4, Nurki and Singhnath forming cluster IV were moderately resistant and Pusa Kranthi and Aushey of cluster II were susceptible to *Leucinodes arbonalis.*

Rai *et al.* (1999) studied non-hierarchical clustering approach to know the nature and magnitude of genetic divergence of fourteen round shaped brinjal genotypes from different geographical origin for yield and its contributing characters. Out of four clusters obtained, the cluster IV comprised of a maximum six genotypes, while the cluster I, II and III consisted of three, two and three genotypes, respectively. Maximum and minimum intra-cluster distances were found, respectively, in clusters II and cluster I. Similarly, inter- cluster distances were maximum and minimum between cluster II and III and cluster I and II, respectively. Thus, for achieving better segregation genotypes hybridization between clusters II and III was suggested.

Kumar *et al.* (2000) studied genetic divergence of forty accessions of brinjal through multivariate analysis for seventeen characters which led to their grouping into six distinct clusters. No relationship was found between genetic divergence and geographic distribution of the collected accessions. Fruit width (58.72%), fruit length (18.08%) and yield per plot (12.12%) contributed maximum towards total divergence.

Thirty four genotypes of brinjal were grouped into ten clusters using Mahalonobis D^2 statistics. Fruit circumference and average fruit weight were the main characters affected the grouping pattern of genotypes (Sarma *et al.*, 2000).

According to Mohanty and Prusti (2001) diversity studies in brinjal *(Solanum melongena* L.) involving fifteen genotypes for five economically important characters revealed substantial differences among the test entries for all the characters. The accessions were grouped into 5 clusters. The highest inter-cluster distance (D^2=4872.03) was noticed between cluster IV (KT 4 and BB 4) and V (Pusa Kranti and Bhawanipatna Local). It was observed that genetic diversity was not parallel to geographic distribution. Intercrossing among the genotypes belonging to cluster III, IV and V was suggested to develop high yielding varieties with other desirable characters.

Rameshbabu and Patil (2002) studied genetic divergence for twenty characters in a collection of ninety brinjal genotypes. Based on Mahalanobis D^2 statistics, genotypes were grouped into seven clusters on the basis of relative magnitude of D^2 values. Maximum contribution towards the total genetic divergence was from yield per plant. It has been observed that, no close correspondence was evident between geographical distribution to genetic divergence. Inter-cluster distance was maximum between clusters IV and VII, while it was minimum between clusters III and IV.

Mehta *et al.* (2004) studied twenty one genotypes of brinjal for genetic diversity. The genotypes were grouped into six clusters irrespective of geographic divergence, indicating no parallelism between geographic and genetic diversity. Cluster I was very large comprising of 15 genotypes, while cluster III to VI were solitary clusters. The maximum inter-cluster distance was obtained between clusters II and V followed by those between clusters IV and V as well as III and V which may serve as potential genotypes for hybridization programme. Fruit length, fruit girth, number of branches per plant and plant height played an important role in divergence between the populations.

Sharma and Maurya (2004) studied genetic divergence for forty genotypes of brinjal using Mahalanobis D^2 statistics for thirteen characters. Based on D^2 values, genotypes were grouped into seven clusters. No relationship was found between genetic divergence and geographic distribution of the collected genotypes. Characters like number of fruits per plant, 1000 seed weight and average width of the fruit contributed maximum to divergence. Inter-cluster distance was maximum between clusters V and VII. Therefore, genotypes of clusters V and VII with high *per se* performance were suggested for utilization in different breeding programmes.

Golani *et al.* (2007) evaluated twenty three genotypes of brinjal to know the genetic divergence for fruit yield and its contributing characters. The genotypes were grouped into six clusters. The cluster I comprised of six genotypes followed by cluster II and III each with five genotypes, while the cluster VI was solitary cluster. The clustering pattern indicated that there was no association between geographical distribution of genotypes and genetic divergence. However, the shape and colour of fruits played major role in grouping of genotypes into various clusters. The maximum inter-cluster D^2 value was reported between cluster II and III.

Genetic divergence was studied by Nandan and Mayuri (2009) using Mahalonobis D^2 statistic for fruit yield and fruit characters in fourteen brinjal genotypes. These genotypes were grouped into five different clusters irrespective of geographical diversity, indicating no parallelism between geographic and genetic diversity. The highest inter-cluster distance was observed between cluster I and II followed by cluster III and IV suggesting wide diversity among these groups.

Quamruzzaman *et al.* (2009) studied genetic divergence among 19 egg plant genotypes by using Mahalanobis D^2 statistic. Altogether five clusters were formed. Cluster I contained the highest number of genotypes (7) and cluster IV and V contained the lowest (2 each). The pattern of distribution of genotypes from different geographical locations into five clusters was random, demonstrating that geographical isolation may not be the only factor causing genetic diversity. The highest intra-cluster distance was observed for cluster V (1.067) and the lowest for cluster III (0.916). The highest inter-cluster distance was observed between cluster IV and V (10.748). Cluster V recorded the highest mean for plant height at last harvest (cm), leaf blade length (cm), leaf blade diameter (cm), leaf petiole length (cm), fruit pedicel length (cm), prickle on calyx. Whereas, number of branches per plant, fruit diameter (cm), individual fruit weight (g), fruit yield (t/ha) and prickle on fruit pedicel were in cluster II with the highest means. Therefore, more emphasis should be given on cluster V for selecting genotypes as parents for crossing with the genotypes of cluster II which may produce new recombinants with desired traits.

Das *et al.* (2010) collected different brinjal genotypes from different places in the country and abroad and evaluated for different morpho-physiological characters and genetic diversity through D^2 statistics. All the nine characters under study differed

significantly among the forty genotypes. The range of D^2 values varied from 8.13 to 8015.95 which revealed high variability among the genotypes. Based on the degree of divergence the genotypes were grouped into ten clusters among which cluster ten was the largest having 22 genotypes. The divergence within the cluster showed medium and consistant level of divergence in all the clusters except cluster ten which had highest intra-cluster distance. The top three characters which contributed most towards the genetic divergence were fruit yield per plant (41.28%), number of fruits per plant (19.74%) and fruit weight (16.41%). These characters may be used in selecting genetically diverse parents for hybridization programme to exploit either maximum heterosis or to execute efficient selection in the segregating generation.

Islam *et al*. (2011) studied genetic divergence among 11 egg plant genotypes using Mahalanobis D^2 statistic. The eleven genotypes were grouped into four distinct clusters. Cluster I comprises four genotypes, cluster II had three, Cluster III and IV had two genotypes each. The highest and the lowest intra-cluster distance were observed in cluster II (1.216) and cluster IV (0.047), respectively. The highest inter- cluster distance was between clusters I and III (8.757) while, it was the lowest between clusters I and II (2.203). Fruit weight, fruit length, flower pedicel length, fruit breadth, plant height and yield per plant had the highest contribution towards total divergence. Cluster III recorded the highest means for number of flowers per inflorescence, north-south plant canopy, leaf petiole length, leaf blade length, number of secondary branches per plant and number of fruits per plant. Whereas, number of node for first flowering, east-west plant canopy, flower pedicel length, leaf petiole diameter, fruit length, plant height and yield per plant were in cluster IV with the highest means. Cluster IV also contained the lowest mean for days to first flowering, days to 50 per cent flowering and days to fruit maturity which is desirable for earliness. Cluster I had the highest mean values for flower pedicel diameter, leaf blade width, number of primary branches per plant, fruit weight and fruit breadth. Therefore more emphasis should be given on cluster I, III and IV for selecting genotypes as parents for future breeding programme which may produce new recombinants with desired traits. Moderate to high Shannon-Weaver Diversity Index was found among the genotypes for most of the characters studied.

Arunkumar *et al.* (2013) studied the genetic divergence of eight morpho-economic characters in thirty four brinjal genotypes and grouped into seven clusters. Cluster I had maximum number with thirteen genotypes followed by cluster III with eleven genotypes, cluster V with three genotypes, whereas the clusters II, IV and VII with two genotypes each and cluster VII was solitary with single indicating its distinctiveness from the germplasm accessions. Average inter and intra-cluster D^2 values among 34 genotypes revealed that the intra-cluster distance ranged from 0.00 to 144.95. Cluster III followed by V, I and VI had maximum intra-cluster values (144.95, 144.14, 128.80 and 110.65 respectively) indicating existence of diverse genotypes that fell in these clusters. The inter-cluster D^2 values ranged from 13635.14 to 65237.45. The minimum inter-cluster D^2 values observed between cluster II and V (13635.14) indicating close relationship among the genotypes included in these clusters. Maximum inter-cluster values were observed between cluster II and VII (65237.45) followed by cluster VI and VII (56306.80) which indicated that genotypes included in these clusters were genetically diverse and may give rise to high heterotic response in early generations.

Morphological diversity in ninety two eggplant genotypes based on twenty one characters was estimated using Mahalanobis D^2 statistics by Begum *et al.* (2013). The highest intra-cluster distance was observed in cluster VIII (2.13), comprising seven genotypes and the lowest intra-cluster distance (1.18) was observed in cluster IV having four genotypes. The cluster X had the maximum number (17) of genotypes and cluster II and III had minimum number (3) of genotypes. The highest inter-cluster distance was observed between cluster II and VIII (30.86) which indicated that the genotypes in these clusters were more diverged than those of other clusters. Cluster II constitute three genotypes and produced the highest mean value for number of flowers per inflorescence (4.67) and yield per plant (812.33) and the lowest mean value for days to first flowering (108.22). Cluster IV constitute three genotypes namely EP-080, EP-081 and EP-089 produced fruits for longer duration (82.33). Cluster VIII constitute seven genotypes and showed the lowest mean value for number of infested shoots per plant (1.57). Cluster X formed with 17 genotypes produced the lowest mean value for number of infested fruit per plant (8.26). Therefore, more emphasis should be given on cluster II, IV and VIII for selecting genotypes as parents for crossing which may produce new recombinants with desired traits.

Kumar *et al*. (2013a) studied genetic divergence among fourteen eggplant genotypes using Mahalanobis D^2 statistic. Altogether six clusters were formed. The maximum numbers of genotypes five were found in cluster III with intra-cluster distance of 2597.79. The maximum inter-cluster distance was observed between cluster II (Alavayal Local and Palamedu Local) and cluster V (Annamalai and Nilakottai Local). Hence, genotypes belonging to these clusters may be utilized for involving in hybridization programme for crop improvement. The characters of fruit yield per plant (48.35%), fruit circumference (13.18%), little leaf incidence (13.18%) and total phenol content (9.89%) contributed more for genetic divergence.

3. MATERIAL AND METHODS

The investigation on variability, divergence and correlation studies in brinjal was undertaken during the *Rabi* season of 2013-2014. The details of the experiment, material used and techniques adopted in the present investigation are presented in this chapter.

3.1 Experimental site

The experiment on variability, divergence and correlation studies in brinjal was conducted at the Research Block of Vegetable Section in Sector No. 1 under the University of Horticultural Sciences, Bagalkot (Karnataka). The soil of the experimental site was medium black. The physical and chemical properties of the soil are presented in Appendix I.

3.2 Location and climate

Bagalkot is situated in Northern dry zone of Karnataka State at 16° 46' North latitude, 74° 59' East longitude and an altitude of 533.0 meters above the mean sea level.

During crop period *i.e.,* from October 2013 to March 2014 the rainfall received was low (138.20 mm) as compared to average of last ten years (509.64 mm). During this year the minimum and maximum temperature was higher as compared to average of last ten years. The meteorological data recorded at MHREC, Bagalkot during 2013-2014 is presented in Appendix II.

3.3 Experimental details

3.3.1 Experimental material

The experimental material comprised of 60 genotypes collected from different regions. The list of genotypes with their sources of collection is given in Table 2.

Table 2. Details of brinjal genotypes with their sources

Sl. No.	Genotypes coded	Genotypes	Source	Fruit characters
1.	CBB-1	Malapur local	Malapur	Fruits purple with green stripes, oblong
2.	CBB-2	K_{12} D_{10} 35-1	North Karnataka	Fruits white with broad light purple stripes, ovoid
3.	CBB-3	K_{12} D_{10} 12-6	North Karnataka	Fruits light purple with narrow white stripes, obovate
4.	CBB-4	K_{12} D_{10} 77-3	North Karnataka	Fruits glossy violet, ovoid
5.	CBB-5	K_{12} D_{10} 75-2	North Karnataka	Fruits purple with narrow white stripes, ovoid
6.	CO-2	------	Coimbatore	Fruits purple with narrow white stripes, ovoid
7.	CBB-6	Melavanki local	Melavanki	Fruits glossy purple with narrow white stripes, obovate
8.	CBB-7	K_{12} D_{10} 21-5	Orissa	Fruits green with white patches, globular
9.	CBB-8	Bijapur Local-1	Bijapur	Fruits dull purple with narrow white stripes, obovate
10.	CBB-9	K_{12} D_{10} 39-1	Orissa	Fruits green with purple and white stripes, obovate
11.	CBB-10	K_{12} D_{10} 87-2	North Karnataka	Fruits glossy violet with narrow white stripes, obovate
12.	CBB-11	K_{12} D_{10} 52-1	Orissa	Fruits green with prominant ridges, round
13.	CBB-12	K_{12} D_{10} 32-5	North Karnataka	Fruits purple with narrow white stripes, ovoid
14.	CBB-13	K_{12} D_{10} 97-3	North Karnataka	Fruits dull purple with pinkish purple patches, ovoid
15.	CBB-14	K_{12} D_{10} 104-1	North Karnataka	Fruits purple black with white patches, ovoid
16.	CBB-15	K_{12} D_{10} 36-3	Orissa	Fruits green with white patches, ovoid
17.	CBB-16	K_{12} D_{10} 116-6	North Karnataka	Fruits white, round
18.	CBB-17	K_{12} D_{10} 118-4	North Karnataka	Fruits purple with narrow white stripes, ovoid
19.	CBB-18	K_{12} D_{10} 69-1	North Karnataka	Fruits white with narrow light purple stripes, round
20.	CBB-19	K_{12} D_{10} 96-2	North Karnataka	Fruits light purple with pinkish purple patches, ellipsoid
21.	CBB-20	K_{12} D_{10} 75-3	North Karnataka	Fruits light purple, ovoid
22.	CBB-21	K_{12} D_{10} 38-5	North Karnataka	Fruits purple with narrow white stripes, obovate
23.	CBB-22	K_{12} D_{10} 129-4	Orissa	Fruits green with white patches, ovoid
24.	CBB-23	K_{12} D_{10} 19-1	Orissa	Fruits green with white patches, obovate
25.	CBB-24	R-2583	V.R.S. Kalyanpur	Fruits light green, ellipsoid

Contd……

Table 2. Continued…

Sl. No.	Genotypes coded	Genotypes	Source	Fruit characters
26.	CBB-25	K_{12} D_{10} 81-3	North Karnataka	Fruits purple with narrow white stripes, ovoid
27.	CBB-26	K_{12} D_{10} 2-3	Orissa	Fruits green with white patches, obovate
28.	CBB-27	R-2584	V.R.S. Kalyanpur	Fruits green with white patches, globular
29.	CBB-28	R-2582	V.R.S. Kalyanpur	Fruits light sky blue, ellipsoid
30.	CBB-29	K_{12} D_{10} 33-4	North Karnataka	Fruits purple with narrow white stripes, ovoid
31.	CBB-30	R-2585	V.R.S. Kalyanpur	Fruits green with white patches, globular
32.	CBB-31	K_{12} D_{10} 19-1	Orissa	Fruits green with white patches, round
33.	CBB-32	K_{12} D_{10} 36-1	North Karnataka	Fruits purple with narrow white stripes, ovoid
34.	CBB-33	K_{12} D_{10} 128-1	Orissa	Fruits green with white patches, obovate
35.	CBB-34	R-2590	V.R.S. Kalyanpur	Fruits green, obovate
36.	CBB-35	K_{12} D_{10} 2-7	Orissa	Fruits green with white patches, ovoid
37.	CBB-36	R-2594	V.R.S. Kalyanpur	Fruits white, ovoid
38.	CBB-37	K_{12} D_{10} 8-2	North Karnataka	Fruits purple with narrow green stripes, obovate
39.	CBB-38	R-2591	V.R.S. Kalyanpur	Fruits green, obovate
40.	CBB-39	K_{12} D_{10} 123-2	Orissa	Fruits green with white patches, pear
41.	CBB-40	K_{12} D_{10} 71-8	North Karnataka	Fruits purple, round
42.	CBB-41	K_{12} D_{10} 86-2	Orissa	Fruits green with white patches, globular
43.	CBB-42	K_{12} D_{10} 32-4	North Karnataka	Fruits purple with narrow white stripes, ovoid
44.	CBB-43	K_{12} D_{10} 80-2	North Karnataka	Fruits purple with narrow white stripes, ovoid
45.	CBB-44	K_{12} D_{10} 114-1	North Karnataka	Fruits white with narrow purple stripes, ovoid
46.	CBB-45	Sokanadigi Local	Sokanadigi	Fruits purple with white stripes, round
47.	CBB-46	K_{12} D_{10} 11-5	Orissa	Fruits green with white patches, round
48.	CBB-47	K_{12} D_{10} 54-1	North Karnataka	Fruits purple with pink purple patches, globular
49.	CBB-48	K_{12} D_{10} 83-3	North Karnataka	Fruits purple with narrow white stripes, obovate
50.	CBB-49	K_{12} D_{10} 26-1	Orissa	Fruits green, round

Contd…

Table 2. Continued…

Sl. No.	Genotypes coded	Genotypes	Source	Fruit characters
51.	CBB-50	K_{12} D_{10} 38-4	Orissa	Fruits green, obovate
52.	CBB-51	R-2580	V.R.S. Kalyanpur	Fruits whitish purple, obovate
53.	CBB-52	K_{12} D_{10} 106-1	Orissa	Fruits green with white patches, round
54.	CBB-53	L-3267	V.R.S. Kalyanpur	Fruits green, club
55.	CBB-54	R-2592	V.R.S. Kalyanpur	Fruits light purple, globular
56.	CBB-55	K_{12} D_{10} 28-5	North Karnataka	Fruits purple, globular
57.	CBB-56	R-2587	V.R.S. Kalyanpur	Fruits purple, pear
58.	CBB-57	R-2586	V.R.S. Kalyanpur	Fruits whitish purple, obovate
59.	CBB-58	K_{12} D_{10} 105-1	Orissa	Fruits green with white patches, ovoid
60.	CBB-59	R-2589	V.R.S. Kalyanpur	Fruits purple, globular

V. R. S= Vegetable Research Station

CBB= College of Bagalkot Brinjal

3.3.2 Layout of the experiment

Number of treatments : 60 genotypes

Experimental design : RCBD

Replications : 3

Season : *Rabi* 2013

Protrays were filled with a mixture of vermicompost and cocopeat, seeds were sown and watered to moisten. These protrays were covered with black polythene to build up humidity for better and early germination of seeds. As soon the seeds germinated, polythene cover was removed and watering done either in the morning or evening hours. The 19:19:19 sprayed to the seedlings @ 0.5gm/liter of water at 25 days after sowing and again this was repeated after 10 days. Triazophos spray @ 1.5 ml/liter of water was taken to protect from leaf miner incidence. Main field was prepared to fine tilth by repeated ploughing and harrowing and the FYM @ 25t/ha was incorporated into the soil. Ridges and furrows prepared at a spacing of 75 cm. On these ridges six week old seedlings were planted at a spacing of 60 cm (Anon., 2012).

Thus, 15 plants were planted on each ridge with plot area of 6.75 m^2. The fertilizers were applied at the rate of 125:100:50 NPK kg/ha and as per the package of practices UHS, Bagalkot (Anon., 2013b). The overall view of experimental field layout is shown in Plate 1.

3.4 Observations recorded

Five randomly chosen plants in each replication of each genotype were labeled and used for recording the observations. The mean of five plants was calculated and used for analysis. The characters studied and techniques adopted to record the observations are given below.

3.4.1 Growth parameters

3.4.1.1 Plant height (cm)

Plant height was measured from ground level to the tip of the plant at 60, 90 and 120 days after transplanting (DAT) and expressed in centimeters.

3.4.1.2 Plant spread (cm)

Plant spread was measured from east to west and north to south direction of the plant at 60, 90 and 120 DAT and expressed in centimeters.

3.4.1.3 Number of primary branches per plant

Number of branches arising on main stem was counted at 60, 90 and 120 DAT.

3.4.1.4 Stem girth (cm)

The girth of the main stem at ground level was measured using vernier calipers at 60, 90 and 120 DAT and expressed in centimeters.

3.4.1.5 Leaf area (cm^2)

The fourth leaf from the tip of the branch was used for recording leaf area it was considered as physiologically fully active. Leaf area was measured by plotting the leaf on the graph and calculated by using below laid formula.

Plate 1: General view of experimental plot

$$\text{Leaf area } (cm^2) = \text{Maximum length} \times \text{Maximum width} \times \text{Factor}$$

Where, Factor = Actual leaf area/ leaf area measured using length and width of leaves.

3.4.2 Earliness parameters

3.4.2.1 Days to first flowering

Number of days taken from the date of transplanting to date of first flower opening was recorded and day to first flowering was calculated.

3.4.2.2 Days to 50 per cent flowering

Number of days taken from the date of transplanting to the day on which 50 per cent of plants flowered was recorded.

3.4.2.3 Days to first fruit maturity

Number of days taken from the date of transplanting to the day on which first fruit attaining physiological maturity (edible maturity) was recorded.

3.4.3 Yield parameters

3.4.3.1 Fruit length

Length of ten mature fruits at third picking was measured individually from the base of calyx to the tip of fruit and average of ten fruits was worked out and expressed in centimeters.

3.4.3.2 Fruit diameter

The fruits selected for measuring fruit length were used to measure the diameter of fruit in centimeter using vernier callipers at widest point of the fruit. Average of ten fruits diameter was worked out and expressed in centimeters.

3.4.3.3 Fruit length-diameter ratio

Average value of fruit length was divided by average value of fruit diameter to derive the fruit length-diameter ratio.

3.4.3.4 Average fruit weight (g)

Average fruit weight was calculated by selecting ten fruits (edible maturity stage) randomly from each of five tagged plants at third harvest and divided it by total number of fruits and expressed in grams per fruit.

3.4.3.5 Number of fruits per cluster

Number of fruits per cluster was recorded from randomly selected five clusters in five tagged plants and average was worked out.

3.4.3.6 Number of fruits per plant

Number of fruits harvested from each of the tagged plants in an experimental plot from all pickings during crop season was totaled and average number of fruits per plant was worked out.

3.4.3.7 Early yield per plant

Total weight of fruits harvested from first three pickings was added from five tagged plants and average was worked out as early yield and expressed in kilograms per plant.

3.4.3.8 Total yield per plant (kg)

Total weight of fruits harvested from five tagged plants of all pickings was added and average yield per plant was worked out and expressed in kilograms per plant.

3.4.3.9 Yield per plot (kg)

The weight of fruits harvested from each picking was recorded from each plot (including the tagged plants) and total yield per plot was obtained by adding the yields of all the harvests and expressed in kilograms per plot.

3.4.3.10 Yield per hectare (t)

Yield per hectare was calculated by using the following formula and expressed in tones per hectare.

$$\text{Yield /ha (t)} = \frac{\text{Yield /plot (kg)} \times 10{,}000}{\text{Plot area} \times 1{,}000}$$

Plot area= 6.75 square meter

3.4.4 Quality parameters

3.4.4.1 Per cent dry matter in fruit

Fresh weight of the fruit was noted and fruit samples were cut into pieces and kept in hot air oven for obtaining dry weight. The samples were dried at 60 ^{0} C till constant weight of samples was achieved over the two subsequent observations and dry weight of fruits was recorded and per cent dry matter in fruit was worked out as follows.

$$\text{Per cent dry matter in fruits} = \frac{\text{Dehydrated fruit weight}}{\text{Fresh fruit weight}} \times 100$$

3.4.4.2 Fruit colour

Based on visual observation the highest per cent of fruit covered with particular colour is named as light, medium and dark based on intensity of colour. Stripe colour on the fruit is also mentioned as the case after recognizing major colour of fruit.

3.4.4.3 Spinyness

It was recorded as spineless when the all the plant parts were devoid of spines, otherwise it was scored as spiny. Spinyness was observed on stem, dorsal and ventral surface of leaf, leaf petiole, calyx and fruit pedicel.

3.4.4.4 Hairyness (leaves)

Based on visual observation of the dorsal and ventral surface of leaves the hairyness and non- hairyness was recorded.

3. 4.4.5 Phenol content (mg/100 g of fruit)

Total phenol content of brinjal fruits was estimated by folin ciocalteu reagent (FCR) method and the procedure is given below.

A sample of 0.5 g of fresh fruit tissue was taken and grinded in 10 ml of ethanol with the help of pestle and mortar and filtered the solution using muslin cloth from which one ml filtered solution was taken in a test tube and boiled at 100^0 C till the solution was evaporated. One ml of distilled water was added to the test tube and from this 0.1 ml of solution was taken into another test tube to which 2.9 ml of distilled water, 1 ml of FCR reagent and two ml of sodium carbonate was added, cooled and finally absorbance was measured at 650 nm wave lengths by using spectrophotometer. Total phenol content was calculated with the help of standard graph and expressed in mg per 100 g of fresh fruit weight (Sadasivam and Manickam, 2005).

3.4.5 Pest and disease incidence

3.4.5.1 Number of dead heart

Number of shoots bored by borer showing the symptoms of drying (dead heart) were counted in 5 plants at 30, 60, 90 and 120 days after transplanting. The sum of these four readings were computed.

$$\text{Per cent shoot infestation} = \frac{\text{Number of infested shoots}}{\text{Total number of shoots observed}} \times 100$$

3.4.5.2 Fruit borer infestation

The number of bored fruits was recorded from the first six harvests and mean per cent infested fruits per plant was worked out as follows.

$$\text{Per cent fruit infestation} = \frac{\text{Number of infested fruits}}{\text{Total number of fruits observed}} \times 100$$

3.4.5.3 Little leaf incidence

Under natural disease pressure conditions each plant in each plot was observed for appearance of little leaf disease symptoms at 90 days after planting. Plant showing mild little leaf or severe little leaf or completely infected were recorded as infected. Per cent disease incidence was computed by following the formula given below.

$$\text{Little leaf incidence (\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants observed}} \times 100$$

3.4.5.4 Phomopsis blight incidence

The number of infected fruits was recorded from the first six harvests and mean per cent infected fruits per plant was worked out as followed.

$$\text{Phomopsis blight incidence (\%)} = \frac{\text{Number of infected fruits}}{\text{Total number of fruits observed}} \times 100$$

3.5 Statistical and Biometrical analysis

The data collected from the experiment was subjected to various statistical analysis to draw the suitable inference. The details of the statistical procedure followed are given below.

3.5.1 Analysis of variance (ANOVA)

Analysis of variance was carried out as per the procedure given by Panse and Sukhatme (1967). Using the mean values of randomly selected plants in each replication from all treatment to find out the significance of treatment effects. The details of analysis of variance are as follows.

Source of variations	Degrees of freedom (d.f)	S.S.	M.S.S.	F ratio (Cal.F)
Replication	(r-1)	RSS	Mr (M_1)	Mr/ Me
Genotype	(g-1)	GSS	Mg (M_2)	Mg/ Me
Error	(r-1) (t-1)	ESS	Me (M_3)	-
Total	(rt-1)	-	-	-

Where,

r = Number of replication Mr= Mean sum of square of replication

g = Number of genotypes Mg = Mean sum of square of genotypes

Me = Mean sum of square of error

Statistical significance of variation due to genotype was tested by comparing calculated values to table F values at one per cent and five per cent level of probability.

3.5.2 Estimation of genetic parameters

3.5.2.1 Genotypic and phenotypic variance

The genotypic and phenotypic variances were computed based on the expected mean sum of squares from ANOVA table as follows:

$$\text{Genotypic variance } (\sigma^2_g) = \frac{\text{Genotype MSS } (M_g) - \text{Error MSS } (M_e)}{r}$$

$$\text{Phenotypic variance } (\sigma^2_P) = \sigma^2_g + \sigma^2_e$$

$$\text{Environmental variance } (\sigma^2_e) = Me$$

3.5.2.2 Coefficient of variations

Genotypic and phenotypic coefficients of variations were computed according to Burton and Devane (1953) based on the estimate of genotypic and phenotypic variances as follows.

3.5.2.3 Genotypic co-efficient of variation (GCV)

$$\text{GCV (\%)} = \frac{\sigma g}{\overline{X}} \times 100$$

3.5.2.4 Phenotypic co-efficient of variation (PCV)

$$\text{PCV (\%)} = \frac{\sigma p}{\overline{X}} \times 100$$

Where,

$\overline{X}$ = General mean

σg = Genotypic standard deviation

σp = Phenotypic standard deviation

GCV and PCV were classified as suggested by Sivasubramanian and Menon (1973).

0-10% : Low

10-20% : Moderate

20% and above : High

3.5.2.5 Heritability

Broad sense heritability was estimated as the ratio of genotypic variance to the phenotypic variance and expressed in percentage (Falconer, 1981).

$$\text{Heritability } (h^2) = \frac{\sigma^2 g}{\sigma^2 p} \times 100$$

Where,

$\sigma^2 g$ = Genotypic Variance

$\sigma^2 p$ = Phenotypic Variance

Heritability percentage was catagorised as demonstrated by Robinson *et al*. (1949).

0-30% : Low

31-60% : Moderate

>60% : High

3.5.2.6 Genetic advance (GA)

Genetic advance (GA) was computed using the formula given by Robinson *et al.* (1949).

$$GA = i.P.h^2$$

Where,

i = Selection differential (2.06) at 5 per cent selection intensity

P = Phenotypic standard deviations

h^2 = Heritability at broad sense

3.5.2.7 Genetic advance as percentage over mean (GAM)

Genetic advance as percentage over mean was worked out as suggested by Johnson *et al.* (1955).

$$\text{Genetic advance over mean (GAM)} = \frac{GA}{\overline{X}} \times 100$$

Where, GA = Genetic advance

$\overline{X}$ = General mean of the character

The GAM was categorized as suggested by Johnson *et al*. (1955).

0-10% : Low

11-20% : Moderate

>20% : High

3.5.3 Correlation

The correlation co-efficient among all important character combinations at phenotypic (r_p) and genotypic (r_g) level were estimated by employing formula given by Al-Jibouri *et al.* (1958).

$$\text{Phenotypic correlation} = r_{xy}(p) = \frac{Cov_{xy}(P)}{\sqrt{Vx(p)X}}$$

$$\text{Genotypic correlation} = r_{xy}(g) = \frac{Cov_{xy}(g)}{\sqrt{Vx(g)X}}$$

Where,

Cov_{xy} (G) = Genotypic covariance between x and y characters

Cov_{xy} (P) = Phenotypic covariance between x and y characters

V_x (G) = Genotypic variance of character ‘x’

V_x (P) = Phenotypic variance of character 'x'

V_y (G) = Genotypic variance of character 'y'

V_y (P) = Phenotypic variance of character 'y'

The test of significance for association between characters was done by comparing table 'r' values at n-2 error degrees of freedom for phenotypic and genotypic correlations with estimated values, respectively.

3.5.4 Path co-efficient analysis

Path co-efficient analysis suggested by Wright (1921) and Dewey and Lu (1957) was carried out to know the direct and indirect effect of the morphological traits on plant yield. The following set of simultaneous equations were formed and solved for estimating various direct and indirect effects.

$r_{1y} = a + r_{12}b + r_{13}c + \ldots\ldots\ldots\ldots\ldots\ldots + r_{1Ii}$

$r_{2y} = a + r_{21}a + b + r_{23}c + \ldots\ldots\ldots\ldots\ldots + r_{2Ii}$

$r_{3y} = r_{31}a + r_{32}b + c + \ldots\ldots\ldots\ldots\ldots\ldots + r_{3Ii}$

$r_{1y} = r_{11}a + r_{12}b + r_{13}c + \ldots\ldots\ldots\ldots\ldots + I$

Where,

r_{1y} to 1_{1y} = Co-efficient of correlation between causal factors 1 to I with dependent characters y.

r_{12} to r_{1I} = Co-efficient of correlation among causal factors

a, b, c…i = Direct effects of characters 'a' to 'I' on the dependent character 'y'

Residual effect (R) was computed as follows.

Residual effect (R) = $1- \sqrt{a^2 + b^2 + c^2 + \ldots\ldots\ldots i^2 + 2abr_{12} + 2acr_{13} + \ldots}$

Lenka and Mishra (1973) have suggested scales for path coefficients analysis.

0.00-0.09: Negligible

0.10-0.19: Low

0.20-0.29: Moderate

0.30-0.99: High

>1.00: Very high

3.5.5 Genetic divergence

3.5.5.1 Mahalanobis D^2 analysis

Mahalanobis (1936) D^2 statistic was used for assessing the genetic divergence between different populations. The D^2 analysis was carried out using the data recorded on germplasms. Mahalanobis generalized distance (D^2) between any two populations is given by the formula.

$$D^2 = \sum \lambda^{ij} \sigma^i \sigma^j$$

Where,

D^2 = Square of generalized distance

λ^{ij} = Reciprocal of the common dispersal index

$\sigma^i = \mu i1 - \mu i2$

$\sigma^j = \mu j1 - \mu j2$

μ = General mean

Since, the formula for computation requires inversion of higher order determinants, transformation of the original correlated unstandardised character mean (Xs) to standardise uncorrelated variable (Ys) was done to simplify the computational procedure. The D^2 values were obtained as the corresponding uncorrelated (Ys) values of any two uncorrelated genotypes (Rao, 1952).

3.5.5.2 Clustering of genotypes

Using all the n (n-1)/2D^2 values were grouped into cluster using Toucher's method as described by Rao (1952).

3.5.5.3 Intra and inter-cluster distance

The intra and inter-cluster distances were calculated by following the formula described by Singh and Choudhary (1977).

$$\text{Square of intra-cluster distance} = \frac{\Sigma D_i^2}{N}$$

Where,

ΣD_i^2 = Sum of distances between all possible combinations of the entries included in the cluster

N = Number of all possible combinations

$$\text{Square of inter-cluster distance} = \frac{\Sigma D_{ij}^2}{n_i n_j}$$

Where,

ΣD_{ij}^2 = Sum of distances between all possible combinations ($n_i n_j$) of the entries included in the cluster

n_i = Number of entries in the cluster i

n_j = Number of entries in the cluster j

4. EXPERIMENTAL RESULTS

The present investigation on genetic variability, correlation, path analysis and divergence were carried out using 60 genotypes of brinjal (*Solanum melongena* L.) at the Research Block of Vegetable Section in Sector No. 1 under the University of Horticultural Sciences, Bagalkot (Karnataka). The results obtained are presented in this chapter.

4.1 Genetic variability

4.1.1 Analysis of variance

The results of the analysis of variance for 29 characters under study are summarised in Tables 3 and 4. The variance due to treatments (genotypes) was highly significant for 26 characters *viz.*, plant height (at 60, 90 and 120 DAT), plant spread (at 60, 90 and 120 DAT), number of primary branches (at 60, 90 and 120 DAT), stem girth at 60 DAT, leaf area (at 60 and 90 DAT), days to first flowering, days to 50 per cent flowering, days to first fruit maturity, number of fruits per cluster, fruit length, fruit diameter, fruit length-diameter ratio, average fruit weight, number of fruits per plant, total yield per plant, yield per plot, yield per hectare, per cent dry matter in fruits and phenol content. There was no significant differences among genotypes for stem girth (at 90 and 120 DAT) as well as early yield per plant.

4.1.2 Genetic variability, heritability and genetic advance

The estimates of mean, range, genotypic variance (GV), phenotypic variance (PV), genotypic coefficient of variance (GCV), phenotypic coefficient of variance (PCV), heritability (h^2), genetic advance (GA) and genetic advance as per cent over mean (GAM) were worked out for 29 plant traits and are presented in Tables 5 and 7.

4.1.2.1 Plant height

Plant height at 60 DAT (Tables 5 and 6) ranged from 35.33 cm (CBB-39) to 67.33 cm (CBB-8) with a mean value of 54.28 cm. The GV (49.66) and PV (50.01) were high. The moderate GCV (12.98%) and PCV (13.08%) were observed. High heritability (99.31%) along with high genetic advance over mean (26.64%) and moderate genetic advance (14.46) were noticed for this trait.

Table 3. Analysis of variance (mean sum of squares) for growth and earliness parameters in brinjal genotypes

Sl. No.	Source of variation / character	Replication	Genotypes (Treatment)	Error	CD (1%)	CD (5%)
	Degrees of freedom	2	59	118		
A.	**Growth parameters**					
1.	Plant height at 60 DAT (cm)	1.11	149.34**	0.34	0.88	0.66
2.	Plant height at 90 DAT (cm)	147.93	250.84**	21.03	6.87	5.19
3.	Plant height at 120 DAT (cm)	137.99	261.84**	20.75	6.82	5.16
4.	Plant spread at 60 DAT (cm)	1.72	171.04**	0.30	0.82	0.62
5.	Plant spread at 90 DAT (cm)	1111.35	183.43**	44.90	10.04	7.59
6.	Plant spread at 120 DAT (cm)	915.24	172.17**	43.48	9.88	7.47
7.	Number of primary branches at 60 DAT	11.68	2.61**	1.13	1.59	1.20
8.	Number of primary branches at 90 DAT	2.08	8.17**	0.16	0.60	0.45
9.	Number of primary branches at 120 DAT	1.99	7.38**	0.15	0.59	0.44
10.	Stem girth at 60 DAT (cm)	0.02	0.26**	0.0036	0.090	0.068
11.	Stem girth at 90 DAT (cm)	0.65	0.22^{NS}	0.057	0.36	0.27
12.	Stem girth at 120 DAT (cm)	0.67	0.22^{NS}	0.058	0.36	0.27
13.	Leaf area at 60 DAT (cm^2)	56.08	3238.55**	12.22	5.24	3.96
14.	Leaf area at 90 DAT (cm^2)	12.88	8811.94**	79.46	13.36	10.10
B.	**Earliness parameters**					
15.	Days to first flowering	35.48	98.48**	7.014	3.96	3.00
16.	Days to 50 per cent flowering	30.09	93.14**	5.60	3.54	2.68
17.	Days to first fruit maturity	8.73	59.43**	3.83	2.93	2.21

**Significant at p=0.01 NS – Non- significant DAT- Days after transplanting

Table 4. Analysis of variance (mean sum of squares) for yield and quality parameters in brinjal genotypes

Sl. No.	Source of variation / character	Replication	Genotypes (Treatment)	Error	CD (1%)	CD (5%)
	Degrees of freedom	2	59	118		
C.	**Yield parameters**					
18.	Number of fruits per cluster	0.0021	0.65**	0.0010	0.048	0.036
19.	Fruit length (cm)	0.99	6.32**	0.47	1.02	0.77
20.	Fruit diameter (cm)	0.30	2.059**	0.171	0.62	0.46
21.	Fruit length-diameter ratio	0.0058	0.47**	0.0098	0.14	0.11
22.	Early yield per plant (kg)	0.012	0.10^{NS}	0.010	0.15	0.11
23.	Average fruit weight (g)	0.21	2354.70**	1.33	1.73	1.30
24.	Number of fruits per plant	2.94	224.79**	18.18	6.39	4.83
25.	Total yield per plant (kg)	0.026	0.45**	0.037	0.29	0.21
26.	Yield per plot (kg)	7.75	91.85**	7.028	3.97	3.00
27.	Yield per hectare (t)	16.97	201.54**	15.42	5.88	4.45
D.	**Quality parameters**					
28.	Per cent dry matter in fruits	0.23	11.37**	0.60	1.17	0.88
29.	Phenol content (mg/100 g)	14.69	14770.24**	3.59	2.84	2.14

**Significant at p=0.01 NS – Non- significant

The range for plant height at 90 DAT (Tables 5 and 6) was from 42.64 cm (CBB-39) to 93.20 cm (CBB-54) with a mean value of 66.90 cm. The estimates of genotypic variance (76.60) and phenotypic variance (97.63) were high. The estimates of genotypic coefficient of variation (13.08%) and phenotypic coefficient of variation (14.76%) were moderate and high heritability (78.46%) along with high GAM (23.86%) and moderate GA (15.97) were observed for this trait.

The range for plant height at 120 DAT (Tables 5 and 6) varied from 47.00 cm (CBB-39) to 99.83 cm (CBB-54) with a mean value of 73.41 cm. The GV and PV were high (80.36 and 101.11, respectively). The moderate GCV (12.21%) and PCV (13.69%) were observed. High heritability (79.48%) and moderate GA (16.46) as well as high GAM (22.42%) were observed for this trait.

4.1.2.2 Plant spread

Plant spread at 60 DAT (Tables 5 and 6) ranged from 40.73 cm (CBB-53) to 77.36 cm (CBB-16) with a mean value of 59.99 cm. The GV (56.91) and PV (57.21) were very high. The moderate genotypic coefficient of variation (12.57%) and phenotypic coefficient of variation (12.60%) with high heritability (99.47%) and moderate GA (15.49) and high GAM (25.83%) were noticed for this trait.

At 90 DAT (Tables 5 and 6) plant spread range varied from 48.42 cm (CBB-53) to 88.06 cm (CBB-16) with a mean value of 69.81 cm. The high genotypic variance (46.17) and phenotypic variance (91.08) were observed. The low estimates of GCV (9.73%) with moderate PCV (13.66%) and moderate heritability (50.70%) and low GA (9.96) and moderate GAM (14.27%) were observed for this trait.

The range for plant spread at 120 DAT (Tables 5 and 6) was from 50.06 cm (CBB-53) to 90.93 cm (CBB-16) with a mean value of 73.79 cm. The genotypic variance (42.89) and phenotypic variance (86.37) were high. The low estimates of GCV (8.87%) with moderate PCV (12.59%) and moderate heritability (49.66%) and low GA (9.50) and moderate GAM (12.88%) were observed.

Table 5. Estimates of range, mean, components of variance, heritability and genetic advance for growth parameters in brinjal

Sl. No.	Character	Range	Mean ±S.Em	GV	PV	GCV (%)	PCV (%)	h^2 (%)	GA	GAM (%)
A.	**Growth parameters**									
1.	Plant height at 60 DAT (cm)	35.33-67.33	54.28±0.336	49.66	50.01	12.98	13.08	99.31	14.46	26.64
2.	Plant height at 90 DAT (cm)	42.64-93.20	66.90±2.625	76.60	97.63	13.08	14.76	78.46	15.97	23.86
3.	Plant height at 120 DAT (cm)	47.70-99.83	73.41±2.608	80.36	101.11	12.21	13.69	79.48	16.46	22.42
4.	Plant spread at 60 DAT (cm)	40.73-77.36	59.99±0.315	56.91	57.21	12.57	12.60	99.47	15.49	25.83
5.	Plant spread at 90 DAT (cm)	48.42-88.06	69.81±3.836	46.17	91.08	9.73	13.66	50.70	9.96	14.27
6.	Plant spread at 120 DAT (cm)	50.06-90.93	73.79±3.775	42.89	86.37	8.87	12.59	49.66	9.50	12.83
7.	Number of primary branches at 60 DAT	2.74-6.10	4.90±0.608	0.49	1.62	14.31	25.97	30.38	0.79	16.25
8.	Number of primary branches at 90 DAT	3.96-11.26	6.65±0.229	2.67	2.83	24.56	25.29	94.31	3.26	49.14
9.	Number of primary branches at 120 DAT	4.76-11.80	7.25±0.225	2.40	2.56	21.40	22.08	93.93	3.09	42.73
10.	Stem girth at 60 DAT (cm)	0.85-2.20	1.41±0.034	0.08	0.09	21.02	21.46	95.99	0.59	42.44
11.	Stem girth at 90 DAT (cm)	1.23-2.38	1.81±0.137	0.05	0.11	12.94	18.54	48.73	0.33	18.61
12.	Stem girth at 120 DAT (cm)	1.27-2.41	1.85±0.138	0.05	0.11	12.65	18.14	48.66	0.33	18.18
13.	Leaf area at 60 DAT (cm^2)	36.63-232.10	95.69±2.001	1075.44	1087.67	34.26	34.46	98.88	67.17	70.19
14.	Leaf area at 90 DAT (cm^2)	79.47-372.00	146.11±5.103	2910.82	2990.28	36.92	37.42	97.34	109.65	75.04

GV = Genotypic variance PV = Phenotypic variance GCV = Genotypic coefficient of variance GA= Genetic advance h^2 = Heritability (broad sense)
PCV =Phenotypic coefficient of variance GAM = Genetic advance (per cent mean) DAT= Days after transplanting

Table 6. ***Per se*** **performance of brinjal (** ***Solanum melongena*** **L.) genotypes for growth and earliness parameters**

Sl. No.	Genotypes	Plant height (cm)			Plant spread (cm)			Number of primary branches			Stem girth (cm)			Leaf area (cm^2)		Days to first flowering	Days to 50 per cent flowering	Days to first fruit maturity
		60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT			
1.	CBB-1	53.86	65.10	70.16	59.76	75.90	80.05	5.53	5.63	6.05	1.54	1.91	1.97	68.40	95.47	41.33	50.53	66.73
2.	CBB-2	56.70	69.62	74.66	59.56	67.40	70.90	5.63	6.66	6.85	1.76	2.26	2.32	71.01	116.15	47.00	54.86	69.26
3.	CBB-3	55.70	65.73	71.16	59.06	65.93	69.86	4.76	7.13	7.39	1.46	1.92	1.97	91.56	144.60	53.66	60.26	76.20
4.	CBB-4	58.00	68.16	74.00	67.50	75.73	81.00	5.85	8.53	8.66	1.58	2.02	2.08	113.45	134.29	46.00	53.66	70.26
5.	CBB-5	55.33	66.33	74.00	63.93	69.13	75.83	6.07	7.60	7.73	1.34	1.99	2.06	92.10	192.92	47.66	54.13	72.66
6.	CO-2	60.46	72.16	79.83	58.33	66.61	72.83	4.78	5.26	5.70	1.54	1.65	1.71	66.02	92.91	45.33	51.26	70.33
7.	CBB-6	63.53	79.00	86.00	76.53	84.52	87.46	8.51	9.86	10.60	2.14	2.38	2.44	104.33	141.76	51.33	58.46	76.93
8.	CBB-7	56.40	68.73	75.86	59.73	68.78	73.60	5.43	6.13	6.46	1.78	2.14	2.18	70.05	103.36	53.33	59.33	79.33
9.	CBB-8	67.33	75.40	83.33	77.16	86.89	89.63	4.88	5.80	6.16	2.13	2.37	2.41	139.56	159.45	58.00	64.00	84.93
10.	CBB-9	56.66	66.10	72.83	59.30	68.67	71.93	5.53	8.53	8.83	1.71	2.02	2.06	44.16	100.54	45.00	52.20	68.33
11.	CBB-10	55.40	66.40	73.66	57.20	69.77	75.33	3.40	4.93	5.29	1.07	1.59	1.63	122.80	273.33	52.66	59.40	76.26
12.	CBB-11	54.80	71.63	79.91	66.80	76.65	79.83	5.55	6.53	6.70	1.59	2.02	2.06	51.51	125.30	46.66	52.13	69.13
13.	CBB-12	55.53	66.73	72.38	57.46	68.38	72.56	5.85	9.80	9.90	1.58	1.80	1.86	90.35	133.96	41.66	50.80	71.86
14.	CBB-13	45.33	56.30	63.16	50.63	62.93	67.16	3.98	6.40	6.58	1.04	1.41	1.48	75.03	132.23	55.33	60.26	77.00
15.	CBB-14	49.20	62.33	72.63	50.56	59.69	64.96	4.21	6.46	6.86	1.40	1.29	1.33	93.06	121.64	56.33	62.93	78.46
16.	CBB-15	57.86	66.76	75.03	66.53	78.81	83.03	6.03	10.06	10.53	1.54	1.77	1.80	80.27	103.29	49.66	55.86	71.80
17.	CBB-16	59.20	69.00	76.73	77.36	88.06	90.93	5.63	9.73	10.40	2.20	1.78	1.83	108.86	143.32	51.66	58.86	72.26
18.	CBB-17	60.40	72.96	81.33	58.46	65.54	69.33	4.40	8.93	9.43	1.46	2.37	2.40	112.57	124.07	53.33	60.00	75.26
19.	CBB-18	52.33	64.96	69.93	67.66	76.32	80.10	5.40	8.20	8.63	1.57	1.85	1.90	147.62	181.04	47.00	54.53	74.13
20.	CBB-19	49.00	59.36	65.45	56.73	66.05	71.80	4.54	6.73	7.16	1.08	1.73	1.76	81.28	137.50	56.00	63.53	77.46
21.	CBB-20	51.40	60.73	67.31	58.53	66.15	71.80	3.43	6.00	6.70	1.36	1.48	1.52	74.39	100.38	41.00	49.40	70.26
22.	CBB-21	60.40	74.86	82.01	65.33	75.58	79.06	5.22	7.73	8.36	1.53	1.62	1.67	80.09	148.82	40.33	48.93	71.40

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Table 6. Continued…

Sl. No.	Genotypes	Plant height (cm)			Plant spread (cm)			Number of primary branches			Stem girth (cm)			Leaf area (cm^2)		Days to first flowering	Days to 50 per cent Flowering	Days to first fruit maturity
		60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT			
23.	CBB-22	51.60	59.63	65.76	60.86	71.94	75.63	4.76	7.13	7.60	1.18	1.79	1.85	140.33	188.20	54.33	61.00	75.73
24.	CBB-23	62.40	72.86	78.01	68.50	78.41	82.40	5.32	11.26	11.80	1.66	1.64	1.69	94.58	152.54	53.33	59.46	77.06
25.	CBB-24	63.46	74.16	80.23	68.50	76.49	82.36	6.08	8.20	9.00	1.54	1.96	2.02	108.11	135.12	50.33	54.73	72.00
26.	CBB-25	52.80	62.40	68.85	51.36	61.14	66.63	3.76	5.20	5.90	1.32	1.62	1.66	102.63	138.49	52.00	58.40	75.26
27.	CBB-26	49.80	57.60	64.70	59.40	68.37	73.10	5.65	6.46	7.10	1.48	1.89	1.94	92.40	155.93	44.33	50.13	69.40
28.	CBB-27	59.66	70.63	74.53	61.30	68.42	73.33	4.18	6.53	7.20	1.22	1.52	1.58	96.06	136.50	60.66	67.86	82.46
29.	CBB-28	59.53	75.50	83.36	68.16	73.60	77.46	6.30	7.66	8.26	1.72	2.27	2.30	93.76	138.36	57.00	64.33	79.06
30.	CBB-29	58.60	68.30	76.07	66.40	69.03	72.70	4.62	7.80	8.53	1.42	2.06	2.13	84.71	147.29	50.66	57.60	79.13
31.	CBB-30	58.40	72.96	79.70	71.60	86.85	89.60	4.06	5.33	6.00	1.23	1.71	1.74	148.35	175.83	57.66	64.60	78.06
32.	CBB-31	52.86	62.30	67.06	65.10	74.92	78.03	4.53	5.13	5.90	1.28	1.79	1.84	113.88	151.44	52.33	62.53	74.13
33.	CBB-32	58.33	68.20	74.03	61.70	72.49	76.22	4.86	5.00	5.70	1.20	1.91	1.96	90.80	109.26	38.33	49.00	66.53
34.	CBB-33	42.53	50.43	57.30	56.20	65.33	70.10	4.21	6.86	7.36	1.08	1.65	1.68	86.46	118.49	60.00	68.26	80.40
35.	CBB-34	63.33	82.40	85.46	68.66	78.53	80.71	5.19	7.80	8.30	1.54	1.61	1.65	92.26	123.03	54.00	61.13	77.26
36.	CBB-35	57.40	63.43	67.01	53.26	63.86	68.03	5.98	7.60	8.23	1.34	1.84	1.90	70.51	91.73	44.00	50.66	69.33
37.	CBB-36	62.80	82.53	87.26	53.83	64.99	71.11	4.73	5.20	5.93	1.54	2.08	2.12	76.52	114.14	53.33	62.46	76.20
38.	CBB-37	57.33	65.06	70.66	59.86	68.55	72.79	3.96	6.00	6.76	1.14	1.57	1.60	80.41	146.67	50.00	59.73	71.00
39.	CBB-38	61.46	76.46	81.40	65.50	71.81	75.03	5.75	9.40	9.93	1.72	2.10	2.13	103.81	160.39	51.66	59.93	73.33
40.	CBB-39	35.33	42.64	47.00	47.23	73.05	58.35	4.31	6.00	6.66	0.85	1.23	1.27	104.97	132.25	48.00	55.40	68.60
41.	CBB-40	51.73	65.66	73.56	67.83	76.94	79.39	4.32	7.73	8.36	1.34	1.83	1.85	101.65	175.47	43.00	48.73	68.80
42.	CBB-41	44.60	52.73	62.50	51.80	69.66	75.40	2.74	4.26	5.10	1.13	1.54	1.58	128.02	268.55	61.00	68.00	81.10
43.	CBB-42	50.20	59.06	68.00	59.60	74.86	76.76	4.96	5.53	6.26	1.06	1.60	1.65	72.86	101.33	42.00	48.33	67.26
44.	CBB-43	43.60	57.20	64.76	44.36	56.00	60.56	3.66	4.00	4.93	0.88	1.52	1.57	70.52	97.74	60.00	65.40	82.13

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Table 6. Continued…

Sl. No.	Genotypes	Plant height (cm)			Plant spread (cm)			Number of primary branches			Stem girth (cm)			Leaf area (cm^2)		Days to first flowering	Days to 50 per cent Flowering	Days to first fruit maturity
		60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT			
45.	CBB-44	54.33	64.53	70.30	54.33	63.43	68.17	4.65	5.46	6.20	1.64	2.20	2.24	76.74	93.65	52.66	58.33	75.80
46.	CBB-45	43.26	64.21	69.73	57.33	72.42	77.05	4.17	4.80	5.70	1.24	1.77	1.80	143.38	185.29	44.00	51.13	69.73
47.	CBB-46	38.86	62.86	70.56	60.00	71.10	75.56	4.20	6.13	6.90	1.34	1.67	1.69	64.61	118.00	50.00	58.33	80.26
48.	CBB-47	47.26	60.43	66.60	58.00	66.05	70.33	4.22	4.60	5.30	1.06	1.71	1.73	68.10	89.15	43.66	49.53	70.00
49.	CBB-48	45.40	55.20	61.23	56.33	62.70	65.87	4.55	4.96	5.93	1.38	1.60	1.65	104.34	126.26	53.33	60.93	74.40
50.	CBB-49	53.46	69.66	76.90	55.50	63.04	64.73	3.42	3.96	4.76	1.12	1.71	1.73	190.43	298.39	57.33	64.40	77.66
51.	CBB-50	56.00	71.33	79.93	56.10	61.41	65.23	4.75	5.00	5.76	1.34	1.70	1.74	67.84	136.08	47.33	53.66	70.13
52.	CBB-51	59.00	79.96	85.03	58.33	68.53	71.59	5.32	5.56	6.23	1.07	1.53	1.58	75.40	132.57	50.33	59.66	77.60
53.	CBB-52	53.13	62.96	69.43	55.83	62.00	65.90	5.31	5.80	6.76	1.12	1.68	1.72	96.88	125.99	53.00	58.40	75.00
54.	CBB-53	35.46	46.60	50.46	40.73	48.42	50.06	4.31	4.80	5.53	0.92	1.40	1.42	70.63	83.60	40.33	47.60	67.93
55.	CBB-54	59.33	93.20	99.83	65.76	78.85	82.40	4.19	5.40	6.46	1.94	2.34	2.34	94.05	237.68	53.66	60.33	79.26
56.	CBB-55	58.33	75.20	81.50	60.43	70.35	72.65	5.86	6.20	7.16	1.44	1.98	2.03	94.58	198.59	55.66	63.26	77.86
57.	CBB-56	60.53	76.06	84.96	45.73	62.67	65.71	4.75	6.20	7.00	1.51	1.94	2.00	66.46	122.19	51.00	58.40	76.73
58.	CBB-57	56.80	77.43	85.93	59.16	70.82	72.54	6.10	8.13	8.60	1.40	1.73	1.77	127.21	203.00	54.33	60.00	77.93
59.	CBB-58	43.46	50.53	54.16	50.93	61.26	65.88	4.54	7.00	7.86	1.06	1.49	1.53	36.63	79.47	54.00	61.60	74.93
60.	CBB-59	60.00	73.73	78.80	59.73	77.03	81.27	5.23	6.33	6.90	1.62	1.96	2.01	232.10	372.00	57.33	64.13	78.00
	Mean	**54.28**	**66.90**	**73.41**	**59.99**	**69.81**	**73.79**	**4.90**	**6.65**	**7.25**	**1.41**	**1.81**	**1.85**	**95.69**	**146.11**	**50.60**	**57.71**	**74.46**
	C.V.	1.08	6.85	6.20	0.91	9.59	8.93	21.67	6.03	5.44	4.29	13.27	12.99	3.65	6.10	5.23	4.10	2.62
	S.E.	0.33	2.64	2.63	0.31	3.86	3.80	0.61	0.23	0.22	0.03	0.13	0.13	2.01	5.14	1.52	1.36	1.13
	C.D 5%	0.94	7.41	7.36	0.89	10.83	10.66	1.71	0.64	0.63	0.09	0.38	0.39	5.65	14.41	4.28	3.82	3.16
	C.D 1%	1.25	9.80	9.73	1.17	14.32	14.09	2.27	0.85	0.84	0.12	0.51	0.51	7.47	19.05	5.66	5.06	4.18

4.1.2.3 Number of primary branches

At 60 DAT (Tables 5 and 6) number of primary branches ranged from 2.74 (CBB-41) to 8.51 (CBB-6) with a mean value of 4.90. The estimates of GV (0.49) and PV (1.62) were very low. The moderate GCV (14.31%) and high PCV (25.97%) with moderate heritability (30.38%) as well as genetic advance over mean (16.25%) and low GA (0.79) were observed for this trait.

The number of primary branches at 90 DAT (Tables 5 and 6) ranged from 3.96 (CBB-49) to 11.26 (CBB-23) with a mean value of 6.65. The GV (2.67) and PV (2.83) were very low. High GCV (24.56%) and PCV (25.29%) and high heritability (94.31%) along with high genetic advance over mean (49.14%) and low GA (3.26) were observed for this trait.

The range for number of primary branches at 120 DAT (Tables 5 and 6) was from 4.76 (CBB-49) to 11.80 (CBB-23) with a mean of 7.25. The GV (2.40) and PV (2.56) were very low. The high GCV (21.40%) and PCV (22.08%) and high heritability (93.93%) along with high genetic advance over mean (42.73%) and low GA (3.09) were noticed for this trait.

4.1.2.4 Stem girth

At 60 DAT (Tables 5 and 6) stem girth ranged from 0.85 cm (CBB-39) to 2.20 cm (CBB-16) with a mean value of 1.41 cm. The GV (0.08) and PV (0.09) were very low. High GCV (21.02%) and PCV (21.46%) were observed. High heritability (95.99%) accompanied with high genetic advance over mean (42.44%) and low GA (0.59) were noticed for this character.

The stem girth at 90 DAT (Tables 5 and 6) varied from 1.23 cm (CBB-39) to 2.38 cm (CBB-6) with a mean value of 1.81 cm. The GV (0.05) and PV (0.11) were very low. The moderate GCV (12.94%) and PCV (18.54%) with moderate heritability (48.73%) and genetic advance over mean (18.61%) and low GA (0.33) were observed for this trait.

At 120 DAT the stem girth (Tables 5 and 6) ranged from 1.27 cm (CBB-39) to 2.41 cm (CBB-8) with a mean value of 1.85 cm. The GV (0.05) and PV (0.11) were very low. The moderate GCV (12.65%) and PCV (18.14%) were observed. Moderate heritability (48.66%) accompanied with genetic advance over mean (18.18%) and low GA (0.33) were observed for this trait.

4.1.2.5 Leaf area

The range for leaf area at 60 DAT (Tables 5 and 6) was from 36.63 cm^2 (CBB-58) to 232.10 cm^2 (CBB-59) with a mean value of 95.69 cm^2. The GV (1075.44) and PV (1087.67) were very high. The high GCV (34.26%) and PCV (34.46%) and high heritability (98.88%) accompanied with high genetic advance over mean (70.19%) and high genetic advance (67.17) were observed.

The leaf area at 90 DAT (Tables 5 and 6) was highest in genotypes CBB-59 (372.00 cm^2) followed by CBB-49 (298.39 cm^2) and CBB-10 (273.33cm^2) and it was minimum in CBB-58 (79.47cm^2) with a mean of 146.11 cm^2. The GV (2910.82) and PV (2990.28) were very high. High estimates of GCV (36.92%) and PCV (37.42%) and high heritability (97.34%) coupled with high genetic advance over mean (75.04%) and very high genetic advance (109.65) were observed for leaf area at 90 DAT.

4.1.2.6 Days to first flowering

For appearance of first flower, the genotype CBB-32 took least number of days (38.33) and CBB-41 took maximum number of days (61.00) with mean value of 50.60 days (Tables 6 and 7). The estimates of genotypic variances (30.48) and phenotypic variances (37.50) were high. The moderate GCV (10.91%) and PCV (12.10%) were observed. The high heritability (81.30%) with moderate GA (10.25) and high GAM (20.26%) were observed for this trait.

4.1.2.7 Days to 50 per cent flowering

The genotype CBB-53 took least number of days (47.60) for 50 per cent flowering, while CBB-33 took maximum number of days (68.26), on an average genotypes took 57.71 days for appearance of 50 per cent flowering (Tables 6 and 7).

Table 7. Estimates of range, mean, components of variance, heritability and genetic advance for earliness, yield and quality parameters in brinjal

Sl. No.	Character	Range	Mean±S.Em	GV	PV	GCV (%)	PCV (%)	h^2 (%)	GA	GAM (%)
B.	**Earliness parameters**									
15.	Days to first flowering	38.33-61.00	50.60±1.516	30.48	37.50	10.91	12.10	81.30	10.25	20.26
16.	Days to 50 per cent flowering	47.60-68.26	57.71±1.355	29.18	34.78	9.35	10.21	83.89	10.19	17.65
17.	Days to first fruit maturity	66.53-84.93	74.46±1.120	18.53	22.36	5.78	6.35	82.87	8.07	10.84
C.	**Yield parameters**									
18.	Number of fruits per cluster	1.00-2.80	1.16±0.018	0.21	0.21	40.04	40.14	99.52	0.95	82.29
19.	Fruit length (cm)	3.20-10.46	7.45±0.393	1.95	2.42	18.73	20.87	80.53	2.58	34.63
20.	Fruit diameter (cm)	2.53-7.03	5.12±0.237	0.62	0.80	15.46	17.45	78.56	1.44	28.24
21.	Fruit length-diameter ratio	0.92-3.47	1.48±0.056	0.15	0.16	26.65	27.48	94.06	0.79	53.25
22.	Early yield per plant (kg)	0.35-1.09	0.73±0.057	0.03	0.04	24.45	28.04	76.05	0.32	43.93
23.	Average fruit weight (g)	25.16-138.00	81.01±0.660	784.45	785.79	34.57	34.60	99.83	57.64	71.16
24.	Number of fruits per plant	6.91-45.71	20.55±2.441	68.86	87.05	40.36	45.38	79.11	15.20	73.95
25.	Total yield per plant (kg)	0.88-2.55	1.49±0.111	0.14	0.17	25.12	28.29	78.86	0.68	45.96
26.	Yield per plot (kg)	13.55-35.00	21.75±1.517	28.27	35.30	24.44	27.31	80.09	9.80	45.05
27.	Yield per hectare (t)	19.25-51.85	32.22±2.248	62.03	77.46	24.44	27.31	80.09	14.52	45.05
D.	**Quality parameters**									
28.	Per cent dry matter in fruits	6.86-17.81	11.95±0.447	3.58	4.19	15.84	17.14	85.48	3.60	30.18
29.	Phenol content (mg/100 g)	26.66-303.33	142.13±1.085	4922.21	4925.81	49.36	49.37	99.90	144.47	101.64

GV = Genotypic variance PV = Phenotypic variance GCV = Genotypic coefficient of variance GA= Genetic advance h^2 = Heritability (broad sense)
PCV =Phenotypic coefficient of variance GAM = Genetic advance (per cent mean)

The genotypic variances (29.18) and phenotypic variances (34.78) were high. The estimates of low GCV (9.35%) and moderate PCV (10.21%) with high heritability (83.89%) and moderate GA (10.19) and moderate GAM (17.65%) were observed for days to 50 per cent flowering.

4.1.2.8 Days to first fruit maturity

The number of days taken for first fruit maturity was minimum in CBB-32 (66.53) while it was maximum in CBB-8 (84.93) with a mean value of 74.46 days. Moderate GV (18.53) and high PV (22.36) were observed. The estimates of low GCV (5.78%) and PCV (6.35%) with high heritability (82.87%) and moderate GAM (10.84) and low GA (8.07) were observed for days to first fruit maturity (Tables 6 and 7).

4.1.2.9 Number of fruits per cluster

Number of fruits per cluster (Tables 7 and 8) was maximum in genotype CBB-12 (2.80) followed by CBB-11 (2.70), CBB-13 and CBB-15 (2.43 for both), CBB-46 (2.35), CBB-19 (2.20) and CBB-52 (2.00) and remaining all other genotypes had solitary fruits.

Number of fruits per cluster (Tables 7 and 8) ranged from 1.00 to 2.80 with a mean value of 1.16. The GV (0.21) and PV (0.21) were very low. High GCV (40.04%) and PCV (40.14%) with very high heritability (99.52%) coupled with very high GAM (82.29%) and very low GA (0.95) were observed for number of fruits per cluster.

4.1.2.10 Fruit length

Fruit length (Tables 7 and 8) ranged from 3.20 cm (CBB-11) to 10.46 cm (CBB-6) with a mean value of 7.45 cm. The GV (1.95) and PV (2.42) were very low. The moderate GCV (18.73%) and high PCV (20.87%) with high heritability (80.53%) and very low GA (2.58) and high GAM (34.63%) were observed for fruit length.

4.1.2.11 Fruit diameter

Fruit diameter (Tables 7 and 8) ranged from 2.53 cm (CBB-53) to 7.03 cm (CBB-49) with a mean value of 5.12 cm. The genotypic variance (0.62) and phenotypic variance (0.80) were very low. Moderate GCV (15.46%) and PCV (17.45%) were observed. High heritability (78.56%) along with high GAM (28.24%) as well as very low GA (1.44) were observed for fruit diameter.

4.1.2.12 Fruit length-diameter ratio

Fruit length-diameter ratio (Tables 7 and 8) was maximum in CBB-53 (3.47) followed by CBB-19 (2.33), CBB-38 (2.17) and CBB-8 (2.16) and it was minimum in CBB-11 (0.92) with a mean value of 1.48. The GV (0.15) and PV (0.16) were very low. The high GCV (26.65%) and PCV (27.48%) were observed. High heritability (94.06%) and low GA (0.79) as well as high GAM (53.25%) were observed for fruit length-diameter ratio.

4.1.2.13 Early yield per plant

Early yield per plant (Tables 7 and 8) was maximum in CBB-40 (1.09 kg) followed by CBB-59 and CBB-8 (1.04 kg for both), CBB-2 (1.03 kg), CBB-23 (1.02 kg) and CBB-22 and CBB-32 (1.00 kg for both) and it was minimum in CBB-43 (0.35 kg) with a mean value of 0.73 kg. The GV (0.03) and PV (0.04) were very low. The GCV (24.45%) and PCV (28.04%) were high. High heritability (76.05%) along with high genetic advance over mean (43.93%) and very low genetic advance (0.32) were observed for early yield per plant.

4.1.2.14 Average fruit weight

Average fruit weight (Tables 7 and 8) was maximum in CBB-49 (138.00 g) followed by CBB-5 (137.83 g), CBB-23 (136.33 g), CBB-4 (134.50 g) and CBB-53 (133.00 g) and it was minimum in CBB-11 (25.16 g) with a mean value of 81.01 g. The GV (784.45) and PV (785.79) were very high. The estimates of GCV and PCV were high (34.57% and 34.60%, respectively). Very high heritability (99.83%) along with very high genetic advance over mean (71.16%) and very high genetic advance (57.64) were observed for average fruit weight.

Table 8. *Per se* performance of brinjal (*Solanum melongena* L.) genotypes for yield and quality parameters

Sl. No.	Genotypes	Number of fruits per cluster	Fruit length (cm)	Fruit diameter (cm)	Fruit length-diameter ratio	Early yield/plant (kg)	Average fruit weight (g)	Number of fruits /plant	Total yield/ plant (kg)	Yield per plot (kg)	Yield per hectare (t)	Dry matter (%)	Phenol content (mg/100 g)
1.	CBB-1	1.00	10.43	6.20	1.68	0.99	111.00	18.00	1.99	29.25	43.32	13.51	55.00
2.	CBB-2	1.00	6.45	4.93	1.30	1.03	86.50	24.12	2.07	30.31	44.91	12.18	125.00
3.	CBB-3	1.00	8.97	5.20	1.72	0.65	107.00	12.25	1.30	19.60	29.03	12.35	144.83
4.	CBB-4	1.00	8.20	6.60	1.24	0.94	134.50	14.11	1.86	26.90	39.85	14.33	73.00
5.	CBB-5	1.00	9.56	5.83	1.64	0.88	137.83	12.83	1.76	25.73	38.12	17.81	129.33
6.	CO-2	1.00	6.10	4.70	1.29	0.71	56.33	26.51	1.43	21.08	31.23	10.76	106.60
7.	CBB-6	1.00	10.46	5.53	1.94	0.85	111.66	15.44	1.72	25.78	38.19	14.11	161.66
8.	CBB-7	1.00	7.63	6.07	1.25	0.91	81.33	22.63	1.83	27.16	40.24	12.56	98.00
9.	CBB-8	1.00	10.26	4.73	2.16	1.04	79.83	26.30	2.09	30.63	45.38	12.25	68.53
10.	CBB-9	1.00	7.00	4.56	1.53	0.63	62.50	20.51	1.27	18.88	27.96	11.03	75.00
11.	CBB-10	1.00	7.96	5.43	1.47	0.53	122.83	8.71	1.06	16.00	23.70	9.95	116.33
12.	CBB-11	2.70	3.20	3.40	0.92	0.57	25.16	45.71	1.15	17.25	25.55	14.33	81.66
13.	CBB-12	2.80	6.60	4.80	1.37	0.94	64.33	39.71	2.55	35.00	51.85	12.52	234.00
14.	CBB-13	2.43	8.13	4.73	1.71	0.56	89.33	12.43	1.11	16.65	24.66	11.29	103.73
15.	CBB-14	1.00	8.60	5.33	1.62	0.54	115.16	9.58	1.10	16.50	24.44	11.53	192.26
16.	CBB-15	2.43	5.20	4.03	1.28	0.78	35.50	44.76	1.56	22.16	32.83	14.39	286.00
17.	CBB-16	1.00	6.66	5.56	1.19	0.86	110.66	15.77	1.73	25.00	37.03	13.39	86.66
18.	CBB-17	1.00	6.60	4.90	1.34	0.91	65.00	27.65	1.79	26.28	38.93	13.90	67.00
19.	CBB-18	1.00	6.43	6.10	1.08	0.84	60.00	28.11	1.67	24.48	36.26	11.79	106.53
20.	CBB-19	2.20	9.28	3.96	2.33	0.61	77.00	16.10	1.23	18.21	26.98	13.52	186.00
21.	CBB-20	1.00	7.86	4.76	1.62	0.64	58.16	21.94	1.29	18.98	28.11	11.96	141.66
22.	CBB-21	1.00	7.76	4.73	1.64	0.66	76.16	17.70	1.34	20.00	29.62	12.56	188.53

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Table 8. Continued…

Sl. No.	Genotypes	Number of fruits per cluster	Fruit length (cm)	Fruit diameter (cm)	Fruit length-diameter ratio	Early yield/plant (kg)	Average fruit weight (g)	Number of fruits /plant	Total yield/ plant (kg)	Yield per plot (kg)	Yield per hectare (t)	Dry matter (%)	Phenol content (mg/100 g)
23.	CBB-22	1.00	7.86	6.50	1.20	1.00	82.16	24.58	2.01	29.25	43.32	11.60	65.16
24.	CBB-23	1.00	8.55	5.83	1.49	1.02	136.33	15.12	2.05	29.85	44.21	15.08	280.33
25.	CBB-24	1.00	8.82	4.90	1.80	0.85	79.00	22.65	1.70	24.71	36.61	9.50	53.50
26.	CBB-25	1.00	6.46	5.13	1.25	0.51	70.66	17.89	1.36	20.23	29.97	12.32	90.00
27.	CBB-26	1.00	9.00	4.96	1.81	0.59	86.50	13.82	1.19	17.60	26.07	10.64	94.50
28.	CBB-27	1.00	7.00	5.80	1.20	0.67	122.33	11.12	1.36	20.06	29.72	12.06	124.66
29.	CBB-28	1.00	8.30	4.50	1.84	0.78	63.00	25.09	1.58	23.03	34.11	11.26	77.00
30.	CBB-29	1.00	6.86	5.13	1.33	0.96	47.83	31.75	1.92	27.95	41.40	11.33	205.73
31.	CBB-30	1.00	7.43	4.93	1.49	0.72	54.16	20.68	1.44	21.28	31.52	13.06	282.00
32.	CBB-31	1.00	5.30	4.66	1.13	0.74	68.33	21.81	1.48	21.73	32.19	12.48	189.00
33.	CBB-32	1.00	6.66	4.80	1.38	1.00	55.16	36.65	2.01	29.25	43.28	10.20	303.33
34.	CBB-33	1.00	8.90	5.73	1.54	0.53	91.16	11.76	1.07	15.63	23.15	9.72	82.46
35.	CBB-34	1.00	8.98	4.86	1.83	0.89	76.50	23.40	1.78	25.90	38.36	11.14	88.03
36.	CBB-35	1.00	7.26	4.66	1.55	0.84	58.00	29.26	1.69	24.95	36.95	12.59	130.00
37.	CBB-36	1.00	6.56	4.06	1.61	0.57	52.83	21.96	1.15	17.03	25.22	6.86	26.66
38.	CBB-37	1.00	7.96	5.66	1.40	0.72	99.16	13.54	1.44	21.20	31.40	11.13	167.30
39.	CBB-38	1.00	8.80	4.03	2.17	0.82	73.00	22.73	1.66	24.48	36.26	11.51	103.06
40.	CBB-39	1.00	7.76	5.13	1.50	0.44	71.16	12.46	0.88	13.00	19.25	12.20	142.30
41.	CBB-40	1.00	6.93	6.00	1.15	1.09	122.16	18.04	2.21	31.64	46.88	10.54	224.33
42.	CBB-41	1.00	6.53	6.30	1.06	0.46	69.66	18.36	0.92	13.55	20.07	14.36	134.26
43.	CBB-42	1.00	6.83	5.06	1.34	0.79	57.83	27.68	1.60	22.90	33.92	12.18	232.60
44.	CBB-43	1.00	4.90	4.16	1.16	0.35	104.50	6.91	0.72	10.58	15.67	11.03	239.66

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Table 8. Continued…

Sl. No.	Genotypes	Number of fruits per cluster	Fruit length (cm)	Fruit diameter (cm)	Fruit length-diameter ratio	Early yield/plant (kg)	Average fruit weight (g)	Number of fruits /plant	Total yield/ plant (kg)	Yield per plot (kg)	Yield per hectare (t)	Dry matter (%)	Phenol content (mg/100 g)
45.	CBB-44	1.00	6.16	4.70	1.30	0.49	46.50	21.24	0.98	14.08	20.85	12.74	125.00
46.	CBB-45	1.00	8.26	6.33	1.30	0.88	107.00	16.54	1.76	25.50	37.77	11.58	162.06
47.	CBB-46	2.35	4.70	4.07	1.15	0.53	55.83	20.40	1.14	16.30	24.14	17.23	261.86
48.	CBB-47	1.00	4.53	4.40	1.02	0.57	45.16	30.82	1.39	19.73	29.23	15.22	175.86
49.	CBB-48	1.00	7.96	5.36	1.47	0.79	105.66	12.07	1.27	18.63	27.60	12.28	140.66
50	CBB-49	1.00	7.56	7.03	1.07	0.47	138.00	7.14	0.98	14.48	21.45	9.64	165.40
.51.	CBB-50	1.00	8.57	5.03	1.71	0.48	62.83	15.51	0.97	14.26	21.13	12.18	56.73
52.	CBB-51	1.00	7.86	4.40	1.78	0.52	68.00	15.82	1.07	15.15	22.44	12.46	72.16
53.	CBB-52	2.00	7.46	6.33	1.17	0.55	65.66	17.05	1.11	16.61	24.61	9.96	51.16
54.	CBB-53	1.00	8.80	2.53	3.47	0.58	133.00	8.73	1.16	17.23	25.52	9.01	247.26
55.	CBB-54	1.00	6.03	5.85	1.05	0.79	43.66	36.49	1.59	23.08	34.19	9.53	120.33
56.	CBB-55	1.00	7.30	5.96	1.22	0.77	97.50	16.00	1.55	23.15	34.29	10.03	202.83
s57.	CBB-56	1.00	7.06	4.63	1.41	0.65	61.33	21.39	1.30	18.75	27.77	11.29	84.16
58.	CBB-57	1.00	8.40	4.93	1.70	0.83	82.00	20.32	1.66	23.96	35.50	9.45	178.40
59.	CBB-58	1.00	7.60	5.50	1.38	0.55	68.83	16.31	1.12	16.21	24.02	10.30	244.20
60.	CBB-59	1.00	5.86	5.56	1.05	1.04	70.33	29.89	2.10	30.48	45.15	9.35	76.60
	Mean	**1.16**	**7.45**	**5.12**	**1.48**	**0.73**	**81.01**	**20.55**	**1.49**	**21.75**	**32.22**	**11.95**	**142.13**
	C.V.	2.79	9.21	8.08	6.69	13.72	1.42	20.74	13.00	12.18	12.18	6.53	1.33
	S.E.	*0.01*	0.39	0.23	0.05	0.05	0.66	2.46	0.11	1.53	2.26	0.45	1.09
	C.D 5%	*0.05*	1.11	0.67	0.16	0.16	1.86	6.89	0.31	4.28	6.34	1.26	3.06
	C.D 5%	*0.06*	1.46	0.88	0.21	0.21	2.46	9.11	0.41	5.66	8.39	1.66	4.05

4.1.2.15 Number of fruits per plant

Number of fruits per plant (Tables 7 and 8) was maximum in CBB-11 (45.71) followed by CBB-15 (44.26), CBB-12 (39.71), CBB-32 (36.65) and CBB-54 (36.49) and it was minimum in CBB-43 (6.91) with a mean value of 20.55. The GV (68.86) and PV (87.05) were very high. The estimates of GCV and PCV were high (40.36% and 45.38%, respectively). High heritability (79.11%) along with very high genetic advance over mean (73.95%) and moderate GA (15.20) were observed for number of fruits per plant.

4.1.2.16 Total yield per plant

Total yield per plant (Tables 7 and 8) was maximum in CBB-12 (2.55 kg) followed by CBB-40 (2.21 kg), CBB-59 (2.10 kg), CBB-8 (2.09 kg) and CBB-2 (2.07 kg) and it was minimum in CBB-39 (0.88 kg) with a mean value of 1.49 kg. The GV (0.14) and PV (0.17) were very low. The estimates of GCV and PCV were high (25.12% and 28.29%, respectively). High heritability (78.86%) along with high genetic advance over mean (45.96%) and very low genetic advance (0.68) were observed for total yield per plant.

4.1.2.17 Yield per plot

Yield per plot (Tables 7 and 8) ranged from 13.55 kg to 35.00 kg with a mean value of 21.75 kg. The GV (28.27) and PV (35.30) were very high. The estimates of GCV and PCV were high (24.44% and 27.31%, respectively). High heritability (80.09%) along with high genetic advance over mean (45.05%) and low genetic advance (9.80) were observed for yield per plot.

4.1.2.18 Yield per hectare

The highest yield per hectare (Tables 7 and 8) was observed in genotype CBB-12 (51.85 t) followed by CBB-40 (46.88 t), CBB-59 (45.15 t), CBB-8 (45.38 t) and CBB-2 (44.91 t) and the lowest yield was observed in CBB-39 (19.25 t) with a mean value of 32.22 tonnes. The GV (62.03) and PV (77.46) were very high. The estimates of GCV and PCV were high (24.44% and 27.31%, respectively). High heritability (80.09%) along with high genetic advance over mean (45.05%) and moderate genetic advance (14.52) were observed for yield per hectare.

4.1.2.19 Per cent dry matter in fruits

Per cent dry matter (Tables 7 and 8) was maximum in genotype CBB-5 (17.81%) followed by CBB-23 (15.08%), CBB-15 (14.39%), CBB-41 (14.36%), CBB-4 and CBB-11 (14.33% for both) and it was minimum in CBB-36 (6.86%) with a mean value of 11.95%. The GV (3.58) and PV (4.19) were very low. The estimates of GCV and PCV were moderate (15.84% and 17.14%, respectively). High heritability (85.48%) along with high genetic advance over mean (30.18%) and very low genetic advance (3.60) were observed for per cent dry matter in fruits.

4.1.2.20 Phenol content

Phenol content (Tables 7 and 8) was maximum in CBB-32 (303.33 mg/100 g) followed by CBB-15 (286.00 mg/100 g), CBB-23 (280.33 mg/100 g) and CBB-46 (261.86 mg/100 g) and it was minimum in CBB-36 (26.66 mg/100 g) with a mean value of 142.13 mg/100 g. The GV (4922.1) and PV (4925.1) were very high. The estimates of GCV and PCV were high (49.36% and 49.37%, respectively). Very high heritability (99.90%) along with very high genetic advance over mean (101.64%) and very high genetic advance (144.47) were observed for phenol content.

4.1.2.21 Fruit colour

The purple fruits with white stripes were observed in genotypes (Table 9) CBB-3, CBB-5, CO-2, CBB-6, CBB-8, CBB-12, CBB-14, CBB-17, CBB-21, CBB-25, CBB-29, CBB-32, CBB-42, CBB-43, CBB-45 and CBB-48. While, green fruits with white patches were observed in genotypes CBB-7, CBB-15, CBB-22, CBB-23, CBB-26, CBB-27, CBB-30, CBB-31, CBB-33, CBB-35, CBB-39, CBB-41, CBB-46, CBB-52 and CBB-58. The genotypes CBB-24, CBB-34, CBB-38, CBB-49, CBB-50 and CBB-53 were included in green fruit group. The genotypes CBB-20, CBB-40, CBB-51, CBB-54, CBB-55, CBB-56, CBB-57 and CBB-59 were under purple fruit group. The genotypes CBB-2, CBB-18 and CBB-44 had white fruits with purple stripes. The genotypes CBB-13 and CBB-19 were grouped under light purple fruits with pinkish purple patches group. The genotypes CBB-16 and CBB-36 were included in white coloured fruits group. Whereas, CBB-1 (Purple fruits with green stripes), CBB-9 (Green fruits with purple stripes), CBB-4 (Fruits glossy violet),

Table 9. Qualitative traits of brinjal (*Solanum melongena* L.) genotypes

Sl. No.	Genotypes	Fruit colour with stripes	Fruit shape	Hairyness	Spinyness
1	CBB-1	Fruits purple with green stripes	Oblong	Hairyness	Non spiny
2	CBB-2	Fruits white with broad light purple stripes	Ovoid	Non hairyness	Non spiny
3	CBB-3	Fruits light purple with narrow white stripes	Obovate	Hairyness	Non spiny
4	CBB-4	Fruits glossy violet	Ovoid	Hairyness	Non spiny
5	CBB-5	Fruits purple with narrow white stripes	Ovoid	Hairyness	Non spiny
6	CO-2	Fruits purple with narrow white stripes	Ovoid	Hairyness	Non spiny
7	CBB-6	Fruits glossy purple with narrow white stripes	Obovate	Hairyness	Spiny
8	CBB-7	Fruits green with white patches	Globular	Non hairyness	Spiny
9	CBB-8	Fruits dull purple with narrow white stripes	Obovate	Hairyness	Non spiny
10	CBB-9	Fruits green with purple and white stripes	Obovate	Hairyness	Non spiny
11	CBB-10	Fruits glossy violet with narrow white stripes	Obovate	Hairyness	Non spiny
12	CBB-11	Fruits green with prominant ridges	Round	Hairyness	Non spiny
13	CBB-12	Fruits purple with narrow white stripes	Ovoid	Hairyness	Non spiny
14	CBB-13	Fruits dull purple with pinkish purple patches	Ovoid	Hairyness	Non spiny
15	CBB-14	Fruits purple black with white patches	Ovoid	Hairyness	Non spiny
16	CBB-15	Fruits green with white patches	Ovoid	Hairyness	Non spiny
17	CBB-16	Fruits white	Round	Hairyness	Non spiny
18	CBB-17	Fruits purple with narrow white stripes	Ovoid	Hairyness	Spiny

Contd.....

Table 9. Continued…

Sl. No.	Genotypes	Fruit colour with stripes	Fruit shape	Hairyness	Spinyness
19	CBB-18	Fruits white with narrow light purple stripes	Round	Hairyness	Spiny
20	CBB-19	Fruits light purple with pinkish purple patches	Ellipsoid	Hairyness	Non spiny
21	CBB-20	Fruits light purple	Ovoid	Non hairyness	Non spiny
22	CBB-21	Fruits purple with narrow white stripes	Obovate	Hairyness	Non spiny
23	CBB-22	Fruits green with white patches	Ovoid	Hairyness	Non spiny
24	CBB-23	Fruits green with white patches	Obovate	Hairyness	Spiny
25	CBB-24	Fruits light green	Ellipsoid	Non hairyness	Non spiny
26	CBB-25	Fruits purple with narrow white stripes	Ovoid	Hairyness	Non spiny
27	CBB-26	Fruits green with white patches	Obovate	Hairyness	Non spiny
28	CBB-27	Fruits green with white patches,	Globular	Non hairyness	Non spiny
29	CBB-28	Fruits light sky blue	Ellipsoid	Hairyness	Non spiny
30	CBB-29	Fruits purple with narrow white stripes	Ovoid	Hairyness	Spiny
31	CBB-30	Fruits green with white patches	Globular	Hairyness	Non spiny
32	CBB-31	Fruits green with white patches	Round	Hairyness	Non spiny
33	CBB-32	Fruits purple with narrow white stripes	Ovoid	Hairyness	Non spiny
34	CBB-33	Fruits green with white patches	Obovate	Hairyness	Non spiny
35	CBB-34	Fruits green	Obovate	Non hairyness	Non spiny
36	CBB-35	Fruits green with white patches	Ovoid	Hairyness	Non spiny
37	CBB-36	Fruits white	Ovoid	Hairyness	Non spiny

Contd.....

Table 9. Continued…

Sl. No.	Genotypes	Fruit colour with stripes	Fruit shape	Hairyness	Spinyness
38	CBB-37	Fruits purple with narrow green stripes	Obovate	Hairyness	Non spiny
39	CBB-38	Fruits green	Obovate	Hairyness	Non spiny
40	CBB-39	Fruits green with white patches	Pear	Hairyness	Non spiny
41	CBB-40	Fruits purple	Round	Hairyness	Spiny
42	CBB-41	Fruits green with white patches	Globular	Non hairyness	Non spiny
43	CBB-42	Fruits purple with narrow white stripes	Ovoid	Non hairyness	Non spiny
44	CBB-43	Fruits purple with narrow white stripes	Ovoid	Hairyness	Non spiny
45	CBB-44	Fruits white with narrow purple stripes	Ovoid	Hairyness	Spiny
46	CBB-45	Fruits purple with white stripes	Round	Non hairyness	Spiny
47	CBB-46	Fruits green with white patches	Round	Hairyness	Spiny
48	CBB-47	Fruits purple with pink purple patches	Globular	Hairyness	Non spiny
49	CBB-48	Fruits purple with narrow white stripes	Obovate	Hairyness	Non spiny
50	CBB-49	Fruits green	Round	Hairyness	Non spiny
51	CBB-50	Fruits green	Obovate	Hairyness	Non spiny
52	CBB-51	Fruits whitish purple	Obovate	Hairyness	Non spiny
53	CBB-52	Fruits green with white patches	Round	Non hairyness	Non spiny
54	CBB-53	Fruits green	Club	Hairyness	Non spiny
55	CBB-54	Fruits light purple	Globular	Hairyness	Non spiny
56	CBB-55	Fruits purple	Globular	Hairyness	Spiny
57	CBB-56	Fruits purple	Pear	Hairyness	Non spiny
58	CBB-57	Fruits whitish purple	Obovate	Hairyness	Non spiny
59	CBB-58	Fruits green with white patches	Ovoid	Non hairyness	Non spiny
60	CBB-59	Fruits purple	Globular	Non hairyness	Non spiny

CBB-10 (Fruits glossy violet with narrow white stripes), CBB-11 (Fruits green with prominant ridges), CBB-28 (Fruits light sky blue), CBB-37 (Fruits purple with narrow green stripes), CBB-47 (Fruits purple with pink purple patches) had different fruit colour pattern.

4.1.2.22 Spinyness

The non-spinyness was observed in genotypes (Table 9) CBB-1, CBB-2, CBB-3, CBB-4, CBB-5, CO-2**,** CBB-8, CBB-9, CBB-10, CBB-11, CBB-12, CBB-13, CBB-14, CBB-15, CBB-16, CBB-19, CBB-20, CBB-21, CBB-22, CBB-24, CBB-25, CBB-26, CBB-27, CBB-28, CBB-30, CBB-31, CBB-32, CBB-33, CBB-34, CBB-35, CBB-36, CBB-37, CBB-38, CBB-39, CBB-41, CBB-42, CBB-43, CBB-47, CBB-48, CBB-49, CBB-50, CBB-51, CBB-52, CBB-53, CBB-54, CBB-56, CBB-57, CBB-58 and CBB-59. While, spinyness was observed in genotypes CBB-6, CBB-7, CBB-17, CBB-18, CBB-23, CBB-29, CBB-40, CBB-44, CBB-45, CBB-46 and CBB-55.

4.1.2.23 Hairyness

The hairyness was found in genotypes (Table 9) CBB-1, CBB-3, CBB-4, CBB-5, CO-2**,** CBB-6, CBB-8, CBB-9, CBB-10, CBB-11, CBB-12, CBB-13, CBB-14, CBB-15, CBB-16, CBB-17, CBB-18, CBB-19, CBB-20, CBB-21, CBB-22, CBB-23, CBB-25, CBB-26, CBB-28, CBB-29, CBB-30, CBB-31, CBB-32, CBB-33, CBB-35, CBB-36, CBB-37, CBB-38, CBB-39, CBB-40, CBB-43, CBB-44, CBB-46, CBB-47, CBB-48, CBB-49, CBB-50, CBB-51 CBB-53, CBB-54, CBB-55, CBB-56 and CBB-57. Whereas, non- hairyness was observed in genotypes CBB-2, CBB-7, CBB-24, CBB-27, CBB-34, CBB-41, CBB-42, CBB-45, CBB-52, CBB-58 and CBB-59.

4.2 Correlation studies

The phenotypic and genotypic correlation coefficients were determined to know the nature of relationship existing between yield and its component characters as well as the association among component characters themselves. The degrees of association of growth, yield and quality characters with yield per plant and also among themselves at genotypic and phenotypic level are depicted in Tables 10 and 11, respectively.

4.2.1 Association of different characters with yield per plant

Total yield per plant was found to be positively and significantly (at p=0.01) associated with plant height at 90 DAT (r_g= 0.385 and r_p= 0.333), plant spread at 90 DAT (r_g= 0.660 and r_p= 0.454), number of primary branches at 90 DAT (r_g= 0.545 and r_p= 0.470), stem girth at 90 DAT (r_g= 0.539 and r_p= 0.420), fruit diameter (r_g= 0.242 and r_p= 0.224), early yield per plant (r_g= 1.000 and r_p= 0.896) and number of fruits per plant (r_g= 0.449 and r_p= 0.499). But it was negatively and significantly (at p=0.01) associated with days to first flowering (r_g= -0.302 and r_p= -0.230), days to 50 per cent flowering (r_g= -0.272 and r_p= -0.229) and days to first fruit maturity at p=0.05 (r_g= -0.164 and r_p= -0.168) both at genotypic and phenotypic level.

4.2.2 Genotypic correlation

Plant height at 90 DAT (Table 10) had positive and significant correlation at p=0.01 with plant spread at 90 DAT (0.633), number of primary branches at 90 DAT (0.279), stem girth at 90 DAT (0.661), leaf area at 90 DAT (0.252), days to first fruit maturity (0.262), early yield per plant (0.407), number of fruits per plant (0.361) and yield per plant (0.385) and days to first flowering (0.147 at p=0.05). While it showed negative and significant (at p=0.05) correlation with average fruit weight (-0.163).

A significant (at p=0.01) and positive correlation of plant spread at 90 DAT (Table 10) was observed with number of primary branches at 90 DAT (0.494), stem girth at 90 DAT (0.461), leaf area at 90 DAT (0.319), fruit diameter (0.220), early yield per plant (0.704), number of fruits per plant (0.450), per cent dry matter in fruits (0.267) and yield per plant (0.660). But it showed significant and negative correlation with fruit length-diameter ratio (-0.240).

Number of primary branches at 90 DAT (Table 10) had positive and significant association at p=0.01 with stem girth at 90 DAT (0.336), number of fruits per cluster (0.190 at p=0.05), fruit length (0.195), early yield per plant (0.531), number of fruits per plant (0.251), per cent dry matter in fruits (0.277) and yield per plant (0.545).

Table 10. Genotypic correlation coefficients among growth, earliness, yield and quality parameters in brinjal genotypes

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1.000	0.633**	0.279**	0.661**	0.252**	0.130	0.147*	0.262**	-0.105	0.003	0.015	-0.096	-0.163*	0.407**	0.361**	-0.117	0.385**
2		1.000	0.494**	0.461**	0.319**	0.051	0.049	0.122	0.006	0.013	0.220**	-0.240**	-0.077	0.704**	0.450**	0.267**	0.660**
3			1.000	0.336**	-0.106	-0.085	-0.104	-0.068	0.190*	0.195**	0.003	0.094	0.076	0.531**	0.251**	0.277**	0.545**
4				1.000	0.096	0.051	0.026	0.139	-0.108	-0.001	0.015	-0.075	-0.223**	0.563**	0.468**	0.060	0.539**
5					1.000	0.383**	0.375**	0.340**	-0.138	0.025	0.490**	-0.248**	0.226**	0.133	-0.081	-0.178*	0.120
6						1.000	1.010**	0.922**	-0.061	0.056	0.218**	-0.122	0.125	-0.239**	-0.315**	-0.124	-0.302**
7							1.000	0.907**	-0.084	0.074	0.227**	-0.110	0.122	-0.220**	-0.314**	-0.134	-0.272**
8								1.000	-0.015	0.061	0.145	-0.067	0.063	-0.146*	-0.197**	-0.041	-0.164*
9									1.000	-0.327**	-0.333**	-0.077	-0.301**	-0.140	0.395**	0.281**	-0.028
10										1.000	0.208**	0.673**	0.559**	0.208**	-0.552**	-0.107	0.139
11											1.000	-0.511**	0.450**	0.288**	-0.303**	-0.015	0.242**
12												1.000	0.244**	-0.042	-0.307**	-0.166*	-0.070
13													1.000	0.137	-0.778**	0.015	0.080
14														1.000	0.399**	0.084	1.000**
15															1.000	0.107	0.449**
16																1.000	0.114
17																	1.000

Critical r_g value at 1per cent= 0.191 Critical r_g value at 5 per cent= 0.146 ** Indicates significant at p=0.01 * Indicates significant at p=0.05

Characters:-

1. Plant height at 90 DAT (cm)
2. Plant spread at 90 DAT (cm)
3. Number of primary branches at 90 DAT
4. Stem girth at 90 DAT (cm)
5. Leaf area at 90 DAT (cm^2)
6. Days to first flowering
7. Days to 50 per cent flowering
8. Days to first fruit maturity
9. Number of fruits per cluster
10. Fruit length (cm)
11. Fruit diameter (cm)
12. Fruit length-diameter ratio
13. Average fruit weight (g)
14. Early yield per plant (kg)
15. Number of fruits per plant
16. Per cent dry matter in fruit
17. Total yield per plant (kg)

The stem girth at 90 DAT (Table 10) showed positive and significant (at p=0.01) correlation with early yield per plant (0.563), number of fruits per plant (0.468) and yield per plant (0.539). Whereas, it had negative and significant (at p=0.01) association with average fruit weight (-0.223).

The leaf area at 90 DAT (Table 10) had positive and significant (at p=0.01) association with days to first flowering (0.383), days to 50 per cent flowering (0.375), days to first fruit maturity (0.340), fruit diameter (0.490) and average fruit weight (0.226). While significantly negative association of this character with fruit length-diameter ratio (-0.248 at p=0.01) and per cent dry matter in fruits (-0.178 at p=0.05) was observed.

The positive and significant (at p=0.01) correlation of days to first flowering (Table 10) was observed with days to 50 per cent flowering (1.010), days to first fruit maturity (0.922) and fruit diameter (0.218). While significantly (at p=0.01) negative association of this character with early yield per plant (-0.239), number of fruits per plant (-0.315) and yield per plant (-0.302) was observed.

Days to 50 per cent flowering (Table 10) had positive significant association with days to first fruit maturity (0.907) and fruit diameter (0.227). Whereas, early yield per plant (-0.220), number of fruits per plant (-0.314) and yield per plant (-0.272) were found significantly (at p= 0.01) and negatively correlation with this trait.

A significant (at p=0.01) and negative correlation of days to first fruit maturity (Table 10) was noticed with number of fruits per plant (-0.197). While, early yield per plant (-0.146) and yield per plant (-0.164) were found significant (at=0.05) but negatively correlated with this trait.

Number of fruits per cluster (Table 10) was positively and significantly (at p=0.01) associated with number of fruits per plant (0.395) and per cent dry matter in fruits (0.281). Whereas, fruit length (-0.327), fruit diameter (-0.333) and average fruit weight (-0.301) were found negatively and significantly (at p=0.01) associated with this trait.

Fruit length (Table 10) had positive and significant (at p=0.01) association with fruit diameter (0.208), fruit length-diameter ratio (0.673), average fruit weight (0.559) and early yield per plant (0.208). Whereas, it had negative and significant (at p= 0.01) relationship with number of fruits per plant (-0.552).

Fruit diameter (Table 10) had negative and significant (at p=0.01) correlation with average fruit weight (0.450), early yield per plant (0.288) and yield per plant (0.242). Whereas, fruit length-diameter ratio (-0.511) and number of fruits per plant (-0.303) were found negatively and significant (at p=0.01) correlation with this trait.

Fruit length-diameter ratio (Table 10) exhibited positive and significant association with average fruit weight (0.244 at p=0.01) and it showed negative association with number of fruits per plant (-0.307 at p= 0.01) and per cent dry matter in fruits (-0.166 at p=0.05).

Average fruit weight (Table 10) exhibited strong negative and significant (at p=0.01) relationship with number of fruits per plant (-0.778). The early yield per plant had positive and significant (at p=0.01) correlation with number of fruits per plant (0.399) and yield per plant (1.000). Number of fruits per plant also had positive and significant (at p=0.01) relationship with yield per plant (0.449).

4.2.3 Phenotypic correlation

Plant height at 90 DAT (Table 11) had positively and significantly correlation at p=0.01 with plant spread at 90 DAT (0.464), number of primary branches at 90 DAT (0.215), stem girth at 90 DAT (0.495), leaf area at 90 DAT (0.220) and days to first fruit maturity (0.190 at p=0.05), early yield per plant (0.321), number of fruits per plant (0.311) and yield per plant (0.333). Whereas, it had negative and significant correlation with average fruit weight (-0.147 at p=0.05).

A significant (at p=0.01) and positive relationship of plant spread at 90 DAT (Table 11) with number of primary branches at 90 DAT (0.330), stem girth at 90 DAT (0.430), leaf area at 90 DAT (0.219), fruit diameter (0.202), early yield per plant (0.477), number of fruits per plant (0.308), per cent dry matter in fruits (0.214) and yield per plant (0.454) was observed.

Table 11. Phenotypic correlation coefficients among growth, earliness, yield and quality parameters in brinjal genotypes

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1.000	0.464**	0.215**	0.495**	0.220**	0.071	0.068	0.190*	-0.100	0.016	0.020	-0.067	-0.147*	0.321**	0.311**	-0.092	0.333**
2		1.000	0.330**	0.430**	0.219**	-0.002	0.017	0.046	0.008	0.095	0.202**	-0.137	-0.058	0.477**	0.308**	0.214**	0.454**
3			1.000	0.229**	-0.105	-0.069	-0.080	-0.064	0.182*	0.177*	0.025	0.080	0.074	0.444**	0.215**	0.250**	0.470**
4				1.000	0.080	-0.024	-0.017	0.016	-0.077	0.053	0.050	-0.035	-0.164*	0.452**	0.397**	0.045	0.420**
5					1.000	0.342**	0.339**	0.304**	-0.139	0.016	0.423**	-0.239**	0.224**	0.125	-0.071	-0.164*	0.104
6						1.000	0.916**	0.808**	-0.055	0.040	0.199**	-0.130	0.112	-0.193**	-0.254**	-0.107	-0.230**
7							1.000	0.802**	-0.074	0.037	0.180*	-0.121	0.110	-0.183*	-0.265**	-0.117	-0.229**
8								1.000	-0.016	0.038	0.129	-0.079	0.056	-0.160*	-0.196**	-0.051	-0.168*
9									1.000	-0.291**	-0.293**	-0.075	-0.300**	-0.117	0.353**	0.259**	-0.019
10										1.000	0.308**	0.637**	0.501**	0.195**	-0.435**	-0.065	0.134
11											1.000	-0.464**	0.398**	0.246**	-0.222**	0.006	0.224**
12												1.000	0.236**	-0.022	-0.268**	-0.142	-0.056
13													1.000	0.120	-0.693**	0.014	0.072
14														1.000	0.396**	0.084	0.896**
15															1.000	0.109	0.499**
16																1.000	0.110
17																	1.000

Critical r_p value at 1per cent= 0.191 Critical r_p value at 5 per cent= 0.146 ** Indicates significant at p=0.01 * Indicates significant at p=0.05

Characters:-

1. Plant height at 90 DAT (cm)
2. Plant spread at 90 DAT (cm)
3. Number of primary branches at 90 DAT
4. Stem girth at 90 DAT (cm)
5. Leaf area at 90 DAT (cm^2)
6. Days to first flowering
7. Days to 50 per cent flowering
8. Days to first fruit maturity
9. Number of fruits per cluster
10. Fruit length (cm)
11. Fruit diameter (cm)
12. Fruit length-diameter ratio
13. Average fruit weight (g)
14. Early yield per plant (kg)
15. Number of fruits per plant
16. Per cent dry matter in fruit
17. Total yield per plant (kg)

Number of primary branches at 90 DAT (Table 11) had positive and significant (at p=0.01) association with stem girth at 90 DAT (0.229), early yield per plant (0.444), number of fruits per plant (0.215), per cent dry matter in fruits (0.250) and yield per plant (0.470). Whereas, number of fruits per cluster (0.182) and fruit length (0.177) were found positive and significant (at p=0.05) association with this trait.

At 90 DAT stem girth (Table 11) had recorded significant (at p=0.01) and positive correlation with early yield per plant (0.452), number of fruits per plant (0.397) and yield per plant (0.420). Whereas, average fruit weight (-0.164) had significant (at p=0.05) and positive association with this trait.

The leaf area at 90 DAT (Table 11) had significant (at p=0.01) and positive relationship with days to first flowering (0.342), days to 50 per cent flowering (0.339), days to first fruit maturity (0.304), fruit diameter (0.423) and average fruit weight (0.224). Whereas, fruit length-diameter ratio (-0.239 at p=0.01) and per cent dry matter in fruits (-0.164 at p=0.05) had negative and significant relationship with this trait.

Days to first flowering (Table 11) exhibited positive and significant (at p=0.01) correlation with days to 50 per cent flowering (0.916), days to first fruit maturity (0.808) and fruit diameter (0.199). But it showed negative and significant (at p= 0.01) association with early yield per plant (-0.193), number of fruits per plant (-0.254) and yield per plant (-0.230).

The days to 50 per cent flowering (Table 11) had positive significant (at p=0.01) correlation with days to first fruit maturity (0.802) and fruit diameter at p=0.05 (0.180). At p=0.05, early yield per plant (-0.183) and at p= 0.01 number of fruits per plant (-0.265) as well as yield per plant (-0.229) showed significantly negative association with this trait.

Days to first fruit maturity (Table 11) had negative and significant (at p=0.01) association with number of fruits per plant (-0.196). Whereas, at p=0.05 this character had significant negative relationship with early yield per plant (-0.160) and yield per plant (-0.168).

Number of fruits per cluster (Table 11) had positively and significantly (at p=0.01) associated number of fruits per plant (0.353) and per cent dry matter in fruits (0.259). While significantly negative association of this character with fruit length (-0.291), fruit diameter (-0.293) and average fruit weight (-0.300) was observed.

Fruit length (Table 11) showed positive and significant (at p=0.01) association with fruit diameter (0.308), fruit length-diameter ratio (0.637), average fruit weight (0.501) and early yield per plant (0.195). Whereas, number of fruits per plant (-0.435) had negative and significant (at p= 0.01) relationship with this trait.

Fruit diameter (Table 11) had positive and significant (at p=0.01) correlation with average fruit weight (0.398), early yield per plant (0.246) and yield per plant (0.224). Whereas, fruit length-diameter ratio (-0.464) and number of fruits per plant (-0.222) showed negatively and significant (at p=0.01) association with this trait.

Fruit length-diameter ratio (Table 11) exhibited positive association with average fruit weight (0.236) while it showed negative and significant (at p=0.01) association with number of fruits per plant (-0.268).

Average fruit weight (Table 11) exhibited negative and significant (at p=0.01) relationship with number of fruits per plant (-0.693). The early yield per plant had positive and significant (at p=0.01) correlation with number of fruits per plant (0.396) and yield per plant (0.896). Number of fruits per plant also had positive and significant (at p=0.01) relationship with yield per plant (0.499).

4.3 Path co-efficient analysis

The correlation would only indicate the overall relationship of independent trait with dependent trait but does not provide cause and effect relationship. Using path analysis, it is possible to resolve the correlations, which provide clue about such relationship. In brinjal 17 important growth, earliness, yield and quality parameters were subjected to genotypic and phenotypic path coefficient analysis by considering fruit yield per plant as dependent variable on 16 other independent variables are presented in Tables 12 and 13, respectively.

4.3.1 Genotypic path co-efficient analysis

Plant height at 90 DAT (Table 12) had moderate and direct positive effect (0.235) on total yield per plant. It had low to high indirect and positive effects through average fruit weight (0.140) and early yield per plant (0.775). It also had moderate and indirect negative effects through plant spread at 90 DAT (-0.258) and it also had low to high indirect negative effects through number of fruits per plant (-0.424) and stem girth at 90 DAT (-0.122).

Plant spread at 90 DAT (Table 12) had very high indirect and positive effect through early yield per plant (1.340). It had high and direct negative effects (-0.408) on total yield per plant and it also had high indirect and negative effect through number of fruits per plant (-0.528).

Number of primary branches at 90 DAT (Table 12) had negligible and direct positive effects (0.071) on total yield per plant and it also had very high indirect and positive effect through early yield per plant (1.010) and it had moderate indirect negative effects through number of fruits per plant (-0.295).

Stem girth at 90 DAT (Table 12) had low to very high indirect positive effects through average fruit weight (0.192) and early yield per plant (1.072). It had low direct and negative effect (-0.184) on total yield per plant. It had also high indirect negative effects through number of fruits per plant (-0.550).

Leaf area at 90 DAT (Table 12) had moderate and direct positive effects (0.228) on total yield per plant and it had moderate and indirect positive effects through early yield per plant (0.253). But it also had low and indirect negative effects through days to 50 per cent flowering (-0.122) and average fruit weight (-0.195).

Days to first flowering (Table 12) had negligible and direct positive effect (0.056) on total yield per plant. It had low to high indirect positive effects through days to first fruit maturity (0.150) and number of fruits per plant (0.370). However, days to 50 per cent flowering (-0.329), average fruit weight (-0.107) and early yield per plant (-0.454) were had low to high indirect negative effects.

Table 12. Genotypic path coefficient analysis among growth, earliness, yield and quality parameters in brinjal genotypes

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	rG
1	**0.235**	-0.258	0.020	-0.122	0.057	0.007	-0.048	0.042	-0.029	-0.000	-0.002	0.005	0.140	0.775	-0.424	-0.013	0.385**
2	0.149	**-0.408**	0.035	-0.085	0.073	0.002	-0.016	0.019	0.001	-0.003	-0.030	0.013	0.066	1.340	-0.528	0.030	0.660**
3	0.065	-0.201	**0.071**	-0.062	-0.024	-0.004	0.033	-0.011	0.053	-0.050	-0.000	-0.005	-0.065	1.010	-0.295	0.031	0.545**
4	0.156	-0.188	0.024	**-0.184**	0.022	0.002	-0.008	0.022	-0.030	0.000	-0.002	0.004	0.192	1.072	-0.550	0.006	0.539**
5	0.059	-0.130	-0.007	-0.017	**0.228**	0.021	-0.122	0.055	-0.038	-0.006	-0.068	0.013	-0.195	0.253	0.096	-0.020	0.120
6	0.030	-0.021	-0.006	-0.009	0.087	**0.056**	-0.329	0.150	-0.017	-0.014	-0.030	0.006	-0.107	-0.454	0.370	-0.014	-0.302**
7	0.034	-0.020	-0.007	-0.004	0.086	0.057	**-0.325**	0.147	-0.023	-0.019	-0.031	0.006	-0.105	-0.420	0.369	-0.015	-0.272**
8	0.061	-0.049	-0.004	-0.025	0.077	0.052	-0.295	**0.162**	-0.004	-0.015	-0.020	0.003	-0.054	-0.277	0.231	-0.004	-0.164*
9	-0.025	-0.002	0.013	0.020	-0.031	-0.003	0.027	-0.002	**0.280**	0.084	0.046	0.004	0.260	-0.267	-0.464	0.032	-0.028
10	0.000	-0.005	0.013	0.000	0.005	0.003	-0.024	0.009	-0.091	**-0.258**	-0.029	-0.036	-0.482	0.397	0.648	-0.012	0.139
11	0.003	-0.090	0.000	-0.002	0.112	0.012	-0.073	0.023	-0.093	-0.053	**-0.140**	0.028	-0.388	0.549	0.356	-0.001	0.242**
12	-0.022	0.098	0.006	0.013	-0.056	-0.006	0.036	-0.011	-0.021	-0.173	0.071	**-0.054**	-0.210	-0.080	0.361	-0.019	-0.070
13	-0.038	0.031	0.005	0.041	0.051	0.007	-0.039	0.010	-0.084	-0.144	-0.063	-0.013	**-0.862**	0.262	0.915	0.001	0.080
14	0.096	-0.287	0.037	-0.104	0.030	-0.013	0.071	-0.023	-0.039	-0.053	-0.040	0.002	-0.118	**1.903**	-0.469	0.009	1.000**
15	0.085	-0.183	0.017	-0.086	-0.018	-0.017	0.102	-0.032	0.110	0.142	0.042	0.016	0.671	0.760	**-1.174**	0.012	0.449**
16	-0.027	-0.109	0.019	-0.011	-0.040	-0.007	0.043	-0.006	0.078	0.027	0.002	0.009	-0.013	0.161	-0.126	**0.114**	0.114

Residual (R) = -0.078 Bold and diagonal values indicate direct effect rG = Genotypic correlation coefficients with total yield per plant

** Indicates significant at p=0.01 * Indicates significant at p=0.05

Characters:-

1. Plant height at 90 DAT (cm)
2. Plant spread at 90 DAT (cm)
3. Number of primary branches at 90 DAT
4. Stem girth at 90 DAT (cm)
5. Leaf area at 90 DAT (cm^2)
6. Days to first flowering
7. Days to 50 per cent flowering
8. Days to first fruit maturity
9. Number of fruits per cluster
10. Fruit length (cm)
11. Fruit diameter (cm)
12. Fruit length-diameter ratio
13. Average fruit weight (g)
14. Early yield per plant (kg)
15. Number of fruits per plant
16. Per cent dry matter in fruit
17. Total yield per plant (kg)

Days to 50 per cent flowering (Table 12) had low to high indirect positive effects through days to first fruit maturity (0.147) and number of fruits per plant (0.369). It had high direct and negative effects (-0.325) on total yield per plant and it also had low to high indirect negative effects through average fruit weight (-0.105) and early yield per plant (-0.420).

Days to first fruit maturity (Table 12) had low direct and positive effects (0.162) on total yield per plant and moderate indirect positive effects through number of fruits per plant (0.231). But it also had moderate and indirect negative effects through early yield per plant (-0.277).

Number of fruit per cluster (Table 12) had moderate and direct positive effects (0.280) on total yield per plant and it also had moderate indirect positive effects through average fruit weight (0.260). It had moderate to high indirect negative effects through early yield per plant (-0.267) and number of fruits per plant (-0.464).

Fruit length (Table 12) had high indirect positive effects through early yield per plant (0.397) and number of fruits per plant (0.648). It also had moderate and direct negative effects (-0.258) on total yield per plant and high indirect negative effects through average fruit weight (-0.482).

Fruit diameter (Table 12) had high indirect positive effects through early yield per plant (0.549) and number of fruits per plant (0.356). It had low direct and negative effects (-0.140) on total yield per plant and it also had high indirect negative effects through average fruit weight (-0.388).

Fruit length-diameter ratio (Table 12) had high indirect positive effects through number of fruits per plant (0.361). It had negligible and direct negative effects (-0.054) on total yield per plant. It also had moderate indirect negative effects through early yield per plant (-0.210).

Average fruit weight (Table 12) had moderate to high indirect positive effects through early yield per plant (0.262) and number of fruits per plant (0.915). But it also had high negative direct effects (-0.862) on total yield per plant.

Early yield per plant (Table 12) had very high direct positive effects (1.903) on total yield per plant and it had high indirect negative effects through number of fruits per plant (-0.469). Number of fruits per plant had very high direct and negative effects (-1.174) on total yield per plant. Per cent dry matter in fruits had low direct and positive effects (0.114) on total yield per plant.

4.3.2 Phenotypic path co-efficient analysis

Plant height at 90 DAT (Table 13) had negligible and direct positive effects (0.023) on total yield per plant, but it had low to moderate and indirect positive effects through early yield per plant (0.208) and number of fruits per plant (0.136).

Plant spread at 90 DAT (Table 13) had low to high indirect positive effects through early yield per plant (0.309) and number of fruits per plant (0.134). It had negligible and direct negative effects (-0.006) on total yield per plant.

Number of primary branches at 90 DAT (Table 13) had negligible and direct positive effects (0.066) on total yield per plant and it also had moderate indirect positive effects through early yield per plant (0.288).

Stem girth at 90 DAT (Table 13) had low to moderate indirect and positive effects through early yield per plant (0.293) and number of fruits per plant (0.173). But it also had negligible and direct negative effects (-0.036) on total yield per plant.

Leaf area at 90 DAT (Table 13) had high indirect positive effects through early yield per plant (0.814) and it had negligible and direct negative effects (-0.018) on total yield per plant. Days to first flowering had negligible direct and negative effects (-0.066) on total yield per plant. But it had low and indirect negative effects through early yield per plant (-0.125) and number of fruits per plant (-0.111).

Days to 50 per cent flowering (Table 13) had negligible and direct negative effects (-0.034) on total yield per plant. But it had low and indirect negative effects through early yield per plant (-0.119) and number of fruits per plant (-0.115). Days to first fruit maturity had negligible direct and positive effects (0.084) on total yield per plant. But it had low indirect negative effects through early yield per plant (-0.104).

Table 13. Phenotypic path coefficient analysis among growth, earliness, yield and quality parameters in brinjal genotypes

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	rP
1	**0.023**	-0.002	0.014	-0.017	-0.004	-0.004	-0.002	0.016	0.000	0.000	0.001	-0.000	-0.037	0.208	0.136	0.001	0.333**
2	0.010	**-0.006**	0.022	-0.015	-0.004	0.000	-0.000	0.004	-0.000	0.003	0.013	-0.000	-0.014	0.309	0.134	-0.002	0.454**
3	0.005	-0.002	**0.066**	-0.008	0.002	0.004	0.002	-0.005	-0.001	0.006	0.001	0.000	0.018	0.288	0.094	-0.003	0.470**
4	0.011	-0.002	0.015	**-0.036**	-0.001	0.001	0.000	0.001	0.000	0.002	0.003	-0.000	-0.041	0.293	0.173	-0.000	0.420**
5	0.005	-0.001	-0.007	-0.002	**-0.018**	-0.022	-0.011	0.025	0.001	0.000	0.027	-0.000	0.056	0.814	-0.031	0.002	0.104
6	0.001	0.000	-0.004	0.000	-0.006	**-0.066**	-0.031	0.068	0.000	0.001	0.013	-0.000	0.028	-0.125	-0.111	0.001	-0.230**
7	0.001	-0.000	-0.005	0.000	-0.006	-0.060	**-0.034**	0.067	0.000	0.001	0.011	-0.000	0.027	-0.119	-0.115	0.001	-0.229**
8	0.004	-0.000	-0.004	-0.000	-0.005	-0.053	-0.027	**0.084**	0.000	0.001	0.008	-0.000	0.014	-0.104	-0.085	0.000	-0.168*
9	-0.002	-0.000	0.012	0.002	0.002	0.003	0.002	-0.001	**-0.009**	-0.011	-0.019	-0.000	-0.075	-0.076	0.154	-0.003	-0.019
10	0.000	-0.000	0.011	-0.001	-0.000	-0.002	-0.001	0.003	0.002	**0.037**	0.020	0.001	0.126	0.126	-0.190	0.000	0.134
11	0.000	-0.001	0.001	-0.001	-0.007	-0.013	-0.006	0.011	0.002	0.011	**0.065**	-0.001	0.100	0.159	-0.097	-0.000	0.224**
12	-0.001	0.000	0.005	0.001	0.004	0.008	0.004	-0.006	0.000	0.023	-0.030	**0.002**	0.059	-0.014	-0.117	0.001	-0.056
13	-0.003	0.000	0.005	0.006	-0.004	-0.007	-0.003	0.004	0.002	0.018	0.025	0.000	**0.252**	0.078	-0.303	-0.000	0.072
14	0.007	-0.003	0.029	-0.016	-0.002	0.012	0.006	-0.013	0.001	0.007	0.016	0.000	0.030	**0.648**	0.173	-0.001	0.896**
15	0.007	-0.001	0.014	-0.014	0.001	0.016	0.009	-0.016	-0.003	-0.016	-0.014	-0.000	-0.174	0.257	**0.437**	-0.001	0.499**
16	-0.002	-0.001	0.016	-0.001	0.003	0.007	0.004	-0.004	-0.002	-0.002	0.000	-0.000	0.003	0.054	0.047	**-0.012**	0.110

Residual (R) = 0.368 Bold and diagonal values indicate direct effect rP = Phenotypic correlation coefficients with total yield per plant

** Indicates significant at p=0.01 * Indicates significant at p=0.05

Characters:

1. Plant height at 90 DAT (cm)
2. Plant spread at 90 DAT (cm)
3. Number of primary branches at 90 DAT
4. Stem girth at 90 DAT (cm)
5. Leaf area at 90 DAT (cm^2)
6. Days to first flowering
7. Days to 50 per cent flowering
8. Days to first fruit maturity
9. Number of fruits per cluster
10. Fruit length (cm)
11. Fruit diameter (cm)
12. Fruit length-diameter ratio
13. Average fruit weight (g)
14. Early yield per plant (kg)
15. Number of fruits per plant
16. Per cent dry matter in fruit
17. Total yield per plant (kg)

Number of fruits per cluster (Table 13) had low indirect positive effects through number of fruits per plant (0.154) and it also had negligible and direct negative effects (-0.009) on total yield per plant. Fruit length had negligible direct positive effects (0.037) on total yield per plant and it had low indirect positive effects through early yield per plant (0.126) and average fruit weight (0.126) and it had low indirect negative effects through number of fruits per plant (-0.190).

Fruit diameter (Table 13) had negligible direct effects (0.065) on total yield per plant and it had low indirect positive effects through average fruit weight (0.100) and early yield per plant (0.159). Fruit length-diameter ratio had negligible direct positive effects (0.002) on total yield per plant and it had low indirect negative effects through number of fruits per plant (-0.117).

Average fruit weight (Table 13) had moderate and direct positive effects (0.252) on total yield per plant. It had high indirect negative effects through number of fruits per plant (-0.303). Early yield per plant had high positive direct effects (0.648) on total yield per plant and it had low indirect positive effects through number of fruits per plant (0.173).

Number of fruits per plant (Table 13) had high positive direct effects (0.437) on total yield per plant. Per cent dry matter in fruits had negligible and direct negative effects (-0.012) on total yield per plant.

4.4 Genetic divergence

Sixty genotypes of different locations were assessed for 21 characters and data obtained was subjected to D^2 statistics to assess the genetic diversity. Seven clusters were constructed using Tocher's method.

4.4.1 Relative contribution of different characters towards divergence

The relative contribution of different characters for genetic divergence (D^2) is given in Table 14. Average fruit weight contributed maximum (52.32%) to the genetic diversity followed by number of fruits per cluster (14.52%), plant spread at 60 DAT (13.90%), plant height at 60 DAT (10.62%), leaf area at 60 DAT (6.50%), leaf area at 90 DAT (1.19%), fruit length-diameter ratio (0.28%), number of primary branches

Table 14. Relative per cent contribution of different characters to the total divergence in brinjal genotypes

Sl. No.	Character or source	No. of times ranked first	Per cent contribution
1.	Plant height at 60 DAT (cm)	188	10.62
2.	Plant height at 90 DAT (cm)	0	0.00
3.	Plant spread at 60 DAT (cm)	246	13.90
4.	Plant spread at 90 DAT (cm)	0	0.00
5.	Number of primary branches at 60 DAT	0	0.00
6.	Number of primary branches at 90 DAT	4	0.23
7.	Stem girth at 60 DAT (cm)	4	0.23
8.	Stem girth at 90 DAT (cm)	0	0.00
9.	Leaf area at 60 DAT (cm^2)	115	6.50
10.	Leaf area at 90 DAT (cm^2)	21	1.19
11.	Days to first flowering	1	0.06
12.	Days to 50 per cent flowering	0	0.00
13.	Days to first fruit maturity	1	0.06
14.	Number of fruits per cluster	257	14.52
15.	Fruit length (cm)	0	0.00
16.	Fruit diameter (cm)	2	0.11
17.	Fruit length-diameter ratio	5	0.28
18.	Early yield per plant (kg)	0	0.00
19.	Average fruit weight (g)	926	52.32
20.	Number of fruits per plant	0	0.00
21.	Total yield per plant (kg)	0	0.00

at 90 DAT (0.23%), stem girth at 60 DAT (0.23%), fruit diameter (0.11%), days to first flowering (0.06%) and days to first fruit maturity (0.06%). Characters like plant height at 90 DAT, plant spread at 90 DAT, number of primary branches at 60 DAT, stem girth at 90 DAT, days to 50 per cent flowering, fruit length, early yield per plant, number of fruits per plant and total yield per plant did not contribute to genetic divergence.

4.4.2 Classification of brinjal genotypes

By following Tocher's method, 60 genotypes were grouped into seven clustering by treating estimated D^2 values as the square of the generalized distance. The distribution of entries into various clusters is given in Table 15.

Cluster I was the largest having 36 genotypes followed by cluster II with 14 genotypes, cluster III with 6 genotypes, cluster IV (CBB-8), cluster V (CBB-39), cluster VI (CBB-59) and cluster VII (CBB-53) had one genotype (Table 15).

Intra-cluster and inter-cluster average D^2 values are presented in Table 16. Among the seven clusters, cluster III with 6 genotypes showed maximum intra-cluster diversity (D^2=27.63) followed by cluster II (D^2=23.64) and cluster I (D^2=20.79). The clusters IV, V, VI and VII had no intra-cluster distance (D^2=0.00) as they possessed single genotype.

Based on distances between clusters, *i.e.*, inter-cluster distances, the maximum divergence was observed between clusters III and cluster VII (D^2=69.50) followed by clusters VI and VII (D^2=68.98), cluster IV and VII (D^2=64.09), cluster II and III (D^2=54.94), cluster II and VI (D^2=47.44) and cluster II and IV (D^2=36.21). The cluster I had the least inter-cluster distance (D^2=28.76) with the cluster V.

4.4.3 Cluster means

The mean values of 21 characters for seven clusters are summarized in Table 17.

4.4.3.1 Plant height at 60 DAT

Highest cluster mean for this character (Table 17) was observed in the cluster IV (67.33 cm) followed by cluster VI (60.00 cm), cluster I (55.66 cm) and cluster II (53.86 cm) and the lowest cluster mean was observed in the cluster VII (35.47 cm).

Table 15. Classification of brinjal genotypes into different clusters based on D^2 value

Cluster number	Number of genotypes	Name of the genotype
I	36	CBB-24, CBB-34, CBB-21, CBB-38, CBB-28, CBB-17, CBB-51, CBB-31, CBB-57, CBB-7, CBB-2, CBB-9, CBB-50, CO-2, CBB-20, CBB-32, CBB-35, CBB-42, CBB-25, CBB-36, CBB-44, CBB-29, CBB-22, CBB-26, CBB-18, CBB-30, CBB-54, CBB-56, CBB-47, CBB-55, CBB-37, CBB-58, CBB-41, CBB-52, CBB-33 and CBB-3.
II	14	CBB-6, CBB-16, CBB-40, CBB-4, CBB-23, CBB-5, CBB-27, CBB-1, CBB-10, CBB-48, CBB-14, CBB-45, CBB-49 and CBB-43.
III	6	CBB-13, CBB-19, CBB-46, CBB-12, CBB-15 and CBB-11.
IV	1	CBB-8
V	1	CBB-39
VI	1	CBB-59
VII	1	CBB-53

Table 16. Average intra and inter-cluster D^2 values of 7 clusters for 21 characters formed by 60 genotypes of brinjal

Clusters	I	II	III	IV	V	VI	VII
I	**20.79**	36.41	39.79	29.45	28.76	36.88	54.60
II		**23.64**	54.94	36.21	40.27	47.44	40.62
III			**27.63**	46.53	44.71	51.15	69.50
IV				**0.00**	46.76	35.33	64.09
V					**0.00**	43.44	43.19
VI						**0.00**	68.98
VII							**0.00**

Note: Bold and diagonal values indicate intra-cluster distances

4.4.3.2 Plant height at 90 DAT

For this character highest cluster mean (Table 17) was observed in the cluster IV (75.40 cm) followed by cluster VI (73.73 cm), cluster I (68.35 cm) and cluster II (66.56 cm) and the lowest cluster mean was observed in the cluster VII (46.60 cm).

4.4.3.3 Plant spread at 60 DAT

The mean (Table 17) for plant spread at 60 DAT was highest in cluster IV (77.17 cm) followed by cluster II (61.72 cm), cluster I (59.79 cm) and cluster VI (59.73 cm) and the lowest cluster mean was observed in the cluster VII (40.73 cm).

4.4.3.4 Plant spread at 90 DAT

Highest cluster mean for this trait (Table 17) was observed in the cluster IV (86.89 cm) followed by cluster VI (77.03 cm), cluster II (71.48 cm) and cluster III (70.66 cm) and the lowest cluster mean was observed in the cluster VII (48.42 cm).

4.4.3.5 Number of primary branches at 60 DAT

The mean (Table 17) for number of primary branches at 60 DAT was highest in cluster VI (5.24) followed by cluster III (5.03), cluster II (4.92) and cluster I (4.90) and the lowest cluster mean was observed in the clusters V and VII (4.31).

4.4.3.6 Number of primary branches at 90 DAT

For this trait highest cluster mean (Table 17) was observed in the cluster III (7.61) followed by cluster II (6.86), cluster I (6.52) and cluster VI (6.33) and the lowest cluster mean was observed in the cluster VII (4.80).

4.4.3.7 Stem girth at 60 DAT

Highest cluster mean for this character (Table 17) was observed in the cluster IV (2.13 cm) followed by cluster VI (1.62 cm), cluster II (1.44 cm) and cluster I (1.41 cm) and the lowest cluster mean was observed in the cluster V (0.85 cm).

Table 17. The mean values of 21 characters for 7 clusters formed by 60 genotypes in brinjal

Sl. No.	Characters	Clusters						
		I	II	III	IV	V	VI	VII
1.	Plant height at 60 DAT (cm)	55.66	53.86	50.23	67.33	35.33	60.00	35.47
2.	Plant height at 90 DAT (cm)	68.35	66.56	63.94	75.40	42.64	73.73	46.60
3.	Plant spread at 60 DAT (cm)	59.79	61.72	59.69	77.17	47.23	59.73	40.73
4.	Plant spread at 90 DAT (cm)	69.41	71.48	70.66	86.89	53.05	77.03	48.42
5.	Number of primary branches at 60 DAT	4.90	4.92	5.03	4.89	4.31	5.24	4.31
6.	Number of primary branches at 90 DAT	6.52	6.86	7.61	5.80	6.00	6.33	4.80
7.	Stem girth at 60 DAT (cm)	1.41	1.44	1.36	2.13	0.85	1.62	0.93
8.	Stem girth at 90 DAT (cm)	1.85	1.76	1.73	2.37	1.23	1.97	1.41
9.	Leaf area at 60 DAT (cm^2)	90.20	107.43	73.85	139.57	104.97	232.10	70.63
10.	Leaf area at 90 DAT (cm^2)	138.74	162.50	125.05	159.46	132.26	372.01	83.60
11.	Days to first flowering	50.41	51.33	49.89	58.00	48.00	57.33	40.33
12.	Days to 50 per cent flowering	57.64	58.28	56.82	64.00	55.40	64.13	47.60
13.	Days to first fruit maturity	74.31	74.70	74.59	84.93	68.60	78.00	67.93
14.	Number of fruits per cluster	1.03	1.00	2.49	1.00	1.00	1.00	1.00
15.	Fruit length (cm)	7.34	8.08	6.19	10.27	7.77	5.87	8.80
16.	Fruit diameter (cm)	5.10	5.79	4.17	4.73	5.13	5.57	2.53
17.	Fruit length-diameter ratio	1.45	1.40	1.46	2.16	1.51	1.05	3.47
18.	Early yield per plant (kg)	0.72	0.78	0.67	1.05	0.44	1.05	0.58
19.	Average fruit weight (g)	68.88	119.98	57.86	79.83	71.17	70.33	133.00
20.	Number of fruits per plant	22.11	12.96	29.77	26.31	12.46	29.90	8.74
21.	Total yield per plant (kg)	1.47	1.54	1.46	2.10	0.88	2.10	1.16

4.4.3.8 Stem girth at 90 DAT

Highest cluster mean for this character (Table 17) was observed in the cluster IV (2.37 cm) followed by cluster VI (1.97 cm), cluster I (1.85 cm) and cluster II (1.76 cm) and the lowest cluster mean was observed in the cluster V (1.23 cm).

4.4.3.9 Leaf area at 60 DAT

Highest cluster mean for this character (Table 17) was observed in the cluster VI (232.10 cm^2) followed by cluster IV (139.57 cm^2), cluster II (107.43 cm^2) and cluster V (104.97 cm^2) and the lowest cluster mean was observed in the cluster VII (70.63 cm^2).

4.4.3.10 Leaf area at 90 DAT

Highest cluster mean for this character (Table 17) was observed in the cluster VI (372.01 cm^2) followed by cluster II (162.50 cm^2), cluster IV (159.46 cm^2) and cluster I (138.74 cm^2) and the lowest cluster mean was observed in the cluster VII (83.60 cm^2).

4.4.3.11 Days to first flowering

The cluster means for days to first flowering (Table 17) were 40.33, 48.00, 49.89 and 50.41 for clusters VII, V, III and I, respectively and the highest cluster mean was observed in the cluster IV (58.00).

4.4.3.12 Days to 50 per cent flowering

The cluster means for days to 50 per cent flowering (Table 17) were 47.60, 55.40, 56.82 and 57.64 for clusters VII, V, III and I, respectively and the highest cluster mean was observed in the cluster VI (64.13).

4.4.3.13 Days to first fruit maturity

The cluster means for days to first fruit maturity (Table 17) were 67.93, 68.60, 74.31 and 74.70 for cluster VII, V, I and II, respectively and the highest cluster mean was observed in the cluster IV (84.93).

4.4.3.14 Number of fruits per cluster

For number of fruits per cluster highest cluster mean (Table 17) was observed in the cluster III (2.49) followed by cluster I (1.03) and the lowest cluster mean was observed in the clusters II , IV, V, VI and VII (1.00).

4.4.3.15 Fruit length

Highest cluster mean for this character (Table 17) was observed in the cluster IV (10.27 cm) followed by cluster VII (8.80 cm), cluster II (8.08 cm) and cluster V (7.77 cm) and the lowest cluster mean was observed in the cluster VI (5.87).

4.4.3.16 Fruit diameter

Highest cluster mean for this character (Table 17) was observed in the cluster II (5.79 cm) followed by cluster VI (5.57 cm), cluster V (5.13 cm) and cluster I (5.10 cm) and the lowest cluster mean was observed in the cluster VII (2.53).

4.4.3.17 Fruit length-diameter ratio

Highest cluster mean for this character (Table 17) was observed in the cluster VII (3.47) followed by cluster IV (2.16), cluster V (1.51) and cluster III (1.46) and the lowest cluster mean was observed in the cluster VI (1.05).

4.4.3.18 Early yield per plant

Highest cluster mean for this character (Table 17) was observed in the clusters IV and VI (1.05 kg) followed by cluster II (0.78 kg), cluster I (0.72 kg) and cluster III (0.67 kg) and the lowest cluster mean was observed in the cluster V (0.44 kg).

4.4.3.19 Average fruit weight

Highest cluster mean for this character (Table 17) was observed in the cluster VII (133.00 g) followed by cluster II (119.98 g), cluster IV (79.83 g) and cluster V (71.17 g) and the lowest cluster mean was observed in the cluster III (57.86).

4.4.3.20 Number of fruits per plant

Highest cluster mean for number of fruits per plant (Table 17) was observed in the cluster VI (29.90) followed by cluster III (29.77), cluster IV (26.31) and I (22.11) cluster and the lowest cluster mean was observed in the cluster VII (8.74).

4.4.3.21 Total yield per plant

Highest cluster mean for this character (Table 17) was observed in the clusters IV and VI (2.10 kg) followed by cluster II (1.54 kg), cluster I (1.47 kg) and cluster III (1.46 kg) and the lowest cluster mean was observed in the cluster V (0.88 kg).

4.5 Pest and diseases incidence

4.5.1 Shoot borer incidence

The shoot borer incidence was maximum in genotype CBB-18 (20.69%) followed by CBB-51 (11.61%), CBB-4 (7.70%), CBB-38 (6.54%), CBB-7 (6.54%), CBB-46 (4.99%), CBB-33 (4.86%), CBB-45 (4.80%), CBB-52 (4.79%), CBB-43 (4.78%), CBB-2 (4.76%), CBB-28 (4.64%), CBB-54 (4.27%), CBB-49 (4.22%), CBB-40 (3.65%) and CBB-29 (3.58%) and the incidence of this pest was not observed in genotypes *viz.*, CBB-1, CBB-3, CBB-5, CO-2, CBB-6, CBB-8, CBB-9, CBB-10, CBB-11, CBB-12, CBB-13, CBB-14, CBB-15, CBB-16, CBB-17, CBB-19, CBB-20, CBB-21, CBB-22, CBB-23, CBB-24, CBB-25, CBB-26, CBB-27, CBB-30, CBB-31, CBB-32, CBB-34, CBB-35, CBB-36, CBB-37, CBB-39, CBB-41, CBB-42, CBB-44, CBB-47, CBB-48, CBB-50, CBB-53, CBB-55, CBB-56, CBB-57, CBB-58 and CBB-59 (Appendix III).

4.5.2 Fruit borer incidence

The maximum infestation by fruit borer was observed in genotype CBB-18 (49.44%) followed by CBB-51 (31.73%), CBB-4 (19.76%), CBB-7 (16.59%), CBB-33 (13.65%), CBB-38 (13.30%), CBB-49 (11.21%), CBB-43 (10.60%), CBB-46 (7.96%), CBB-52 (7.95%), CBB-54 (7.15%), CBB-29 (6.89%), CBB-40 (6.83%), CBB-28 (5.97%) and CBB-45 (5.90%). The genotypes CBB-1, CBB-3, CBB-5, CO-2, CBB-6, CBB-8, CBB-9, CBB-10, CBB-11, CBB-12, CBB-13,

CBB-14, CBB-15, CBB-16, CBB-17, CBB-19, CBB-20, CBB-21, CBB-22, CBB-23, CBB-24, CBB-25, CBB-26, CBB-27, CBB-30, CBB-31, CBB-32, CBB-34, CBB-35, CBB-36, CBB-37, CBB-39, CBB-41, CBB-42, CBB-44, CBB-47, CBB-48, CBB-50, CBB-53, CBB-55, CBB-56, CBB-57, CBB-58 and CBB-59 were not infested by fruit borer (Appendix III).

4.5.3 Phomopsis blight incidence

The phomopsis blight incidence was high in genotype CBB-27 (45.64%) followed by CBB-13 (43.34%), CBB-14 (15.96%), CBB-50 (14.40%), CBB-19 (10.73%), CBB-51 (9.93%), CBB-53 (9.90%) and CBB-36 (8.00%). The rest of the genotypes were not affected by this disease (Appendix III).

4.5.4 Little leaf incidence

The incidence of little leaf was maximum in genotypes namely CBB-9 (13.33%), CBB-12, CBB-13, CBB-42 and CBB-53 (6.66%) and the incidence of this disease was not noticed in genotypes *viz.*, CBB-1, CBB-2, CBB-3, CBB-4, CBB-5, CO-2, CBB-6, CBB-7, CBB-8, CBB-10, CBB-11, CBB-14, CBB-15, CBB-16, CBB-17, CBB-18, CBB-19, CBB-20, CBB-21, CBB-22, CBB-23, CBB-24, CBB-25, CBB-26, CBB-27, CBB-28, CBB-29, CBB-30, CBB-31, CBB-32, CBB-33, CBB-34, CBB-35, CBB-36, CBB-37, CBB-38, CBB-39, CBB-40, CBB-41, CBB-43, CBB-44, CBB-45, CBB-46, CBB-47, CBB-48, CBB-49, CBB-50, CBB-51, CBB-52, CBB-54, CBB-55, CBB-56, CBB-57, CBB-58 and CBB-59 (Appendix III).

5. DISCUSSION

The success of crop improvement programme depends on the extent of genetic variability existing in the germplasm. Magnitude of genetic variability can determine the pace and quantum of genetic improvement through selection or through hybridisation followed by selection. Therefore, in the present investigation, assessment of genetic variability in brinjal was carried out and the results of the experiments are discussed in this chapter.

5.1 Genetic variability, heritability, genetic advance and genetic advance over mean

Totally 60 genotypes were evaluated to know the amount of variability for yield and yield contributing characters. The analysis of variance (Tables 3 and 4) indicated highly significant (at p=0.01) differences among genotypes for most of the characters *viz.*, plant height (at 60, 90 and 120 DAT), plant spread (at 60, 90 and 120 DAT), number of primary branches (at 60, 90 and 120 DAT), stem girth at 60 DAT, leaf area (at 60 and 90 DAT), days to first flowering, days to 50 per cent flowering, days to first fruit maturity, number of fruits per cluster, fruit length, fruit diameter, fruit length-diameter ratio, average fruit weight, number of fruits per plant, total yield per plant, yield per plot, yield per hectare, per cent dry matter in fruits and phenol content. It indicated that sufficient variability existed for all the characters and considerable improvement could be achieved in most of these characters by selection. However, the analysis of variance by itself is not enough and conclusive to explain all the inherent genotypic variance in the genotypes.

One of the ways in which the variability of these characters assessed is through a simple approach of examining the range of variation. Range of variation observed for all the traits in the present study (Tables 5 and 7) indicated the presence of sufficient amount of variation among the genotypes for all the characters studied. The range in the values reflects the amount of phenotypic variability which is not very reliable since it includes genotypic, environmental and genotype X environmental interaction components and does not reveal as which component is showing higher degree of variability. Further, the phenotype of crop is influenced by additive gene effect (heritable), dominance (non-heritable) and epistatic (non-allelic interaction).

Hence, it becomes necessary to split the observed variability into phenotypic variation (PV) and genotypic variation (GV) which indicates the extent of variability existing for various traits. However, these GV and PV estimates are influenced by the units of measurements of the various traits and even these estimates don't give a true picture. But, the estimates of phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) will indicate the extent of variability existing for various traits irrespective of their units of measurements. However, even these don't give a correct picture about the extent of inheritance of the characters. Therefore, heritability of characters can be relied upon, as it enables the plant breeder to decide the extent of selection pressure to be applied under a particular environment, which separates out the environmental influence from the total variability. Nevertheless, its use would be limited as this is prone to change with environments and material. The estimation of heritability has a greater role to play in determining the effectiveness of selection for a character, provided it is considered in conjunction with the predicted genetic advance as suggested by Panse and Sukhatme (1957) and Johnson *et al.* (1955) as the heritability is influenced by biometrical method, generation of hybrid, sample size of experimental material and environment. With these points in view, the results of the variability observed in the 60 brinjal genotypes evaluated in the present investigation are discussed hereunder.

5.1.1 Growth parameters

In the present investigation high genotypic coefficient of variation and phenotypic coefficient of variation (>20%) were observed for number of primary branches (at 90 and 120 DAT), stem girth at 60 DAT and leaf area (at 60 and 90 DAT). Similar results were also obtained by Devi and Sankar (1990), Mishra and Mishra (1990), Pramanick *et al.* (1994), Kumar *et al*. (2012), Nayak and Nagre (2013) and Shekar *et al.* (2012). It indicated the presence of high variability in the germplasm for selection and even the differences between PCV and GCV values were minimum, indicating that traits under study were less influenced by environment. Hence, these characters can be relied upon and simple selection can be practiced for further improvement. For number of primary branches at 60 DAT, values of PCV was higher than the values of GCV indicating that that apparent of variation is not only due to genotypes but also due to influence of environment. Hence, selection for improvement of such characters will not be rewarding.

Plant spread (at 90 and 120 DAT) recorded low GCV and moderate PCV estimates. This result indicates that apparent variation is not only due to genotypes but also due to the influence of environment on the expression of character. Selection for such traits sometimes may be misleading. The findings of Patel *et al.* (2004) were similar.

Moderate estimates of GCV and PCV (11-20%) were observed for plant height (at 60, 90 and 120 DAT), stem girth (at 90 and 120 DAT) and plant spread at 60 DAT. Several workers *viz.*, Devi and Sankar (1990), Mishra and Mishra (1990), Pramanick *et al.* (1994), Prakash *et al.* (1994), Singh and Gopalakrishnan (1995), Sharma and Swaroop (2000), Mahaveerprasad *et al.* (2004), Kushwah and Bandhyopadhya (2005), Naik (2005), Golani *et al.* (2007), Sherly and Shanthi (2008), Das *et al.* (2010), Muniappan *et al.* (2010), Kumar *et al*. (2011), Arunkumar *et al.* (2013), Kumar *et al.* (2013b), Lokesh *et al.* (2013) and Nayak and Nagre (2013) reported similar findings. These results suggest that influence of environment was low or little. Therefore, phenotypic variability may be a good measure of genotypic variability.

In the present study, very high heritability (>60%) along with high genetic advance as per cent over mean (>20%) was recorded for the growth parameters *viz.*, plant height (at 60, 90 and 120 DAT), plant spread at 60 DAT, number of primary branches (at 90 and 120 DAT), stem girth at 60 DAT and leaf area (at 60 and 90 DAT). These results suggested that the inheritance of such characters is governed mainly by additive gene effects and therefore, selection based on phenotypic performance may prove useful. Similar results were also reported by Devi and Sankar (1990), Mishra and Mishra (1990), Prakash *et al.* (1994), Pramanick *et al.* (1994), Singh and Gopalakrishnan (1995), Sharma and Swaroop (2000), Kushwah and Bandhyopadhya (2005), Naik (2005), Sherly and Shanthi (2008), Muniappan *et al.* (2010), Kumar *et al*. (2012), Arunkumar *et al*. (2013) and Lokesh *et al.* (2013).

Moderate heritability (30-60%) along with moderate genetic advance as per cent over mean (10-20%) was recorded for the growth parameters *viz.*, plant spread (at 90 and 120 DAT), number of primary branches at 60 DAT and stem girth (at 90 and 120 DAT). This indicates that most likely the heritability is due to additive gene effects and selection may be effective. These results are in conformity with the findings of Mishra and Mishra (1990) and Naik (2005).

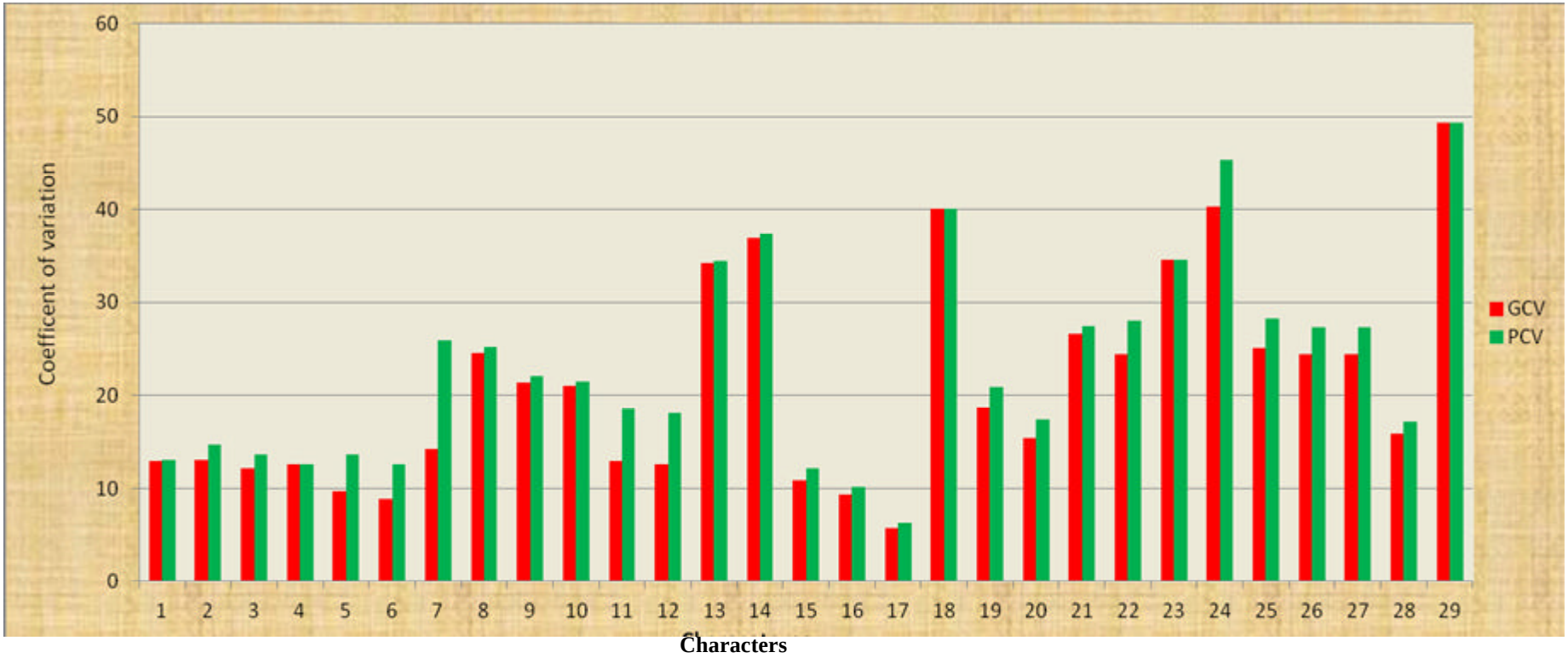

Fig. 1: Genotypic coefficient of variation and phenotypic coefficient of variation for different characters in brinjal genotypes

1. Plant height at 60 DAT (cm)
2. Plant height at 90 DAT (cm)
3. Plant height at 120 DAT (cm)
4. Plant spread at 60 DAT (cm)
5. Plant spread at 90 DAT (cm)
6. Plant spread at 120 DAT (cm)
7. Number of primary branches at 60 DAT
8. Number of primary branches at 90 DAT
9. Number of primary branches at 120 DAT
10 Stem girth at 60 DAT (cm)
11. Stem girth at 90 DAT (cm)
12. Stem girth at 120 DAT (cm)
13. Leaf area at 60 DAT (cm^2)
14. Leaf area at 90 DAT (cm^2)
15. Days to first flowering
16. Days to 50 per cent flowering
17. Days to first fruit maturity
18. Number of fruits per cluster
19. Fruit length (cm)
20. Fruit diameter (cm)
21. Fruit length-diameter ratio
22. Early yield per plant (kg)
23. Average fruit weight (g)
24. Number of fruits per plant
25. Total yield per plant (kg)
26. Yield per plot (kg)
27. Yield per hectare (t)
28. Per cent dry matter in fruits
29. Phenol content (mg/100 g)

5.1.2 Earliness parameters

Low GCV and PCV were recorded for days to 50 per cent flowering and days to first fruit maturity. These findings are in close agreement with the results obtained by Devi and Sankar (1990, Mishra and Mishra (1990), Sharma and Swaroop (2000), Naik (2005), Muniappan *et al.* (2010), Kumar *et al*. (2011), Arunkumar *et al*. (2013), Sao and Mehta (2009), Dahatonde *et al.* (2010) and Shekar *et al.* (2012). Low GCV and PCV for both characters indicated the narrow genetic base. Moderate GCV and PCV were observed for days to first flowering indicating the little influence of environment. Therefore, phenotypic variability may be a good measure of genotypic variability. The findings of Pramanick *et al.* (1994), Prakash *et al.* (1994) and Sherly and Shanthi (2008) are in conformity with present findings.

High heritability coupled with high genetic advance as percentage over mean was recorded for days to first flowering indicating that the heritability is due to additive gene effects and selection may be effective. This view was supported by Pramanick *et al.* (1994), Prakash *et al.* (1994) and Sherly and Shanthi (2008).

High heritability with moderate GAM observed for days to 50 per cent flowering indicated that expression of this character as governed by non-additive gene action and could be exploited through heterosis breeding. These findings are similar to the reports of Mishra and Mishra (1990), Sharma and Swaroop (2000), Muniappan *et al.* (2010) and Arunkumar *et al*. (2013) and days to first fruit maturity (Pramanick *et al.*, 1994), Kushwah and Bandhyopadhya (2005), Sao and Mehta (2009) and Shekar *et al.* (2012).

5.1.3 Yield parameters

High (>20%) GCV and PCV were observed for most of yield traits *viz.*, number of fruits per cluster, average fruit weight, fruit length-diameter ratio, number of fruits per plant, total yield per plant, yield per plot and yield per hectare and early yield per plant. These results indicated the existence of sufficient variability in genetic stock studied and the environmental role is negligible. Hence, there is ample scope for improving these characters with direct selection. Several workers like Devi and Sankar (1990), Mishra and Mishra (1990), Pramanick *et al*. (1994),

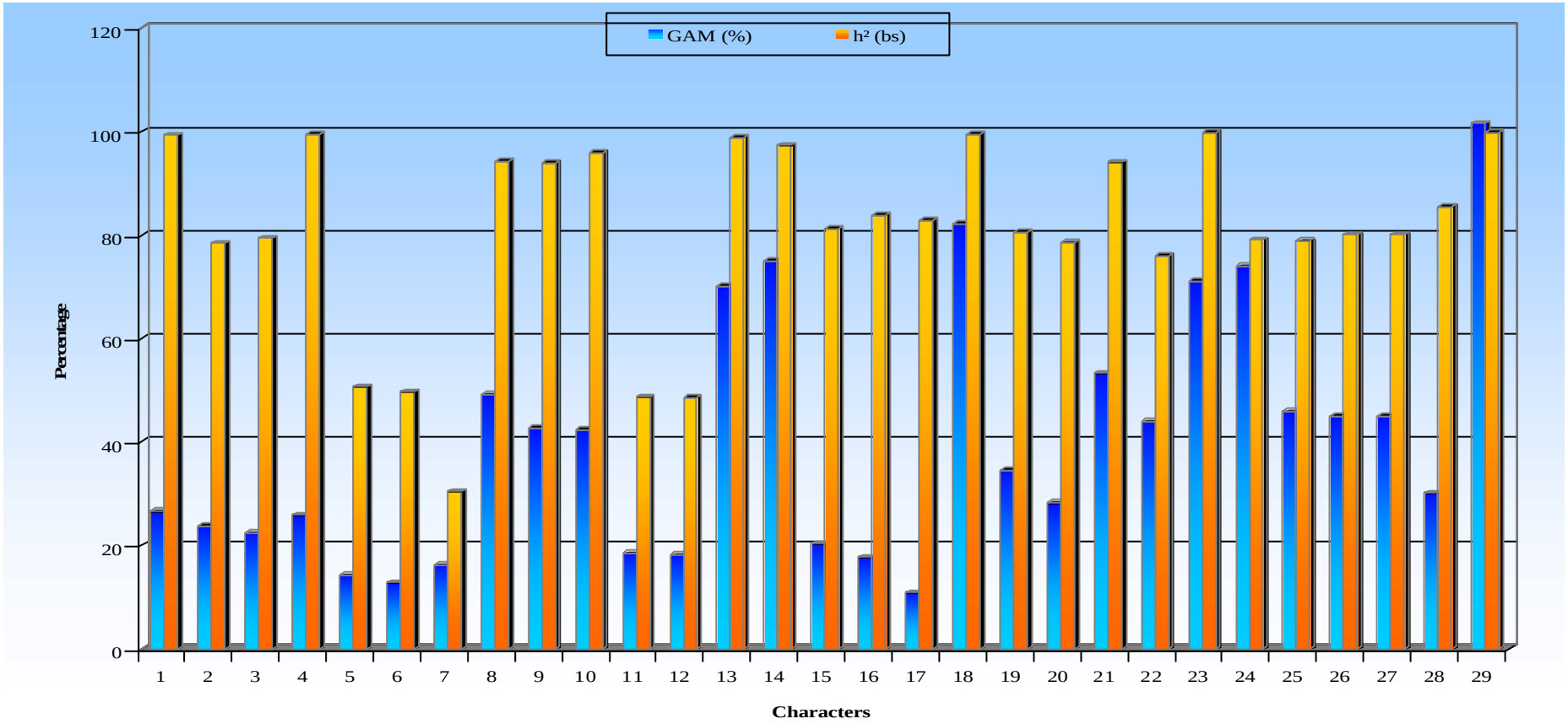

Fig. 2: Heritability and genetic advance over mean for different characters in brinjal genotypes

1. Plant height at 60 DAT (cm)
2. Plant height at 90 DAT (cm)
3. Plant height at 120 DAT (cm)
4. Plant spread at 60 DAT (cm)
5. Plant spread at 90 DAT (cm)
6. Plant spread at 120 DAT (cm)
7. Number of primary branches at 60 DAT
8. Number of primary branches at 90 DAT
9. Number of primary branches at 120 DAT
10 Stem girth at 60 DAT (cm)
11. Stem girth at 90 DAT (cm)
12. Stem girth at 120 DAT (cm)
13. Leaf area at 60 DAT (cm^2)
14. Leaf area at 90 DAT (cm^2)
15. Days to first flowering
16. Days to 50 per cent flowering
17. Days to first fruit maturity
18. Number of fruits per cluster
19. Fruit length (cm)
20. Fruit diameter (cm)
21. Fruit length-diameter ratio
22. Early yield per plant (kg)
23. Average fruit weight (g)
24. Number of fruits per plant
25. Total yield per plant (kg)
26. Yield per plot (kg)
27. Yield per hectare (t)
28. Per cent dry matter in fruits
29. Phenol content (mg/100 g)

Prakash *et al.* (1994), Singh and Gopalakrishnan (1995), Sanwal *et al.* (1998), Sharma and Swaroop (2000), Baswana *et al.* (2002), Mahaveerprasad *et al.* (2004), Patel *et al.* (2004), Kushwah and Bandhyopadhya (2005), Naik (2005), Golani *et al.* (2007), Sherly and Shanthi (2008), Sao and Mehta (2009), Dahatonde *et al.* (2010), Das *et al.* (2010), Muniappan *et al.* (2010), Kumar *et al*. (2012), Arunkumar *et al*. (2013), Lokesh *et al.* (2013), Nayak and Nagre (2013) reported similar findings.

Moderate (11-20%) GCV and PCV were observed for fruit diameter indicating presence of moderate amount of variability for these traits. Moderate GCV and high PCV observed for fruit length indicates that the apparent variation is not only due to genotypes but also due to the influence of environment on the expression of character. Selection for such traits may not give desired results. Similar results were also obtained by Kumar *et al*. (2012).

High heritability (>60%) estimates along with high GAM (>20%) was recorded for number of fruits per cluster, fruit length, fruit diameter, fruit length-diameter ratio, average fruit weight, early yield per plant, number of fruits per plant, total yield per plant, yield per plot and yield per hectare indicating predominance of additive gene component. Thus, there is ample scope for improving these characters with direct selection. In the existing germplasm stock, the *per se* performance of genotypes CBB-50, CBB-5 and CBB-24 for average fruit weight and CBB-13, CBB-41 and CBB-60 for yield per plant indicated that these genotypes could be used for further improvement. Similar findings were also reported by several investigators like Devi and Sankar (1990), Mishra and Mishra (1990), Pramanick *et al.* (1994), Prakash *et al.* (1994), Singh and Gopalakrishnan (1995), Sanwal *et al.* (1998), Sharma and Swaroop (2000), Baswana *et al.* (2002), Mahaveerprasad *et al.* (2004), Patel *et al.* (2004), Kushwah and Bandhyopadhya (2005), Naik (2005), Golani *et al.* (2007), Sherly and Shanthi (2008), Sao and Mehta (2009), Dahatonde *et al.* (2010), Das *et al.* (2010), Muniappan *et al.* (2010), Kumar *et al*. (2012), Arunkumar *et al*. (2013), Lokesh *et al.* (2013) and Nayak and Nagre (2013).

5.1.4 Quality parameters

High GCV and PCV were observed for phenol content in fruits indicating the existence of broad genetic base, which would be amenable for further selection.

Plate 2a: Variability in fruit shape, size and colour of the brinjal genotypes

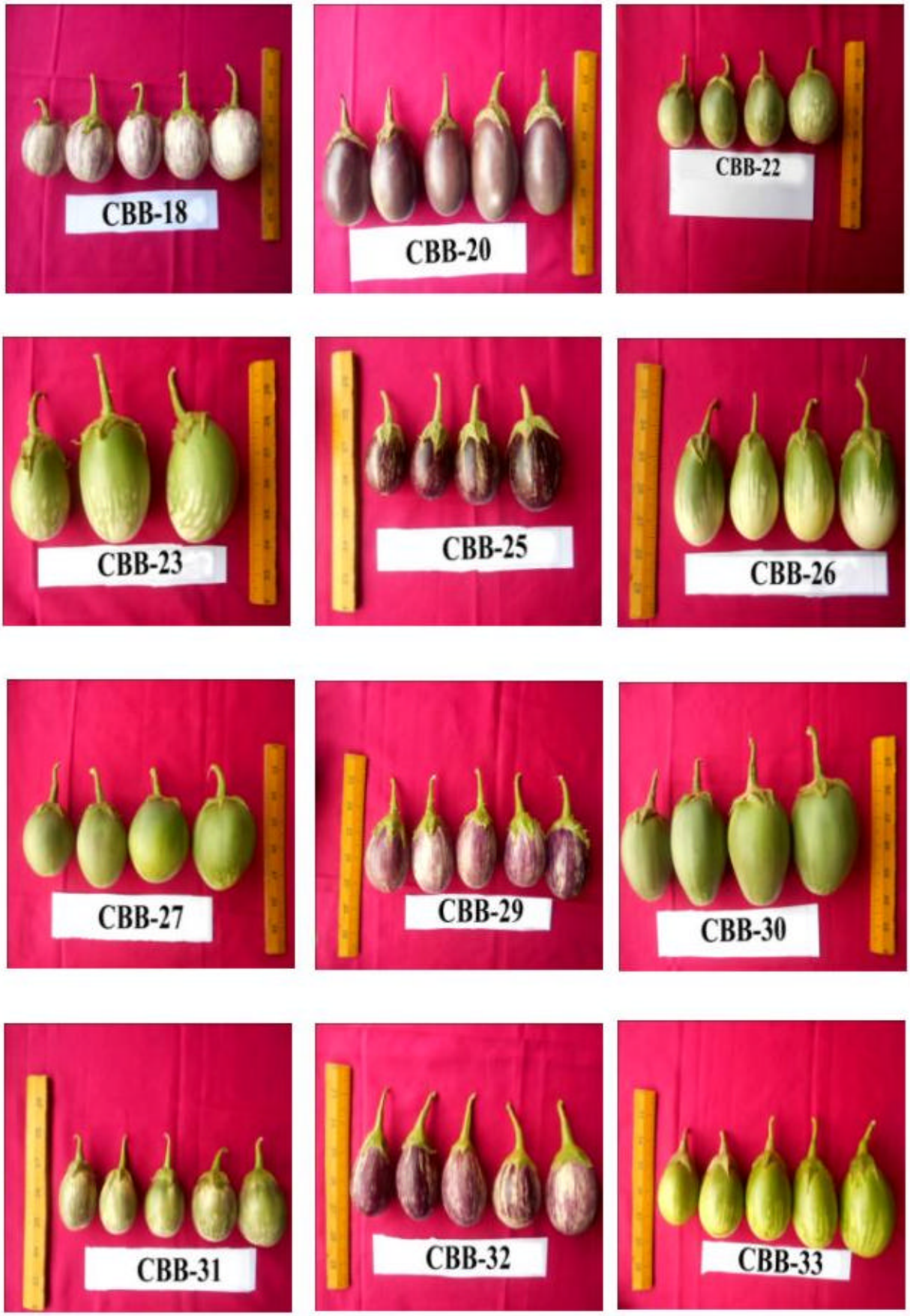

Plate 2b: Variability in fruit shape, size and colour of the brinjal genotypes

Plate 2c: Variability in fruit shape, size and colour of the brinjal genotypes

Similar results were also obtained by Kumar *et al.* (2013b). Moderate GCV and PCV were observed for per cent dry matter in fruits indicating the presence of moderate amount of variability for this trait. Similar results were also reported by Devi and Sankar (1990) and Naik (2005).

High heritability (>60%) accompanied with high genetic advance as percentage over mean (>20%) was recorded for quality traits *viz.*, phenol content in fruits and per cent dry matter in fruits. Therefore, additive component is predominant and hence, direct selection would be more effective in improving these traits. The findings of Naik (2005), Sherly and Shanthi (2008) and Kumar *et al.* (2013b) were similar.

5.2 Correlation studies

Variability studies provide information on the extent of improvement could be achieved in different characters, but they do not throw light on the extent and nature of relationship existing between various characters. Therefore, for rational approach towards the improvement of yield, selection has to be made for the components of yield, since there may not be genes for yield *per se*, but only for various yield components (Grafius, 1959). Further, many of these yield contributing characters may interact in desirable and undesirable direction. Hence, a knowledge regarding the association of various characters among themselves and with economic characters is essential. In the present study, the genotypic and phenotypic correlation coefficients were worked for growth, earliness, yield and quality components in brinjal observed difference between the genotypic and phenotypic correlation coefficients was narrow for various traits in the present findings and this indicates the lesser influence of environment in the expression of these traits and presence of strong inherent association among the traits. Hence, only genotypic correlations are discussed hereunder.

Total yield per plant was found to be positively and significantly (at p=0.01) associated with plant height at 90 DAT (r_g= 0.385), plant spread at 90 DAT (r_g= 0.660), number of primary branches at 90 DAT (r_g= 0.545), stem girth at 90 DAT (r_g= 0.539), fruit diameter (r_g= 0.242), early yield per plant (r_g= 1.000) and number of fruits per plant (r_g= 0.449). But it was negatively and significantly (at p=0.01)

associated with days to first flowering (r_g= -0.302), days to 50 per cent flowering (r_g= -0.272) and days to first fruit maturity (r_g= -0.164 at p=0.05) at genotypic level. Hence, direct selection for growth and yield components could be made for improving yield. Several workers *viz.*, Sinha (1983), Devi and Sankar (1990), Ushakumari *et al.* (1991), Gautham and Srinivas (1992), Ponnuswami and Irulappan (1994), Narendrakumar (1995), Mohanty (1999), Sharma and Swaroop (2000), Pratibha *et al.* (2004), Kushwah and Bandhyopadhya (2005), Senapati and Senapati (2006), Lohakare *et al*. (2008), Prabhu and Natarajan (2008), Jadhao *et al.* (2009), Dahatonde *et al.* (2010), Muniappan *et al.* (2010), Praneetha and Veeraragavathathum (2011), Danquash and Ofori (2012), Thangamani and Jansirani (2012), Ahmed *et al.* (2013), Arunkumar *et al*. (2013) and Dhaka and Soni (2014) reported similar findings.

Plant height at 90 DAT had positive and significant correlation at p=0.01 with plant spread at 90 DAT (0.633), number of primary branches at 90 DAT (0.279), stem girth at 90 DAT (0.661), leaf area at 90 DAT (0.252), days to first fruit maturity (0.262), early yield per plant (0.407), number of fruits per plant (0.361) and yield per plant (0.385) and days to first flowering (0.147 at p=0.05). While showed negative and significant (at p=0.05) correlation with average fruit weight (-0.163). The findings of Sharma and Swaroop (2000), Naik (2005), Prabhu and Natarajan (2008), Thangamani and Jansirani (2012), Nayak and Nagre (2013), Muniappan *et al.* (2010), Dahatonde *et al.* (2010) and Arunkumar *et al*. (2013) were similar.

A significant (at p=0.01) and positive correlation of plant spread at 90 DAT was observed with number of primary branches at 90 DAT (0.494), stem girth at 90 DAT (0.461), leaf area at 90 DAT (0.319), fruit diameter (0.220), early yield per plant (0.704), number of fruits per plant (0.450), per cent dry matter in fruits (0.267) and yield per plant (0.660). But it showed significant and negative correlation with fruit length-diameter ratio (-0.240).

Number of primary branches at 90 DAT had positive and significant association at p=0.01 with stem girth at 90 DAT (0.336), number of fruits per cluster (0.190 at p=0.05), fruit length (0.195), early yield per plant (0.531), number of fruits per plant (0.251), per cent dry matter in fruits (0.277) and yield per plant (0.545). Similar results were also reported by Sharma and Swaroop (2000), Naik (2005), Prabhu and Natarajan (2008), Thangamani and Jansirani (2012) and Dahatonde *et al.* (2010).

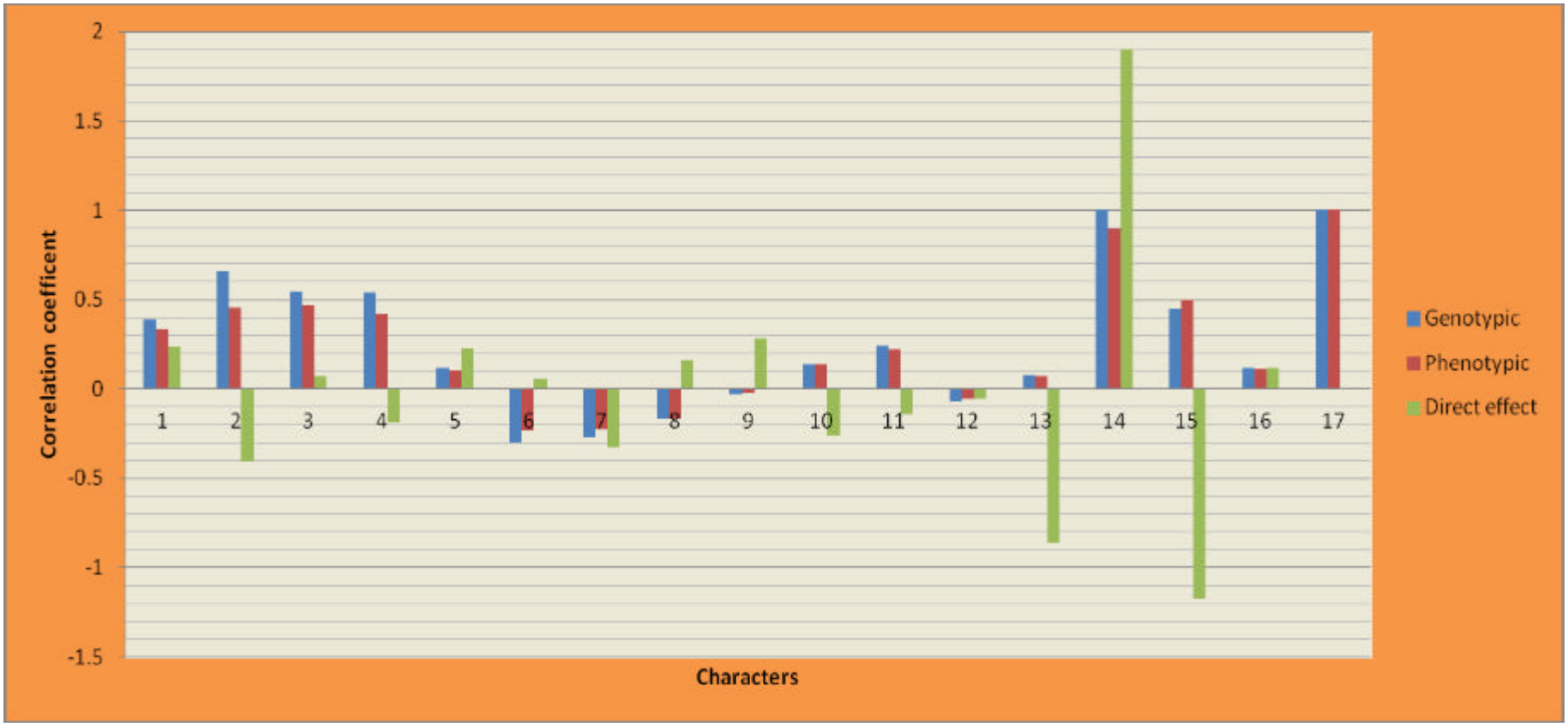

Fig. 3: Genotypic and phenotypic correlation of different characters and direct genotypic effect with yield per plant in brinjal genotypes

1. Plant height at 90 DAT (cm)
2. Plant spread at 90 DAT (cm)
3. Number of primary branches at 90 DAT
4. Stem girth at 90 DAT (cm)
5. Leaf area at 90 DAT (cm^2)
6. Days to first flowering
7. Days to 50 per cent flowering
8. Days to first fruit maturity
9. Number of fruits per cluster
10. Fruit length (cm)
11. Fruit diameter (cm)
12. Fruit length-diameter ratio
13. Average fruit weight (g)
14. Early yield per plant (kg)
15. Number of fruits per plant
16. Per cent dry matter in fruits
17. Total yield per plant (kg)

The stem girth at 90 DAT showed positive and significant (at p=0.01) correlation with early yield per plant (0.563), number of fruits per plant (0.468) and yield per plant (0.539). Whereas, it had negative and significant (at p=0.01) association with average fruit weight (-0.223). This view was supported by Naik (2005).

The leaf area at 90 DAT had positive and significant (at p=0.01) association with days to first flowering (0.383), days to 50 per cent flowering (0.375), days to first fruit maturity (0.340), fruit diameter (0.490) and average fruit weight (0.226). While significantly negative association of this character with fruit length-diameter ratio (-0.248 at p=0.01) and per cent dry matter in fruits (-0.178 at p=0.05) was observed.

The positive and significant (at p=0.01) correlation of days to first flowering was observed with days to 50 per cent flowering (1.010), days to first fruit maturity (0.922) and fruit diameter (0.218). While significantly (at p=0.01) negative association of this character with early yield per plant (-0.239), number of fruits per plant (-0.315) and yield per plant (-0.302) was observed. Several workers like Naik (2005), Thangamani and Jansirani (2012), Nayak and Nagre (2013) and Dahatonde *et al.* (2010) reported similar findings.

Days to 50 per cent flowering had positive significant association with days to first fruit maturity (0.907) and fruit diameter (0.227). Whereas, early yield per plant (-0.220), number of fruits per plant (-0.314) and yield per plant (-0.272) were found significantly (at p= 0.01) and negatively correlation with this trait. Similar results were also obtained by Naik (2005) and Muniappan *et al.* (2010).

A significant (at p=0.01) and negative correlation of days to first fruit maturity was noticed with number of fruits per plant (-0.197). While, early yield per plant (-0.146) and yield per plant (-0.164) were found significant (at=0.05) but negatively correlated with this trait.

Number of fruits per cluster was positively and significantly (at p=0.01) associated with number of fruits per plant (0.395) and per cent dry matter in fruits (0.281). Whereas, fruit length (-0.327), fruit diameter (-0.333) and average fruit weight (-0.301) were found negatively and significantly (at p=0.01) associated with this trait.

Fruit length had positive and significant (at p=0.01) association with fruit diameter (0.208), fruit length-diameter ratio (0.673), average fruit weight (0.559) and early yield per plant (0.208). Whereas, it had negative and significant (at p= 0.01) relationship with number of fruits per plant (-0.552). The findings of Nayak and Nagre (2013), Muniappan *et al.* (2010), and Arunkumar *et al*. (2013) are in conformity with present findings.

Fruit diameter had negative and significant (at p=0.01) correlation with average fruit weight (0.450), early yield per plant (0.288) and yield per plant (0.242). Similar results were also reported by Sharma and Swaroop (2000) and Arunkumar *et al*. (2013). Whereas, fruit length-diameter ratio (-0.511) and number of fruits per plant (-0.303) were found negatively and significant at p=0.01 correlation with this trait.

Fruit length-diameter ratio exhibited positive and significant association with average fruit weight (0.244 at p=0.01) and it also showed negative association with number of fruits per plant (-0.307 at p=0.01). Whereas, per cent dry matter in fruits (-0.166 at p=0.05) had negative and significant correlation with this trait.

Average fruit weight exhibited strong negative and significant (at p=0.01) relationship with number of fruits per plant (-0.778). For yield improvement, balancing of average fruit weight and number of fruits is an important task. This may be attributed to pleiotrophy or linkage between genes in repulsion phase. Tight linkage can be broken by *inter se* mating and selection. This can upgrade cealing limit on yield due to negative association of these two important yield contributing characters. These results were also confirmed by the findings of Devi and Sankar (1990), Naik (2005) and Dahatonde *et al.* (2010).

Early yield per plant had positive and significant (at p=0.01) correlation with number of fruits per plant (0.399) and yield per plant (1.000). Number of fruits per plant had positive and significant (at p=0.01) relationship with yield per plant (0.449). Several investigators like Naik (2005), Dahatonde *et al.* (2010) and Arunkumar *et al*. (2013) reported similar findings.

5.3 Path co-efficient analysis

Though correlation analysis indicates the association pattern of component traits with yield, it simply represents the overall association of a particular trait with yield rather than providing cause and effect relationship. The technique of path coefficient analysis developed by Wright (1921) and demonstrated by Dewey and Lu (1957) facilitates in partitioning the correlation coefficients into direct and indirect contribution of various characters on yield. It is a standardised by partial regression coefficient analysis. As such, it measures the direct influence of one variable upon other. Such information would be of great value in enabling the breeder to specifically identify important component traits of yield and utilise the genetic stock for improvement in a planned way.

Path analysis also measures the relative importance of causal factors involved. This is simply a standardized partial regression analysis, where in total correlation values were subdivided into causal factors.

In the present study, path coefficient analysis between the components of brinjal was worked out. As the genotypic associations are inherent, the path analysis is discussed only at genotypic level.

Among the 17 traits chosen for path analysis at genotypic level *viz.*, plant height at 90 DAT (0.235), leaf area at 90 DAT (0.228), days to first fruit maturity (0.162), number of fruits per cluster (0.280) and early yield per plant (1.903) had positive direct effect indicating their true positive and significant association with yield per plant. Therefore, direct selection for these traits would be rewarding for improvement of yield.

Plant height at 90 DAT had moderate and direct positive effect (0.235) on total yield per plant. It had low to high indirect and positive effects through average fruit weight (0.140) and early yield per plant (0.775). It also had moderate to high and indirect negative effects through plant spread at 90 DAT (-0.258), number of fruits per plant (-0.424) and stem girth at 90 DAT (-0.122). Similar results were also obtained by Dahatonde *et al.* (2010), Muniappan *et al.* (2010) and Arunkumar *et al.* (2013).

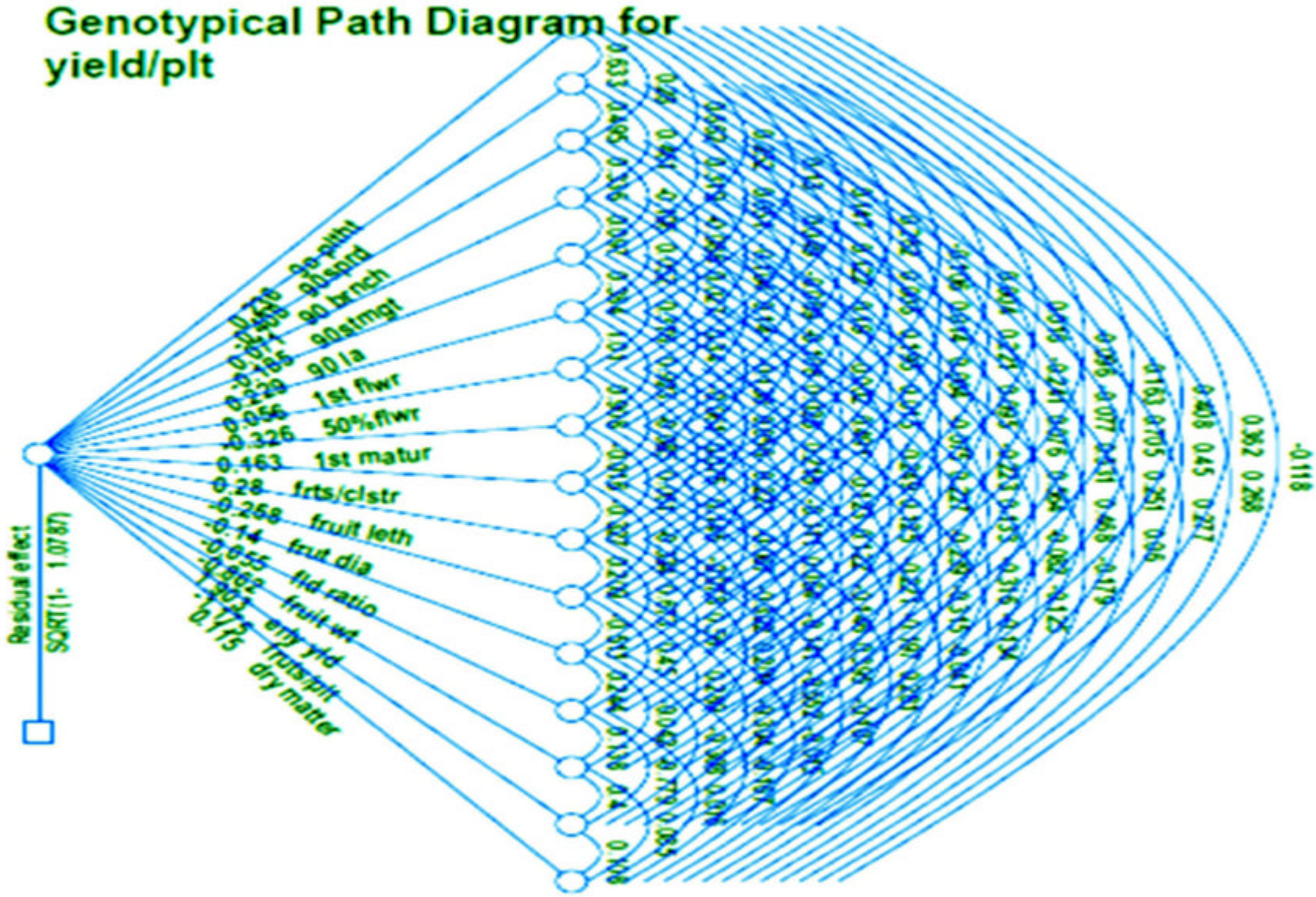

Fig. 4: Genotypic path diagram for yield per plant in 60 genotypes of brinjal

Plant spread at 90 DAT had very high indirect and positive effects through early yield per plant (1.340). It had high and direct negative effects (-0.408) on total yield per plant and it also had high indirect and negative effects through number of fruits per plant (-0.528).

Number of primary branches at 90 DAT had negligible and direct positive effects (0.071) on total yield per plant and it also had very high indirect and positive effects through early yield per plant (1.010) indicating that indirect selection through such trait will be effective in yield improvement and it had moderate indirect negative effects through number of fruits per plant (-0.295).

Stem girth at 90 DAT had low to very high indirect positive effects through average fruit weight (0.192) and early yield per plant (1.072). It had low direct and negative effects (-0.184) on total yield per plant. It had also high indirect negative effects through number of fruits per plant (-0.550).

Leaf area at 90 DAT had moderate and direct positive effect (0.228) on total yield per plant and it had moderate and indirect positive effects through early yield per plant (0.253). But it also had low and indirect negative effects through days to 50 per cent flowering (-0.122) and average fruit weight (-0.195).

Days to first flowering had negligible and direct positive effect (0.056) on total yield per plant. It had low to high indirect positive effects through days to first fruit maturity (0.150) and number of fruits per plant (0.370). However, days to 50 per cent flowering (-0.329), average fruit weight (-0.107) and early yield per plant (-0.454) were had low to high indirect negative effects.

Days to 50 per cent flowering had low to high indirect positive effects through days to first fruit maturity (0.147) and number of fruits per plant (0.369). It had high direct and negative effect (-0.325) on total yield per plant and it also had low to high indirect negative effects through average fruit weight (-0.105) and early yield per plant (-0.420).

Days to first fruit maturity had low direct and positive effects (0.162) on total yield per plant and moderate indirect positive effects through number of fruits per plant (0.231). But it also had moderate and indirect negative effects through early yield per plant (-0.277).

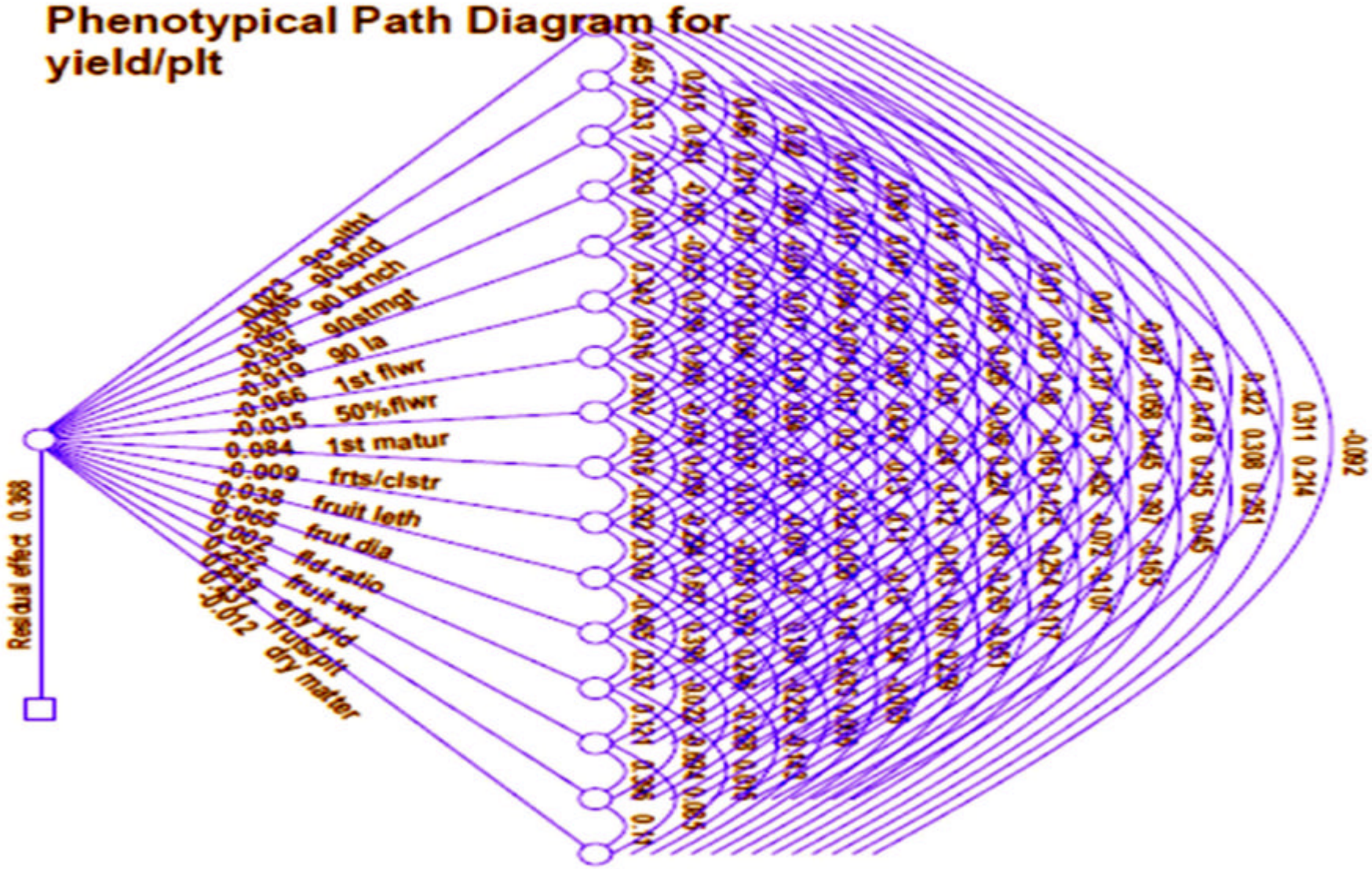

Fig. 5: Phenotypic path diagram for yield per plant in 60 genotypes of brinjal

Number of fruit per cluster had moderate and direct positive effects (0.280) on total yield per plant and it also had moderate indirect positive effects through average fruit weight (0.260). It had moderate to high indirect negative effects through early yield per plant (-0.267) and number of fruits per plant (-0.464).

Fruit length had high indirect positive effects through early yield per plant (0.397) and number of fruits per plant (0.648). It indicated that indirect selection through such trait will be effective in yield improvement. It also had moderate and direct negative effects (-0.258) on total yield per plant and high indirect negative effects through average fruit weight (-0.482).

Fruit diameter had high indirect positive effects through early yield per plant (0.549) and number of fruits per plant (0.356). It indicated that indirect selection through such trait will be effective in yield improvement. It had low direct and negative effects (-0.140) on total yield per plant and it also had high indirect negative effects through average fruit weight (-0.388).

Fruit length-diameter ratio had high indirect positive effects through number of fruits per plant (0.361) indicating the indirect selection through such trait will be effective in yield improvement. It had negligible and direct negative effects (-0.054) on total yield per plant. It also had moderate indirect negative effects through early yield per plant (-0.210).

Average fruit weight had moderate to high indirect positive effects through early yield per plant (0.262) and number of fruits per plant (0.915). It indicated that indirect selection through such trait will be effective in yield improvement. But it had very high negative direct effects (-0.862) on total yield per plant.

Early yield per plant had very high direct positive effects (1.903) on total yield per plant indicating that direct selection for this trait will be rewarding for yield improvement. It also had high indirect negative effects through number of fruits per plant (-0.469). Number of fruits per plant had very high direct and negative effects (-1.174) on total yield per plant. Per cent dry matter in fruits had low direct and positive effects (0.114) on total yield per plant.

Similar results were obtained by several workers like Nainar *et al.* (1990), Randhawa *et al.* (1993), Mohanty (1999), Sharma and Swaroop (2000), Naik (2005), Praneetha (2006), Lohakare *et al.* (2008), Prabhu and Natarajan (2008), Jadhao *et al.* (2009), Dahatonde *et al.* (2010), Muniappan *et al.* (2010), Thangamani and Jansirani (2012), Ahmed *et al.* (2013) and Arunkumar *et al.* (2013) for different characters as the set of genotypes included for study might be different.

5.4 Genetic divergence

Eggplant or brinjal was first cultivated in India which is regarded as the primary centre of origin/ diversity. Information on genetic divergence among the available germplasm is vital to a plant breeder for an efficient choice of parents for hybridization. It is established fact that genetically diverse parents are likely to contribute desirable segregants. It was also observed that the more diverse parents, greater are the chance of obtaining high heterotic F_1s and broad spectrum of variability in the segregating generation. Improvement on yield and quality achieved by selecting genotypes with desirable character combinations existing in the nature or by hybridization. Selection of parents identified on the basis of divergence analysis would be more promising for a hybridization programme. Of the several methods available, Mahalanobis generalized distances estimated by D^2 statistic (Rao, 1952) is a unique method for disseminating populations considering a set of parameters together rather than deciding from indices based upon morphological similarities, eco-geographical diversity and phylogenetic relationship.

The material for present study includes 60 genotypes grouped into seven clusters using Tocher's method. Of the seven clusters, studied the cluster I was the largest having 36 genotypes followed by cluster II with 14 genotypes, cluster III with 6 genotypes, cluster IV (CBB-9), cluster V (CBB-40), cluster VI (CBB-60) and cluster VII (CBB-54) had one genotype. Genotypes usually did not cluster according to geographical distributions. The findings of Pramanick *et al.* (1992), Thambe *et al.* (1993), Singh *et al.* (1995), Rameshbabu and Patil (2002), Mohanty and Prusti (2001) and Sharma and Mourya (2004) were similar. There is no any direct relationship between geographical distribution and genetic distance.

Clustering by Tocher's method

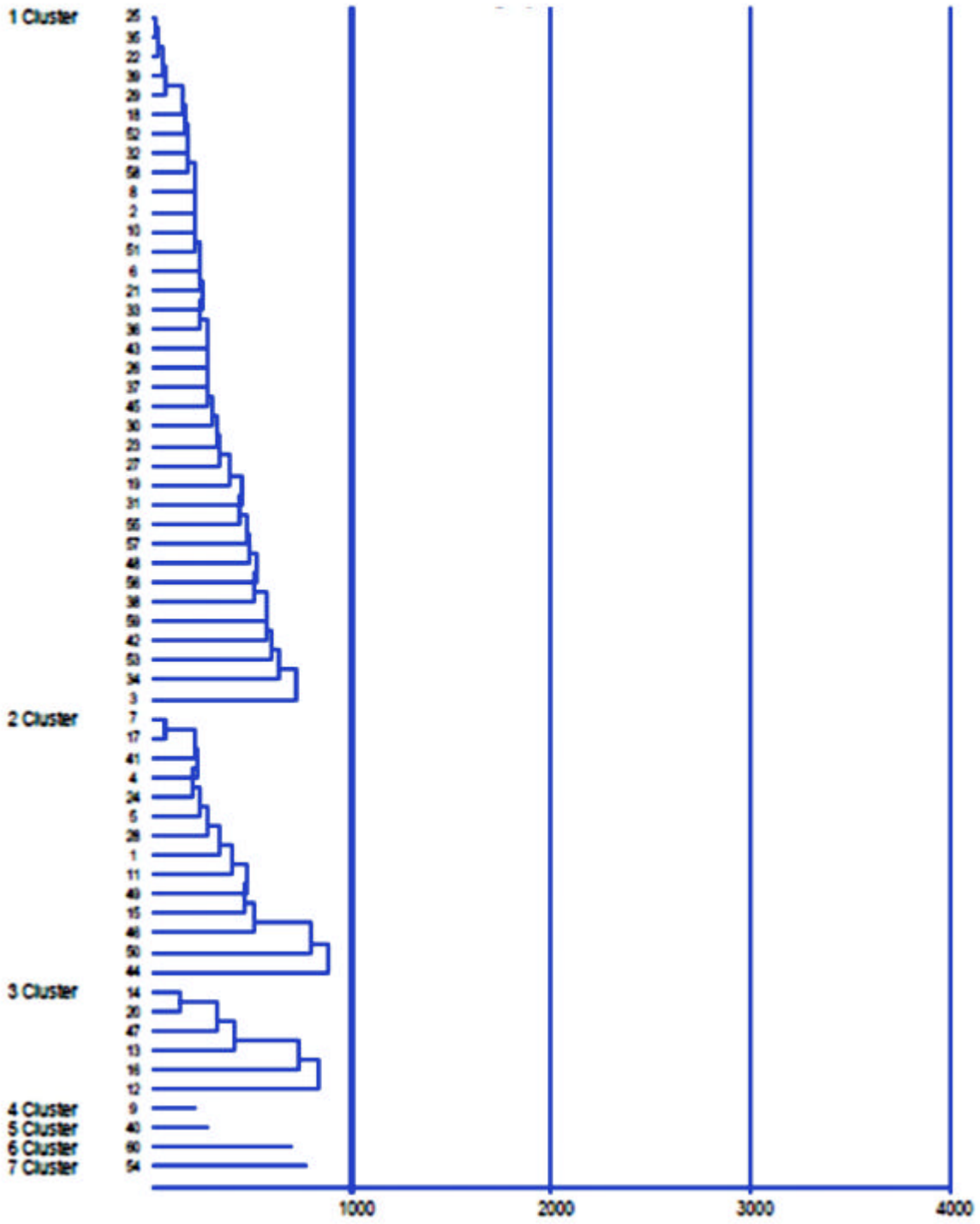

Fig. 6: Dendrogram of clustering pattern of sixty genotypes of brinjal

Intra-cluster distances revealed that cluster III with 6 genotypes showed maximum intra-cluster diversity (D^2=27.63) followed by cluster II (D^2=23.64) and cluster I (D^2=20.79). The clusters IV, V, VI and VII had no intra-cluster distance (D^2=0.00) as they possessed single genotype. Maximum intra-cluster distance was observed in cluster III indicating existence of wide genetic divergence among the constituent genotypes in it as compared to other cluster. High degree of divergence among the genotypes within a cluster would produce more segregating breeding material and selection within such cluster might be executed based on maximum mean value for the desirable characters.

Based on distances between clusters, *i.e.*, inter-cluster distances, the maximum divergence was observed between clusters III and cluster VII (D^2=69.50) followed by clusters VI and VII (D^2=68.98), cluster IV and VII (D^2=64.09), cluster II and III (D^2=54.94), cluster II and VI (D^2=47.44) and cluster II and IV (D^2=36.21). Maximum inter-cluster D^2 values was observed between the clusters III and VII indicating that the genotypes in these clusters can be used as a parents in hybridization programme to get higher heterotic hybrids and segregating population contribution of characters. Similar results were reported by Rai *et al.* (1999). The cluster I had the least inter-cluster distance (D^2=28.76) with the cluster V indicating that close relationship and less divergence between the genotypes included in these clusters I and V.

These clusters have been formed based on the contribution of different characters to the divergence. Among these characters, the average fruit weight contributed maximum (52.32%) to the genetic diversity followed by number of fruits per cluster (14.52%), plant spread at 60 DAT (13.90%), plant height at 60 DAT (10.62%), leaf area at 60 DAT (6.50%), leaf area at 90 DAT (1.19%), fruit length-diameter ratio (0.28%), number of primary branches at 90 DAT (0.23%), stem girth at 60 DAT (0.23%), fruit diameter (0.11%), days to first flowering (0.06%) and days to first fruit maturity (0.06%). Characters like plant height at 90 DAT, plant spread at 90 DAT, number of primary branches at 60 DAT, stem girth at 90 DAT, days to 50 per cent flowering, fruit length, early yield per plant, number of fruits per plant and total yield per plant did not contribute to genetic divergence. Contribution of characters towards divergence *viz.*, plant height at 60 DAT, leaf area at 60 and 90 DAT, plant

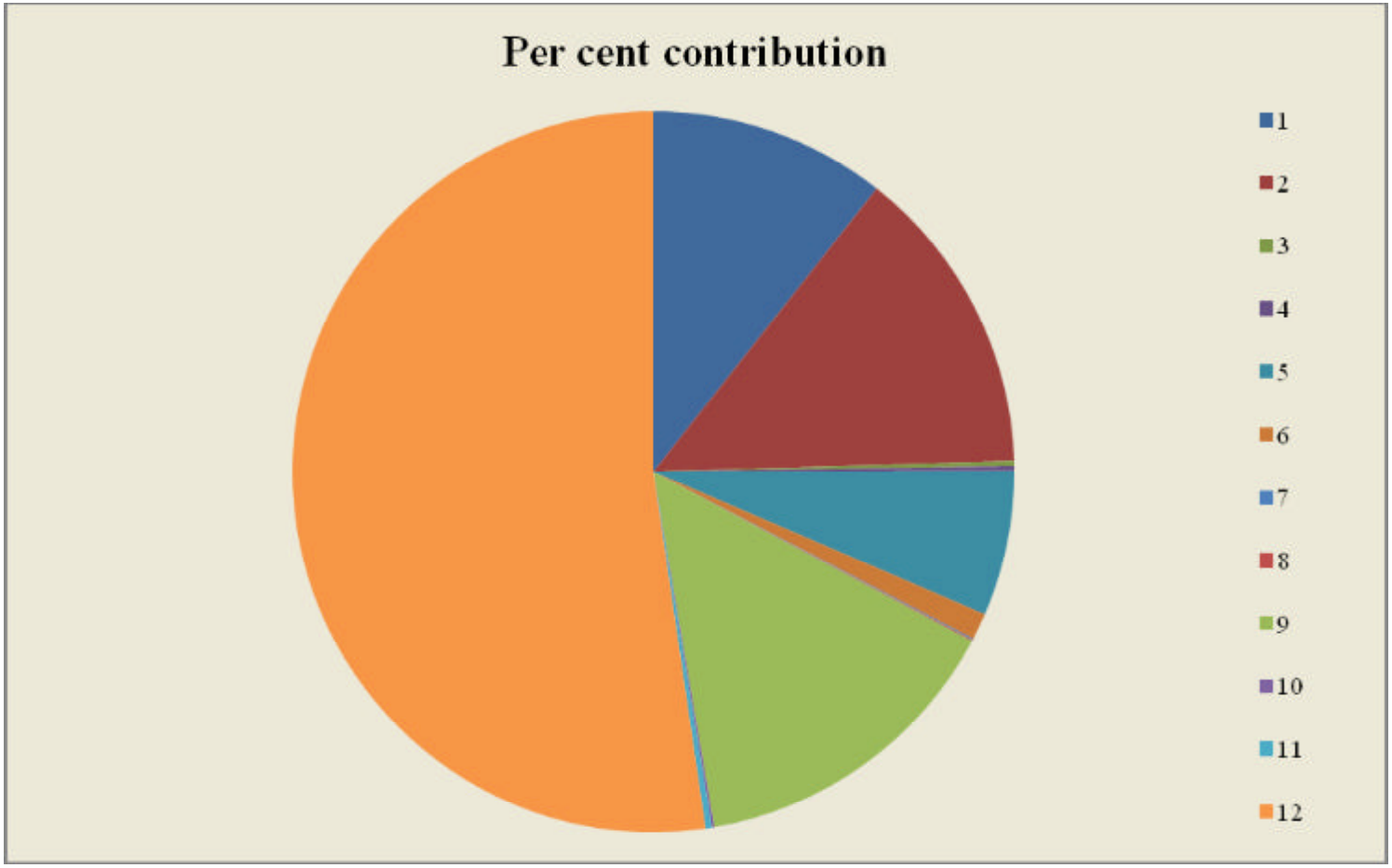

Fig. 7: Per cent contribution of different traits towards divergence in brinjal genotypes

1. Plant height at 60 DAT (cm) -10.62%
2. Plant spread at 60 DAT (cm)-13.90%
3. Number of primary branches at 90 DAT-0.23%
4. Stem girth at 60 DAT (cm)-0.23%
5. Leaf area at 60 DAT (cm^2)-6.50%
6. Leaf area at 90 DAT (cm^2)-1.19%
7. Days to first flowering -0.06%
8. Days to first fruit maturity -0.06%
9. Number of fruits per cluster – 14.52%
10. Fruit diameter (cm) - 0.11%
11. Fruit length-diameter ratio-0.28%
12. Average fruit weight (g)-52.32 %

spread at 60 DAT, average fruit weight, days to first flowering, fruit diameter, number of branches per plant, days to first maturity and number of fruits per cluster was also reported by Mehta *et al*. (2004), Naik (2005), Golani *et al.* (2007), Das *et al.* (2010), Shekar *et al.* (2012) and Kumar *et al.* (2013a) by several workers.

Plant height at 60 and 120 DAT the highest cluster mean was observed in the cluster IV followed by clusters VI, I and II. The inter-cluster distance between cluster IV and VI (D^2=35.53), cluster IV and I (D^2=29.45) and IV and II (D^2=36.21) were comparatively high. Therefore, crosses between the genotypes belonging to these respective clusters may be tried to isolate tall genotypes, which ultimately help in increasing the branches, flowers, fruit set and finally the yield as revealed by correlation studies.

For plant spread at 60 DAT the highest cluster mean was observed in the cluster IV followed by clusters II, I and VI. The inter-cluster distance between cluster IV and II (D^2=36.21), cluster IV and I (D^2= 29.45), IV and VI (D^2=35.33) were comparatively high. For plant spread at 90 DAT highest cluster mean was observed in the cluster IV followed by clusters VI, II and III. The inter-cluster distance between cluster IV and VI (D^2=35.33), cluster IV and II (D^2= 36.21), IV and III (D^2=46.53) were comparatively high. Hence, crosses can be made between the genotypes belonging to the respective clusters to isolate genotypes with better spreading habit, which ultimately help in increasing the branches, flowers, fruit set and finally resulting with higher yields.

For number of primary branches at 60 DAT highest cluster mean was observed in the cluster VI followed by clusters III, II and I. The inter-cluster distance between cluster VI and III (D^2= 51.15), cluster VI and II (D^2= 47.44) and cluster VI and I (D^2= 36.88) were comparatively high. For number of primary branches at 90 DAT highest cluster mean was observed in the cluster III followed by clusters II, I and VI. The inter-cluster distance between cluster III and II (D^2= 54.94), cluster III and I (D^2= 39.79) and cluster III and VI (D^2= 51.15) were comparatively high. Therefore, crosses can be made between the genotypes belonging to the respective clusters to isolate genotypes with more number of branches, which ultimately helps in increasing flowers and fruit set which ultimately contributed to the total yield.

For stem girth at 60 DAT highest cluster mean was observed in the cluster IV followed by clusters VI, II and I. The inter-cluster distance between cluster IV and VI (D^2= 35.33), cluster IV and II (D^2= 36.21) and cluster IV and I (D^2= 29.45) were comparatively high. For stem girth at 90 DAT highest cluster mean was observed in the cluster IV followed by clusters VI, I and II. The inter-cluster distance between cluster IV and VI (D^2= 35.33), cluster IV and I (D^2=29.45) and cluster IV and II (D^2= 36.21) were comparatively high. Hence, hybridization between genotypes of respective clusters to improve the stem girth is suggested.

For leaf area at 60 DAT highest clusters mean was observed in the cluster VI followed by clusters IV, II and V. The inter-cluster distance between cluster VI and IV (D^2=35.33), cluster VI and II (D^2=47.44) and cluster VI and V (D^2=43.44) were comparatively high. For leaf area at 90 DAT highest cluster mean was observed in the cluster VI followed by clusters II, IV and I. The inter-cluster distance between VI and II (D^2=47.44), cluster VI and IV (D^2=35.33) and cluster VI and I (D^2=36.88) were comparatively high. Hence, crosses can made between the genotypes belonging to the respective clusters to isolate genotypes with more leaf area that ultimately helps in increasing the higher yields.

For days to first flowering lowest cluster mean was observed in the cluster VII followed by clusters V, III and I. The inter-cluster distance between cluster VII and V (D^2=43.19), cluster VII and III (D^2= 69.50) and cluster VII and I (D^2=54.60 were comparatively high. Hence, hybridization between genotypes of respective clusters is advisable to improve the earliness.

For days to 50 per cent flowering lowest cluster mean was observed in the cluster VII followed by clusters V, III and I. The inter-cluster distance between cluster VII and V (D^2=43.19), cluster VII and III (D^2= 69.50) and cluster VII and I (D^2=54.60) were comparatively high. Hence, hybridization between genotypes of respective clusters may yield desirable results.

For days to first fruit maturity lowest cluster mean was observed in the cluster VII followed by clusters V, I and II. The inter-cluster distance between cluster VII and V (D^2=43.19), cluster VII and I (D^2= 54.60) and cluster VII and II (D^2=40.62) were comparatively high. Hence, crosses can be made between the genotypes of these respective clusters to improve the earliness.

For number of fruits per cluster highest cluster mean was observed in the cluster III followed by cluster I. The inter-cluster distance between cluster III and I (D^2=39.79) were comparatively high. Hence, crosses can be made between the genotypes of these clusters for improvement of number of fruits per cluster will ultimately contribute for yield improvement.

For fruit length highest cluster mean observed in the cluster IV followed by clusters VII, II and V. The inter-cluster distance between cluster IV and VII (D^2=64.09), cluster IV and II (D^2=36.21) and cluster IV and V (D^2=46.76) were comparatively high. Hence, hybridization between genotypes of respective clusters can be attempted to improve fruit length that ultimately contributes towards yield.

For fruit diameter highest cluster mean was observed in the cluster II (5.79 cm) followed by clusters VI, V and I. The inter-cluster distance between cluster II and VI (D^2=47.44), cluster II and V (D^2=40.27) and cluster II and I (D^2=36.41) were comparatively high. Hence, hybridization between genotypes of these clusters can be attempted to improve fruit diameter that contributes to yield.

For fruit length-diameter ratio highest cluster mean was observed in the cluster VII followed by clusters IV, V and III. The inter-cluster distance between cluster VII and IV (D^2=64.09), cluster VII and V (D^2=43.19) and cluster VII and III (D^2=69.50) were comparatively high. Hence, hybridization between genotypes of respective clusters can be attempted to improve fruit-length diameter ratio, which ultimately contributed yield.

For early yield per plant highest cluster mean was observed in the cluster IV followed by clusters II, I and III. The inter-cluster distance between cluster IV and II (D^2=36.21), cluster IV and I (D^2=29.45) and cluster IV and III (D^2=46.53) were comparatively high. Hence the crosses between the genotypes of these pair of clusters may be tried to improve early yield per plant.

Average fruit weight was the highest contributor to the diversity (52.32%) and the highest cluster mean for this was observed in the cluster VII followed by clusters II, IV and V. The inter-cluster distance between cluster VII and II (D^2=40.62), cluster

VII and IV (D^2=64.09) and cluster VII and V (D^2=43.19) were comparatively high. Hence, crosses can be made between the genotypes of these respective clusters for improvement average fruit weight that contributes for yield.

For number of fruits per plant highest cluster mean was observed in the cluster VI followed by clusters III, IV and I. The inter-cluster distance between cluster VI and III (D^2=51.15), cluster VI and IV (D^2=35.33) and cluster VI and I (D^2=36.88) were comparatively high. Hence, crosses can be made between the genotypes of these pair of clusters for improvement of number of fruits per plant.

For total yield per plant highest cluster mean was observed in the cluster IV followed by clusters II, I and III. The inter-cluster distance between cluster IV and II (D^2=36.21), cluster IV and I (D^2=29.45) and cluster IV and III (D^2=46.53) were comparatively high. Hence, crosses can be made between the genotypes of these respective clusters for improvement of total yield per plant.

The top three characters contributing most towards the genetic divergence were average fruit weight followed by number of fruits per cluster and plant spread at 60 DAT. These characters may be used in selecting genetically diverse parents for hybridization programme to exploit either maximum heterosis or to execute efficient selection in the segregating generation.

Salient findings and future line of work

1. Number of fruits per cluster, fruit length-diameter ratio, number of fruits per plant, early yield per plant, average fruit weight, total yield per plant, yield per plot and yield per hectare can be improved through direct selection from the existing germplasm stock, as the GCV and PCV were high for these traits indicated by the predominance of additive gene action in genetic variance.

2. Plant height at 90 DAT, leaf area at 90 DAT, days to first fruit maturity, number of fruits per cluster, average fruit weight and number of fruits per plant had high direct and indirect effects on total yield per plant at genotypic level. Hence, more emphasis has to be given to these traits for improving the yield.

3. For recovering improved progenies for growth, earliness and yield parameters, crosses can be attempted between the genotypes belonging to clusters IV and VI, clusters VII and V, clusters IV and II, respectively as revealed by divergence studies.

4. The high yielding genotypes CBB-12, CBB-40, CBB-8, CBB-22, CBB-23, CBB-59, CBB-2 and CBB-1 can be used for further hybridization programme.

5. The high yielding genotypes having purple coloured fruits with white stripes and spiny (CBB-6, CBB-17, CBB-29 and CBB-45) and green coloured fruits with white patches and spiny (CBB-7 and CBB-23) and purple coloured fruits with green stripes (CBB-1) can be further assessed for their performance in different environments.

6. SUMMARY

The main objectives of the present investigation were to study the nature and extent of genetic variability and association in brinjal germplasm for growth, earliness, yield and quality parameters and to study the divergence for growth, earliness and yield parameters in brinjal germplasm. The work was carried out at Research Block of Vegetable Section in Sector No. 1 under the University of Horticultural Sciences, Bagalkot with 60 genotypes.

Variability studies

The variance due to treatments (genotypes) was highly significant for 26 characters *viz.*, plant height (at 60, 90 and 120 DAT), plant spread (at 60, 90 and 120 DAT), number of primary branches (at 60, 90 and 120 DAT), stem girth at 60 DAT, leaf area (at 60 and 90 DAT), days to first flowering, days to 50 per cent flowering, days to first fruit maturity, number of fruits per cluster, fruit length, fruit diameter, fruit length-diameter ratio, average fruit weight, number of fruits per plant, total yield per plant, yield per plot, yield per hectare, per cent dry matter in fruits and phenol content. While no significant difference was found among genotypes for stem girth (at 90 and 120 DAT) and early yield per plant. Means of genotypes varied greatly for several traits indicating the higher magnitude of variability in the germplasm.

High GCV and PCV (>20%) were observed for number of primary branches (at 90 and 120 DAT), stem girth at 60 DAT, leaf area (at 60 and 90 DAT), number of fruits per cluster, number of fruits per plant, average fruit weight, fruit length-diameter ratio, total yield per plant, yield per plot, yield per hectare and phenol content. It indicates existence of broad genetic base, which would be amenable for further selection. Moderate GCV and PCV (10-20%) were observed for plant height (at 60, 90 and 120 DAT), plant spread at 60 DAT, stem girth (at 90 and 120 DAT), days to first flowering, fruit length, fruit diameter and per cent dry matter in fruits. These results suggested that little influence of environment. Therefore, phenotypic variability may be a good measure of genotypic variability and hence selection for such traits would be rewarding.

Low GCV (<10%) and Moderate PCV (10-20%) were observed for plant spread (at 90 and 120 DAT), days to 50 per cent flowering and days to first fruit maturity. These results indicate that apparent variation is not only due to genotypes but also due to the influence of environment on the expression of character. Selection for such traits may not give desirable results.

Higher (>20%) values of genetic advance over mean (GAM) coupled with high estimates of heritability (>60%) were observed for the characters *viz.*, plant height (at 60, 90 and 120 DAT), plant spread at 60 DAT, number of primary branches (at 90 and 120 DAT), stem girth at 60 DAT, leaf area (at 60 and 90 DAT), days to first flowering, number of fruits per cluster, fruit length, fruit diameter, fruit length-diameter ratio, average fruit weight, phenol content, early yield per plant, total yield per plant, yield per plot, yield per hectare and per cent dry matter in fruits. These results indicated the predominant role of additive genetic component in governing these traits and improvement of these traits through direct selection would be rewarding.

Moderate (20-30%) values of genetic advance over mean (GAM) coupled with moderate estimates of heritability (30-60%) were observed plant spread (at 90 and 120 DAT), number of primary branches at 60 DAT, stem girth (at 90 and 120 DAT). This indicates the importance of additive effects for this trait and selection may be rewarding.

High heritability coupled with moderate genetic advance over mean were observed for days to 50 per cent flowering and days to first fruit maturity, indicating non-additive gene action. The high heritability is being exhibited due to favorable influence environment rather than genotype and selection for such traits may not be rewarding.

Correlation and path analysis

The character association studies revealed that the total yield per plant had significant (at p=0.01) and positive association with plant height at 90 DAT, plant spread at 90 DAT, number of primary branches at 90 DAT, stem girth at 90 DAT, early yield per plant, number of fruits per plant and fruit diameter. While it was

negatively and significantly associated with days to first flowering, days to 50 per cent flowering and days to first fruit maturity at both genotypic and phenotypic level. Narrow differences between the genotypic and phenotypic correlation coefficients were observed for various traits in the present findings and this indicates the lesser influence of the environment in the expression of these traits and presence of strong inherent association among the traits.

Path analysis studies revealed that significant positive association at genotypic level among the traits *viz.*, plant height at 90 DAT (0.235), leaf area at 90 DAT (0.228), days to first fruit maturity (0.162), number of fruits per cluster (0.280) and early yield per plant (1.903) had exhibited true association with direct effect on yield per plant. The direct selection for these traits would be rewarding for improvement in the total yield per plant.

Genetic divergence

Sixty genotypes were grouped into seven clusters. A maximum of 36 genotypes included in cluster I followed by 14 genotypes in cluster II, 6 genotypes in cluster III and the clusters IV, V, VI and VII had solitary genotype.

Intra-cluster distances revealed that cluster III with 6 genotypes showed maximum intra-cluster diversity (D^2=27.63) followed by cluster II (D^2=23.64) and cluster I (D^2=20.79). Maximum intra-cluster distance was observed in cluster III, indicating the existence of genetic divergence among the constituent genotypes as compared to other cluster. High degree of divergence among the genotypes within a cluster would produce more segregating breeding materials and selection within such cluster might be executed based on maximum mean value for the desirable characters.

Based on inter-cluster distances, the maximum divergence was observed between clusters III and cluster VII (D^2=69.50) followed by clusters VI and VII (D^2=68.98), cluster IV and VII (D^2=64.09), cluster II and III (D^2=54.94), cluster II and VI (D^2=47.44) and cluster II and IV (D^2=36.21). The cluster I had the least inter-cluster distance (D^2=28.76) with the cluster V. This clustering helps the breeders for selection of genotypes for hybridization programmes and can be used as base for patenting or registration.

Among the 21 characters included for D^2 analysis, average fruit weight contributed maximum (52.32%) to the genetic diversity followed by number of fruits per cluster (14.52%), plant spread at 60 DAT (13.90%), plant height at 60 DAT (10.62%), leaf area at 60 DAT (6.50%), leaf area at 90 DAT (1.19%), fruit length-diameter ratio (0.28%), number of primary branches at 90 DAT (0.23%), stem girth at 60 DAT (0.23%), fruit diameter (0.11%), days to first flowering (0.06%) and days to first fruit maturity (0.06%).

The top three characters contributing most towards the genetic divergence were average fruit weight followed by number of fruits per cluster and plant spread at 60 DAT. These characters may be used in selecting genetically diverse parents for hybridization programme to exploit either maximum heterosis or to execute efficient selection in the segregating generation.

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Appendix I: Physical and chemical properties of soil from experimental site

Sl. No.	Particulars	Value obtained
A	**Physical properties**	
1	Particle size analysis	
	a) Sand (%)	23.70
	b) Silt (%)	18.10
	c) Clay (%)	58.20
	d) Textural class	Clayey
2	Bulk Density (g/cc)	1.28
B	**Chemical properties**	
1	EC	0.65
2	Organic carbon (%)	0.82
3	Soil reaction (pH)	6.87
4	Available nitrogen (kg/ha)	195.10
5	Available phosphorus (kg/ha)	16.25
6	Available potassium (kg/ha)	267.60

Appendix II: Meteorological data recorded during experimental period from October 2013 to March 2014 in MHREC, Bagalkot

Month	Temperature (^{0}C)		Relative humidity (%)		Rainfall (mm)
	Min	Max	Min	Max	
October	18.60	30.90	69.00	84.00	90.20
November	17.60	28.90	42.00	70.00	6.00
December	15.20	28.40	33.00	62.00	0.00
January	17.50	29.60	31.00	67.00	3.00
February	18.40	30.70	22.00	51.00	21.40
March	18.77	36.19	47.09	65.61	17.60

Appendix III: *Per se* performance of brinjal (*Solanum melongena* L.) genotypes for pest and diseases incidence

Sl. No.	Genotypes	Fruit borer incidence (%)	Shoot borer incidence (%)	Phomopsis blight incidence (%)	Little leaf incidence (%)
1.	CBB-1	0.00	0.00	0.00	0.00
2.	CBB-2	9.00	4.76	0.00	0.00
3.	CBB-3	0.00	0.00	0.00	0.00
4.	CBB-4	19.76	7.70	0.00	0.00
5.	CBB-5	0.00	0.00	0.00	0.00
6.	CO-2	0.00	0.00	0.00	0.00
7.	CBB-6	0.00	0.00	0.00	0.00
8.	CBB-7	16.59	6.54	0.00	0.00
9.	CBB-8	0.00	0.00	0.00	0.00
10.	CBB-9	0.00	0.00	0.00	13.33
11.	CBB-10	0.00	0.00	0.00	0.00
12.	CBB-11	0.00	0.00	0.00	0.00
13.	CBB-12	0.00	0.00	0.00	6.66
14.	CBB-13	0.00	0.00	43.34	6.66
15.	CBB-14	0.00	0.00	15.96	0.00
16.	CBB-15	0.00	0.00	0.00	0.00
17.	CBB-16	0.00	0.00	0.00	0.00
18.	CBB-17	0.00	0.00	0.00	0.00
19.	CBB-18	49.44	20.69	0.00	0.00
20.	CBB-19	0.00	0.00	10.73	0.00
21.	CBB-20	0.00	0.00	0.00	0.00
22.	CBB-21	0.00	0.00	0.00	0.00
23.	CBB-22	0.00	0.00	0.00	0.00
24.	CBB-23	0.00	0.00	0.00	0.00
25.	CBB-24	0.00	0.00	0.00	0.00
26.	CBB-25	0.00	0.00	0.00	0.00
27.	CBB-26	0.00	0.00	0.00	0.00
28.	CBB-27	0.00	0.00	45.64	0.00
29.	CBB-28	5.97	4.64	0.00	0.00
30.	CBB-29	6.89	3.58	0.00	0.00
31.	CBB-30	0.00	0.00	0.00	0.00
32.	CBB-31	0.00	0.00	0.00	0.00

Contd.....

Appendix III: Continued...

Sl. No.	Genotypes	Fruit borer incidence (%)	Shoot borer incidence (%)	Phomopsis blight incidence (%)	Little leaf incidence (%)
33.	CBB-32	0.00	0.00	0.00	0.00
34.	CBB-33	13.65	4.86	0.00	0.00
35.	CBB-34	0.00	0.00	0.00	0.00
36.	CBB-35	0.00	0.00	0.00	0.00
37.	CBB-36	0.00	0.00	8.00	0.00
38.	CBB-37	0.00	0.00	0.00	0.00
39.	CBB-38	13.30	6.54	0.00	0.00
40.	CBB-39	0.00	0.00	0.00	0.00
41.	CBB-40	6.83	3.65	0.00	0.00
42.	CBB-41	0.00	0.00	0.00	0.00
43.	CBB-42	0.00	0.00	0.00	6.66
44.	CBB-43	10.60	4.78	0.00	0.00
45.	CBB-44	0.00	0.00	0.00	0.00
46.	CBB-45	5.90	4.80	0.00	0.00
47.	CBB-46	7.96	4.99	0.00	0.00
48.	CBB-47	0.00	0.00	0.00	0.00
49.	CBB-48	0.00	0.00	0.00	0.00
50.	CBB-49	11.21	4.22	0.00	0.00
51.	CBB-50	0.00	0.00	14.40	0.00
52.	CBB-51	31.73	11.61	9.93	0.00
53.	CBB-52	7.95	4.79	0.00	0.00
54.	CBB-53	0.00	0.00	9.90	6.66
55.	CBB-54	7.15	4.27	0.00	0.00
56.	CBB-55	0.00	0.00	0.00	0.00
57.	CBB-56	0.00	0.00	0.00	0.00
58.	CBB-57	0.00	0.00	0.00	0.00
59.	CBB-58	0.00	0.00	0.00	0.00
60.	CBB-59	0.00	0.00	0.00	0.00

VARIABILITY AND GENETIC DIVERSITY STUDIES IN BRINJAL (*Solanum melongena* L.) GENOTYPES

VITTAL L. MANGI **2014** **Dr. H. B. PATIL**
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ABSTRACT

The investigation on "Variability and genetic diversity studies in brinjal (*Solanum melongena* L.) genotypes" was undertaken during *Rabi* season of 2013. Sixty brinjal genotypes were evaluated in randomized block design with three replications in Sector no.1 under the University of Horticultural Sciences, Bagalkot. Analysis of variance revealed highly significant differences among genotypes for 26 out of 29 characters studied. Broad genetic base was evident as the values of genotypic and phenotypic coefficient of variations were high for number of primary branches (90 and 120 DAT), stem girth at 60 DAT, leaf area (60 and 90 DAT), number of fruits per cluster, number of fruits per plant, average fruit weight, fruit length-diameter ratio, total yield per plant and phenol content. High heritability coupled with high genetic advance over mean was observed for plant height (60, 90 and 120 DAT), plant spread at 60 DAT, number of primary branches (90 and 120 DAT), stem girth at 60 DAT, leaf area (60 and 90 DAT), days to first flowering, number of fruits per cluster, fruit length, fruit diameter, fruit length-diameter ratio, average fruit weight, phenol content, early yield per plant, total yield per plant and per cent dry matter in fruits indicates predominance additive gene action. Thus, there is ample scope for improving these characters through direct selection.

Correlation studies revealed significant and positive association of total yield per plant with fruit diameter, early yield per plant and number of fruits per plant. Path analysis studies revealed high direct effects of number of fruits per cluster and early yield per plant on total yield per plant.

Mahalanobis D^2 analysis grouped 60 genotypes of brinjal into seven clusters. The cluster III showed maximum intra-cluster distance and maximum inter-cluster distance was observed between clusters III and VII. Average fruit weight contributed maximum (52.32%) to the genetic diversity followed by number of fruits per cluster (14.52%) and plant spread at 60 DAT (13.90%). Heterosis studies can be planned by involving genotypes belonging to cluster III and cluster VII. The high yielding genotypes having purple coloured fruits with white stripes and spiny (CBB-6, CBB-17, CBB-29 and CBB-45), green coloured fruits with white patches and spiny (CBB-7 and CBB-23) and purple coloured fruits with green stripes (CBB-1) can be further assessed for stability before exploiting them for commercial cultivation.

§zÀÉiÀ°è(¸ÉÃ¯Áå£ÀÀÀ ªÉÉÉAf£Á J¯ï.) vÀÀUÀÀªÀÀvÁå¸ÀªÀÀvÀÀÀC£ÀªÀÀ²APA ªÉ«zÀvÉiÀÀCzÀiÀÀÀ

«oÀÀ J¯ï. ªÀÀÀV **2014** **qÁ|| JZï. ©. ¥ÁnÃ® ¥ÀÀÀR ªÀÀUÀÀzÀÀPÀgÀÀ**

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§z£AiÄ° (¸ÆÃ¯Á£ªïï ªÄ¯ÆAf£Á J¯ï.) v½U¼ ªÀvÁ¸ ªÄvÄ C£ÄªA²ÃP ªÉ«zÀvAiÄ CzÀAiÄ£ª£Ä 2013 g »AUÁgÄ lÄvÄ«£° ¸Pg £A. 1 vÆÃlUÁjP «eÁ£U¼ «±«zÁ®AiÄ ¨ÁU®PÆÃmAiÄ° PÉUÆ¼¯Á¬ÄvÄ. §z£AiÄ 60 v½U¼£Ä ªÄÆgÄ ¥æÉwU¼£ÁV¹ AiiÁzÉaÀP ¥æÃ± «£Á¸z° F ¥æÆÃUª£Ä £q¸¯Á¬ÄvÄ. ªÀvÁ¸z «±ÃµuAiÄ ¥Æg CzÀAiÄ£ ªiÁrz 29 UÄtU¼ ¥ÉQ 26 UÄtU¼° UªÄ£Áºð ªÀvÁ¸ PAqÄ §A¢z. C£ÄªA²ÃP ªÄvÄ ¥Æd ®PtU¼ UÄuÁAPz ªÀvÁ¸z ªiË®U¼ ¥Æg ªÄÄR PÆA¨U¼ ¸ASÀ, PÁAqz ¸Äv¼v, J¯AiÄ «¹Ãtð, UÆAZ°£°gÄª PÁ¬ÄU¼ ¸ASÀ, Vqz PÁ¬ÄAiÄ ¸ASÀ, PÁ¬ÄAiÄ ¸gÁ¸j vÆP, PÁ¬ÄAiÄ Gz¦;ªÁ¸z ¸gÁ¸j, Vqz MlÄ E¼Äªj ªÄvÄ ¦£Á¯ï CA± GvªÄ ªÄlz° EgÄªÀzjAz C£ÄªA²ÃAiÄ DzÁg ¸µªÁUÄvz. C£ÄªA²ÃAiÄ CzÀAiÄ£z° ºa£ C£ÄªA²ÃAiÄ ¸ÁªÄxð ªÄvÄ ¸gÁ¸j C£ÄªA²ÃAiÄ ªÄÄAzÄªjPAiÄÄ PAqÄ §A¢z GzÁºguU Vqz Jvg, Vqz ºgqÄ«P, Vqz ªÄÄRÀ PÆA¨U¼ ¸ASÀ, PÁAqz ¸Äv¼v, J¯AiÄ «¹Ãtð, ªÆz® ºÆ ©qÄªÀzÄ, UÆAZ°£°gÄª PÁ¬ÄU¼ ¸ASÀ, PÁ¬ÄAiÄ GzÀ, PÁ¬ÄAiÄ ªÁ¸, PÁ¬ÄAiÄ GzÀ;ªÁ¸z ¸gÁ¸j, PÁ¬ÄAiÄ ¸gÁ¸j vÆP, ¦£Á¯ï CA±, ªÆz® PÁ¬ÄAiÄ E¼ÄªÄj, Vqz MlÄ E¼ÄªÄj ªÄvÄ PÁ¬ÄAiÄ°gÄª ±Ã. Mt ¥zÁxð, F J¯Á UÄt®PtU¼ ºa£ G¥AiÆÃU ¥qAiÄ®Ä £Ãg DAiÄAiÄ DzÁgz° GvªÄ v½U¼£Ä DAiÄ ªiÁq§ºÄzÁVz.

¥g¸g UÄt®PtU¼ ¸A§Azz CzÀAiÄ£¢Az zÉq¥r¹zÀÃ£Azg, PÁ¬ÄAiÄ ªÁ¸, ªÆz® PÁ¬ÄAiÄ E¼ÄªÄj ºÁUÆ Vqz PÁ¬ÄU¼ ¸ASÀ ¸A§A¢v UÄt®PtU¼ÆA¢U ªÄºvªÁz ªÄvÄ zÉÁvÀP ¸A§AzªÄ ºÆA¢gÄvª. UÆAZ°£°gÄª PÁ¬ÄU¼ ¸ASÀ ªÄvÄ ªÆz® PÁ¬ÄAiÄ E¼ÄªÄjAiÄÄ Vqz MlÄ E¼ÄªÄjAiÄ ªÄÄ¯ D¥ÃPtAiÄ z£ÁvÀP ªÄvÄ £Ãg ¥juÁªÄª£Ä ºÆA¢z JAzÄ ªiÁUð «±ÃµuAiÄ ¥°vÁA±¢Az zÉq¥nz.

ªÄºÁ®£ÆÃ©¸ï r² «±ÃµuAiÄ£Ä C£Ä¸j¹ 60 §z£AiÄ v½U¼£Ä 7 UÄA¥ÄU¼ÁV «AUr¸¯Á¬ÄvÄ. Ujµ DAvjP UÄA¥ÄU¼ zÆgªÀ ªÄÆg£ÃAiÄ UÄA¦£° PAqÄ§Azg, ¥g¸g UÄA¦£ CAvg CwÃ ºZÁV ªÄÆgÄ ªÄvÄ K¼g £qÄª PAqÄ §A¢z. PÁ¬ÄAiÄ ¸gÁ¸j vÆPz PÆqÄUAiÄÄ (52.32%) MmÁg C£ÄªA²ÃP ªÉ«zÀvAiÄ° UjµªÁVzÄ £Avgz ¸Á£z° UÆAZ°£°gÄª PÁ¬ÄU¼ ¸ASÀ (14.52%) ªÄvÄ Vqz ºgÄqÄ«P (13.90%) EgÄªÀzÄ PAqÄ §gÄvz. 3 ªÄvÄ 7 £ÃAiÄ UÄA¦£ v½U¼£Ä ¸AQÃgt v½U¼ CzÀAiÄ£PÁV §¼¸§ºÄzÄ. ¸zj CzÀAiÄ£z° §z£ v½U¼Áz ¹©©-6, ¹©©-17, ¹©© 29 ªÄvÄ ¹©©-45 (£Ãg¼ §t, ©½ ¥mU¼Ä ªÄvÄ ªÄÄ¼£Ä ºÆA¢gÄvª), ¹©©-7 ªÄvÄ ¹©©-23 (º¹gÄ §t, ©½ ªÄZU¼Ä ªÄvÄ ªÄÄ¼£Ä ºÆA¢gÄvª) ªÄvÄ ¹©©-1 (£Ãg¼ §tz eÆvU º¹gÄ ¥nAiÄ£Ä ºÆA¢gÄvz) ºZÄ E¼ÄªÄj ¤ÃqÄª v½U¼AzÄ UÄgÄw¸¯ÁVz. F v½U¼£Ä ªÁtdÀ PÉ¶UÁV §¼¹PÆ¼ÄªÄ ªÆz®Ä ''v½U¼ ¹gv''AiÄ CzÀAiÄ£ PÉUÆ¼ªÀzÄ CªÀ±ÀP.