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Estimation of Genetic variability and Response to Selection in Brinjal (*Solanum melongena* L.)

Sandeep Kumar[1*], G.C. Yadav[2], Jaswant Prajapati[1], Lav Kumar[3], Lokesh Yadav[1] and Anjana C.S.[1]
[1]PG Student, Department of Vegetable Science, College of Horticulture & Forestry,
Acharya Narendra Deva University of Agriculture and technology Kumarganj, Ayodhaya (Uttar Pradesh), India.
[2]Professor, Department of Vegetable Science, College of Horticulture & Forestry,
Acharya Narendra Deva University of Agriculture and technology Kumarganj, Ayodhaya (Uttar Pradesh), India.
[3]Research Scholar, Department of Vegetable Science, College of Horticulture & Forestry,
Acharya Narendra Deva University of Agriculture and technology Kumarganj, Ayodhaya (Uttar Pradesh), India.

(Corresponding author: Sandeep Kumar)*
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ABSTRACT: The present investigation carried out during autumn winter season 2021-2022 at the MES, Department of Vegetable Science, ANDUA&T, Kumarganj, Ayodhya (U.P.) with the objectives to estimate the genetic variability, heritability in broad sense and genetic advance in percent of mean among the 32 genotypes of brinjal including two checks Pant Rituraj and Pant Samrat. The ANOVA revealed that mean sum of squares due to genotypes was highly significant for all the traits indicating ample variation among the genotypes. The estimates of the PCV were higher than the GCV for all the traits. The highest PCV and GCV were observed for non-reducing sugar followed by reducing sugar, total sugar, no of fruits per plant. High heritability was recorded for all the characters except days to first fruit harvest and TSS. Genetic advance in per cent of mean ranged from 6.6 % to 110.46 %. It was high (>20) in total fruit yield per plant (38.41) and polar diameter of fruit length (38.39). High heritability coupled with high genetic advance (Ga) were recorded for the traits which are average fruit weight total, number of fruits/plant, fruit yield per plant, average fruit weight, total sugar, reducing sugar and non-reducing sugar. Therefore, from the above obtained results it can be concluded that there is great chance of effective crop improvement for greater yield and yield attributing traits.

Keywords: Brinjal, GCV, PCV, heritability and genetic advance.

INTRODUCTION

Brinjal, commonly known as eggplant or aubergine, is a popular vegetable crop in India and across the world. Brinjal is also known as the "poor man's vegetable" due to its lower production costs, easy to cultivation, and year-round availability. *Solanum melongena* L. is a member of the Solanaceae family (Nightshade). It grows best on light, well-drained sandy-loam soils with a pH range of 6.0 to 7.5. Brinjal is a crop which is often cross pollinated. The high rate of cross-pollination is due to the presence of heterostyly that encourages cross-pollination. It is grown on an area of 7.36 ha of land in India, with an annual yield of 127.77 million tonnes. It is available in the following states: Orissa, Bihar, Karnataka, Karla, West Bengal, Andhra Pradesh, Maharashtra, and Uttar Pradesh. Brinjal is grown on 4.10 lakh ha in Uttar Pradesh, with an annual yield of 136.16 lakh tonnes (Anony., 2018). The success of any crop improvement programme largely depends upon the nature and magnitude of the genetic variability existing in the breeding material with which the plant breeder is working. The genetic make-up of the plant, the environment in which it is developed and the interaction between the genotypes and the environment all has a role in the phenotypic expression of the plant characters. As a result, genetic variability studies using appropriate biometrical instruments such as coefficient of variability, heritability and genetic advance have become essential in breeding programmes for achieving concrete outcomes of desired values. Keeping in view the above facts the present research work was panned to estimate the genetic variability, heritability and genetic advance in the available germplasm of brinjal.

MATERIALS AND METHODS

The present research work on brinjal was carried out during autumn-winter season 2021-22 at the MES, Deptt. of Vegetable Science, ANDUA&T, Narendra Nagar, (Kumarganj), Ayodhya (U.P.). The experiment was conducted in RCBD with 3 replications during autumn-winter season in 2021-22 to assess the performance of thirty-two genotypes. Each treatment consisted of 2 rows. 6 plants were maintained in each row each and each treatment replicated thrice. Transplanting was done at a spacing of 60 cm × 50 cm

having net plot size of 1.2 × 3.0 m^2. All the recommended agronomic practices and plant protection measures were followed to raise a crop. Observations were recorded on 18 quantitative characters *viz*., days to 50% flowering, first harvesting, plant height (cm), number of primary branches per plant, polar diameter (cm), equatorial diameter (cm), length of pedicel (cm), number of fruit per cluster, average fruit weight (g), number of fruits per plant, total phenol content (mg/100g), dry matter content (%), reducing sugars (%), non-reducing sugar (%), total sugars (%) TSS (%), ascorbic acid (mg/100) and total fruit yield per plant (kg). biometrical analyses were done as per formulae suggested by Panse and Sukhatme (1987) for analysis of variance, Burton and De vane (1953) for coefficient of variation, Hanson *et al*. (1956) for heritability in broad sense and Johnson *et al*. (1955) for genetic advance in per cent of mean.

RESULTS AND DISCUSSION

The mean sum of square in ANOVA revealed high variability among the 32 genotypes for all characters at 5 % and 1 % of probability (Table 1). The highly significant differences might be endorsed to their genetic makeup of germplasm line and various region from where they have been collected. The character under investigation were analysed for genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability (broad sense) and genetic advance as per cent of mean (Table 2).

The estimates of GCV and PCV for ten characters of brinjal germplasm have been presented in Table 2. The estimates of PCV were higher than GCV for all the traits. High magnitudes of PCV and GCV was observed in case of non-reducing sugar (53.78%) and 53.70%), reducing sugars (51.76 and 51.64%), total- sugars (34.49 and 34.37%), number of fruits per plant (31.54 and 29.34 %), average fruit weight (26.62 and 25.50%), equatorial diameter (23.67 and 22.76%), total yield per plant (23.31 and 20.85%), and polar diameter (23.15 and 20.77%). Moderate PCV and GCV were recorded in number of primary branches per plant (18.77 and 16.81%), dry matter content (18.76 and 18.28%), plant height (17.72 and 15.09%), number of fruit per cluster (17.55 and 15.32%), total phenol content (15.93 and 15.69%), length of pedicle (15.30% and 14.23%), day to50% flowering (15.70 and 14.58%) and ascorbic acid (13.61 and 13.28%) and low PCV and GCV were noticed in, day to fist fruit harvest (8.79 and 6.15%) and TSS (6.37 and 4.51%). Reshmika *et al*. (2015); Banerjee *et al.* (2018); Devaraju *et al.* (2020); Balsubramniyam *et al.* (2021) also reported similar findings in their studies. Heritability in broad sense of a character is important to the breeder since it indicates the possibility and extent to which improvement is possible through selection. It also indicates direction of selection pressure to be applied for a trait during selection because it measures relationship between parents and their progeny, hence widely used in determining the degree to which a character may be transmitted from parents to offspring. However, high heritability alone is not enough to make efficient selection in advanced generation unless accompanied by substantial amount of genetic advance (Burton, 1952). High estimates of heritability along with high genetic advance provides good scope for further improvement in advance generations.

Estimates of heritability and genetic advance for eighteen characters are presented in Table 2. The heritability in broad sense ranged from 49.08 per cent in case of day to first harvesting to 99.69 per cent for non-reducing sugar. High heritability (>75%) were recorded for all the characters like reducing sugar, total sugar, total phenol content ascorbic acids, dry matter content, equatorial diameter of fruit average fruit weight, length of pedicle, number of fruits per plant, day to 50% flowering, polar diameter, number of primary branches, total fruit yield per plant and number of fruit per plant except for the plant height (71.84%) and TSS (50.16%). Resmika *et al.* (2014); Balsubramniyam *et al.* (2021) also showed high heritability for all traits.

Highest value of genetic advance (Ga) in per-cent of mean was observed by non-reducing sugar (110.46 %) while TSS (6.60) exhibited lowest value. The characters also showed very high estimate of Ga were non-reducing sugar (110.46 %), reducing sugars (106.14%), total sugars (70.55%), number of fruits per plant (56.20%), average fruit weight (50.33 %), equatorial diameter (45.10%), total fruit yield per plant (38.41%), polar diameter (38.39%), day matter content (36.67), total phenol content (31.85%) and number of primary branches per plant (31.00%). Moderate genetic advance in per cent of mean was recorded for days to 50% flowering (27.92%), number of fruits per cluster (27.56%), length of pedicle (27.27%), ascorbic acid (26.69) and plant height (26.22%), while, the low genetic advance for days to first harvest (8.88 %) and TSS (6.60%). High heritability coupled with high Ga were observed for most of the traits except TSS, non-reducing sugar, total phenol content, number of fruits/cluster and number of primary braches/plant which indicated opportunity for selection response in available germplasm of brinjal with low selection, intensity for improvement. Similar results were also reported by Kumar *et al.* (2018); Balsubramniyam *et al.* (2021); Devaraju *et al.* (2020) in brinjal and Maurya and Yadav (2022) in bottle gourd. Characters like days to 50% flowering, plant height, days to first harvest and TSS exhibited medium heritability along with low genetic advance as per cent of mean indicating that it is largely influenced by environment and thus, require high selection intensity for improving of this trait. Banerjee *et al.* (2018) reported high genetic advance as per cent of mean for almost all the characters except for days to first flowering.

Table 1: Analysis of variance (mean squares) for eighteen quantitative characters in brinjal germplasm.

Sr. No.	Traits	Mean squares		
		Replicate	Treatments	Error
		2	31	62
1.	Days to 50 % flowering	92.521	8640.292**	866.146
2.	Days to first fruit harvest	22.396	3929.958*	2019.604
3.	Plant height	141.41	8912.875**	2059.923
4.	Number of primary branches per plant	0.322	27.553**	4.204
5.	Polar diameter	3.637	971.344**	145.265
6.	Equatorial diameter	3.331	968.92**	51.237
7.	Length of pedicle	2.264	68.788**	6.805
8.	Number of fruit per cluster	0.19	21.705**	4.088
9.	Average fruit weight	431.686	56459.847**	3279.35
10.	Number of fruit per plant	108.842	8614.237**	852.808
11.	Total phenol content	0.005	13.29**	0.27
12.	Dry matter content	1.48	164.029**	5.82
13.	Reducing sugars	0.002	29.644**	0.093
14.	Non-reducing sugar	0.001	9.963**	0.02
15.	Total sugars	0.002	31.595**	0.15
16.	TSS	0.376	6.817*	3.384
17.	Ascorbic acid	0.761	193.954**	6.427
18	Total fruit yield per plant	0.138	36.363**	5.591

*- Significant at 5 per cent probability level; **- Significant at 1 per cent probability level

Table 2: Range, grand mean, phenotypic (PCV), genotypic (GCV) coefficient of variation, heritability in broad sense, genetic advance in per cent of mean ($\overline{Ga}$) for eighteen characters in brinjal germplasm.

Sr. No.	Characters/ traits	Range		Grand Mean	PCV	GCV	Heritability (in broad sence) (%) (h^2bs)	Genetic Advance (Ga)	Gen. Adv.as % of Mean ($\overline{Ga}$)
		Min	Max						
1.	Days to 50 % flowering	50.00	80.67	64.40	15.70	14.58	86.33	17.98	27.92
2.	Days to first fruit harvest	77.67	99.67	90.98	8.79	6.15	49.08	8.08	8.88
3.	Plant height	47.51	94.13	61.30	17.72	15.01	71.84	16.07	26.22
4.	Number of primary branches per plant	2.28	4.31	3.11	18.77	16.81	80.14	0.96	31.00
5.	Polar diameter	9.27	21.39	14.96	23.15	20.77	80.48	5.74	38.39
6.	Equatorial diameter	9.46	22.88	13.99	23.67	22.76	92.46	6.30	45.10
7.	Length of pedicle	4.41	7.04	5.89	15.30	14.23	86.49	1.60	27.27
8.	Number of fruit per cluster	2.12	4.10	3.00	17.55	15.32	76.22	0.82	27.56
9.	Average fruit weight	68.83	180.56	95.19	26.62	25.50	91.76	47.91	50.33
10.	Number of fruit per plant	17.01	51.68	31.98	31.54	29.3	86.48	17.97	56.20
11.	Total phenol content	1.74	2.92	2.40	15.99	15.69	97.01	0.76	31.85
12.	Dry matter content	4.96	11.90	7.20	18.76	18.28	94.85	2.64	36.67
13.	Reducing sugars	0.12	1.79	1.09	51.76	51.64	99.52	1.15	106.14
14.	Non-reducing sugar	0.27	1.14	0.61	53.78	53.70	99.69	0.67	110.46
15.	Total sugars	0.52	2.73	1.69	34.49	34.37	99.29	1.19	70.55
16.	TSS	4.83	6.13	5.20	6.374	4.519	50.263	0.343	6.6
17.	Ascorbic acid	7.75	13.31	10.78	13.61	13.28	95.189	2.878	26.69
18.	Total fruit yield per plant	2.13	4.52	2.88	23.31	20.85	80.01	1.107	38.41

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Conflict of Interest. None.

CONCLUSIONS

The results for ANOVA showed that the mean square due to genotype was highly significant for all the characters indicating significant genetic variation which enables us to utilize genotypes in various breeding as well as improvement programmes. The characters showing high heritability coupled with high genetic advance provide a broad way for the improvement in genotypes for specific characters. The information may further help the breeders in formulating appropriate strategy aimed at getting higher yields and character improvement in brinjal.

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