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Study on genetic variability, heritability and genetic advance for yield and its attributing parameters in brinjal [*Solanum melongena* (L.)] genotypes

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Abstract
In order to estimate variability in 32 brinjal accessions, the study was conducted at Dr. YSR Horticultural University, Venkataramannagudem during Rabi 2022-23. Significant differences were noticed among all studied traits. Thirty two genotypes and traits under study showed high significant differences, showing that all the traits were sufficiently variable. For every character analyzed, PCV estimates were greater than corresponding GCV values. PCV and GCV values were high for percent fruit set in medium styled flowers, number of fruits per plant, length of the fruit, fruit diameter, weight of the fruit, fruit yield per plant, percent plants infested with shoot and fruit borer whereas, days to first harvest, duration of harvest period, total phenols and ascorbic acid content recorded moderate GCV and PCV. Heritability values were high for all the characters. High heritability combined with high genetic advance as percent of mean was noticed for all traits under study.

Keywords: Genetic variability, heritability, genetic advance, yield

Introduction
Brinjal (*Solanum melongena* L. 2n = 24) is one among the most significant vegetable crops farmed throughout the nation. It is also called as an egg-plant or an aubergine. Patients with diabetes are thought to benefit from white brinjal. As a treatment for hepatic issues, it was also suggested (Shukla and Naik, 1993) [1]. Roots are utilized in Unani medicine to relieve pain.
It is considered that origin of Brinjal is India (Vavilov, 1931) [2]. Based on the agro-climatic parameters and growing conditions, genotype performance varies. Additionally, customer preferences vary from place to region. In order to meet the growers' regional needs, it has become necessary to develop new brinjal types. The degree of genetic divergence and variability present in the genotypes has a significant impact on how a breeding program is planned and carried out to improve the various quantitative traits. As a result, Coefficient of Variation is helpful in evaluating genetic variability for specific traits. The foundation of the entire breeding program is genetic variety. Without variability, selection in a population is ineffective. When it comes to variability, the genetic component of the observed variation is what gives an indication of how transmissible is the studied variation and how it reacts to selection. Heritability is a measure of how traits are passed down from one generation to the next (Falconer, 1989) [3]. According to Koundinya *et al*. (2013) [4], heritability is the percentage of phenotypic variation that is repeatable and caused by genes. This information aids breeders in choosing the best variety for a particular trait. Genetic advance is defined as an increase of mean values in chosen families relative to the base population (Singh, 1983) [5]; this aids the breeder in choosing the progeny from the previous generation. Heritability and genetic progress studies are crucial for determining if variation observed in a certain characteristic is brought on by environment or genotype. Given the foregoing, the current study was undertaken to examine genetic variability traits among the thirty two genotypes.

Material and Methods
The research work was done at HRS, Venkataramannagudem, Dr. YSRHU to study genetic diversity in 32 brinjal genotypes in two replications with RBD design during Rabi 2022-23. Thirty two genotypes were studied in the experiment, all of which were obtained from NBPGR Hyderabad. Planting was done with 75 cm x 40 cm inter- and intra-row spacing. Twelve traits were observed on five randomly chosen plants in each genotype.

The Burton (1952) [6] formula was used to determine the genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV). PCV and GCV were classified as per suggestions given by Sivasubramanian and Menon (1973) [7]. With the help of formula provided by Lush (1949) [8] and Hanson *et al*., 1956 [9], heritability at broad sense was calculated. In accordance with the formulas provided by Johnson *et al*., 1955 [10], genetic gain and genetic advance were determined.

Results and Discussion

The germplasm material under study for this experiment underwent a thorough screening that demonstrated enough variation in nine quantitative, qualitative parameters were two and one major pest characteristics. *viz*., No. of flower clusters per plant, No. of flowers per cluster, No. of fruits per cluster, No. of fruits per plant, fruit length (cm), fruit diameter (cm), fruit weight (g), days to first harvest, duration of harvest period, fruit yield per plant (kg), ascorbic acid content (mg/100 g), total phenol content (mg/100 g), shoot and fruit borer infestation (%).

Yield and yield attributing parameters

High phenotypic (74.27) and genotypic (70.13) variances along with moderate PCV (13.88 %) and GCV (12.53 %) were recorded for fruit set percent in long styled flowers. High heritability of 90.00 percent with moderate GA of 16.79 and high GAM of 25.11 percent was recorded for this trait. Similar results were recorded by Ukkund *et al.* (2007) [11]. High phenotypic (108.23) and genotypic (107.38) variances were recorded for- fruit set percent in medium styled flowers with high estimates of PCV (27.15 %) and GCV (26.07 %). High heritability of 96.00 percent along with moderate genetic advance of 21.28 and high GAM of 53.53 percent was noticed for this trait. No.of fruits per plant recorded low phenotypic (3.58) and genotypic (3.40) variances, high PCV (30.95 %), GCV (28.91 %), high heritability (93 %), low genetic advance (3.79) and high GAM (59.48). Similar results were noticed by Chitra *et al*. (2022) [12], Surabhi *et al*. (2020) [13], Balas *et al*. (2019) [14].

With regard to fruit length, moderate phenotypic and genotypic variances of 13.05 and 12.89, were recorded respectively with high PCV (35.69 %) and GCV (33.62 %) values. High heritability of 94.00 percent along with low genetic gain of 7.38 and high GAM of 69.10 percent were also noticed for this trait. Similar results were recorded by Balasubramaniyam *et al*. (2021) [15], Mili *et al*. (2014) [16]. Low phenotypic and genotypic variances of 2.94 and 2.63, respectively were observed with high PCV (34.54 %) and GCV (31.47 %) for fruit diameter. High heritability of 91.00 percent along with low genetic advance of 3.33 and high GAM of 64.69 percent was noticed for this trait. These results were similar to the findings of Babu and Patil (2005) [17], Kushwah and Bandhyopadya (2005) [18]. High phenotypic (2300.44) and genotypic (2292.18) variances, high PCV (42.86 %) and GCV (40.79 %) were recorded for fruit weight. High heritability (95 %), high genetic advance (98.45) and high GA as percent of mean (83.88) estimates were recorded. These results are similar with Balas *et al*. (2019) [14], Priyanka *et al*. (2018) [19]. Days to first harvest had recorded high phenotypic (96.26) and high genotypic (93.39) variances, moderate PCV (15.88 %) and GCV (13.68 %), high heritability (86.00 %), moderate genetic gain of (19.63) and high GAM of (27.79 %). Similar results were reported by Gavade and Ghadage (2015) [20], Jyothi *et al*. (2019) [21]. High phenotypic (103.11) and genotypic (97.38) variances, were recorded coupled with moderate PCV (12.73 %) and GCV (10.44 %) for the trait duration of harvest period. High heritability of 82.00 percent along with moderate genetic advance of 19.77 and moderate GAM 0f 20.91 percent was observed for this character. Low phenotypic (0.27) and genotypic (0.07) variances were recorded for fruit yield per plant with high estimates of PCV (29.28 %) and GCV (27.18 %). High heritability of 92.00 percent along with low genetic advance of 0.53 and high GAM of 55.77 percent was noticed for this trait. These results are in agreement with findings of Balas *et al*. (2019) [14], Balasubramaniyam *et al*. (2021) [15], Chitra *et al*. (2022) [12].

Quality parameters

Low phenotypic (0.54) and genotypic (0.39) variances, moderate PCV (11.26 %) and GCV (10.09 %), high heritability (89.00 %), low genetic advance (1.27) and high GAM (20.43) were recorded for ascorbic acid content. Similar results were reported by Ramesh Kumar and Arumugam (2013) [22], Kumar *et al*. (2012) [23]. Total phenols recorded high phenotypic (51.23) and genotypic (49.43) variances, moderate PCV (16.44 %), GCV (15.20 %), high heritability (92 %), moderate genetic advance (14.25) and high GA as percent of mean (30.81). Similar results were recorded by Surabhi *et al*. (2020) [13], Parvati *et al*. (2017) [24].

Table 1: Estimates of variability, heritability and genetic advance as percent of mean for thirteen characters in thirty two genotypes of brinjal

S. No	Characters	Range		Mean	Variance		PCV (%)	GCV (%)	h2 bs (%)	Genetic Advance	GA as percent of mean
		Minimum	Maximum		Phenotypic	Genotypic					
1	Percent fruit set in long styled flowers	52.34	85.86	66.84	74.27	70.13	13.88	12.53	90	16.79	25.11
2	Percent fruit set in medium styled flowers	19.045	60.195	39.76	108.23	107.38	27.15	26.07	96	21.28	53.53
3	No. of fruits per plant	2.775	9.805	6.37	3.58	3.40	30.95	28.91	93	3.79	59.48
4	Fruit length (cm)	10.79	21.665	15.68	10.66	10.23	22.63	20.40	90	6.51	41.56
5	Fruit diameter (cm)	1.295	5.045	3.11	1.09	0.97	33.57	31.59	94	2.01	64.72
6	Fruit weight (g)	0.98	4.46	1.56	0.89	0.82	60.15	58.09	96	1.12	71.79
7	Days to first harvest	2.775	9.805	6.37	3.58	3.40	30.95	28.91	93	3.79	59.48
8	Duration of harvest period	10.79	21.665	15.68	10.66	10.23	22.63	20.40	90	6.51	41.56
9	Fruit yield per plant (kg)	1.295	5.045	3.11	1.09	0.97	33.57	31.59	94	2.01	64.72
10	Ascorbic acid content(mg/100 g)	0.98	4.46	1.56	0.89	0.82	60.15	58.09	96	1.12	71.79
11	Total phenol content (mg/100 g)	2.775	9.805	6.37	3.58	3.40	30.95	28.91	93	3.79	59.48
12	Shoot and fruitborer infestation (%)	10.79	21.665	15.68	10.66	10.23	22.63	20.40	90	6.51	41.56

Shoot and fruit borer infestation (%)

Percent plants infestation with shoot and fruit borer recorded high phenotypic (43.94) and genotypic (42.14) variances, high PCV (34.02%), GCV (31.43%), high heritabiity (92%), moderate genetic advance (13.13) and high GAM of (63.56%). Similar results were observed by Vidhya and Kumar (2015) [19], Jyothi *et al*. (2019) [21].

Conclusion

The current study concluded that high phenotypic and genotypic coefficients of variation, high heritability and high genetic advance as a percentage of mean were exhibited for percent fruit set in medium styled flowers, No.of fruits per plant, fruit weight, fruit diameter, fruit yield per plant, fruit length and percent plants infested with shoot and fruit borer.

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