Evaluation and Selection of brinjal (*Solanum melongena L.*) genotypes for high yield with fruit and shoot borer tolerance

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ABSTRACT

Aim: Brinjal (*Solanum melongena* L.) is a vital crop of India which belongs to the family Solanaceae with a chromosome number of 2n=24.This study is aimed to evaluate brinjal genotypes and identify superior types with desirable qualities, high yield with fruit and shoot borer tolerance.

Study Design: The experimental materials consisted of fifteen genotypes and two checks which were laid out in a Randomized Block Design (RBD) with three replications.

Place and Duration of Research: The investigation was carried at Horticultural College orchard, Department of Vegetable Science, Horticultural College and Research Institute Tamil Nadu Agricultural University, Coimbatore during 2021-2022.

Methodology: Fifteen local types of brinjal and two checks were collected from several districts of Tamil Nadu and various other sources. Seeds were sown in portrays and then transplanted to main field at the age of 30 days. Growth and yield parameters were observed and recorded.

Results: Based on the *per se* performance of the genotypes, CBE SM-006 was adjudged as the best one since, it has recorded superior performance for the characters studied *viz.*, number of branches, fruit weight, number of fruits per plant, fruit yield per plant. Also, CBE–SM-006 found to have minimum fruit borer infestation and shoot borer infestation hence providing maximum marketable yield per plant. The genotype CBE-SM-105 also performed the best for most of the desirable characters. Thus, CBE-SM-006 could be a promising genotype for further breeding programme.

Conclusion: Thus, the study will provide comprehensive knowledge on evolving and selecting superior genotypes which is indispensable to aim at rational improvement in crop plant.

Key Words: Brinjal Accessions; Plant Traits; Earliness; Fruit Traits; Shoot and Fruit Borer Infestations; Marketable Yield, Superior genotypes.

1. Introduction

Brinjal (*Solanum Melongena* L.) is a vital crop of India which belongs to the family Solanaceae with a chromosome number of 2n=24. It is one of the most common, versatile, popular and principal vegetable crops grown throughout the country. Internationally, it is also

referred as eggplant / aubergine / poor man's crop. It is probably originated in India and secondary diversity of origin is believed to be in South East Asia [1].

In India it is cultivated in an area of 7,36,000 ha with production of 1,27,77,000 MT as per the data of National Horticulture Board 2019-2020 (2^{nd} advance estimate) (www.nhb.gov.in). The major countries cultivating brinjal around the world are India, Bangladesh, china, Pakistan, Nepal, U.S.A, Sri Lanka, Cyprus, Egypt, Japan, Philippines, Syria and other tropical countries. The major brinjal producing states in India are West Bengal, Orissa, Bihar, Karnataka, Andhra Pradesh, Maharashtra, Uttar Pradesh and Tamil Nadu. In case of Tamil Nadu, it is grown in almost all the districts and intensively in Coimbatore, Dindigul, Salem, Cuddalore, Kancheepuram, Madurai, Namakkal, Thirunelveli, Thiruvallur, Thiruvanamalai and Erode districts [2].

Brinjal play a vital role to achieve the nutritional security through vegetables [3]. It is rich in minerals like iron (0.0013%), phosphorous (0.02%), calcium(0.02%) and other vitamins like β-carotene(34 mg), riboflavin(0.05 mg), thiamine 90.05mg), niacin (0.5mg) and ascorbic acid (0.9 mg) per 100 g of fruit [4].

From region to region and locality to locality, the consumer preference varies a lot among various genotypes. Hence, it becomes important to evaluate the genotypes for wider adaptability, acceptance as per consumers choice. In Tamil Nadu the consumers choice depends on fruit size, fruit shape, color, taste etc. Information regarding the range of variability present with respect to different quantitative characters is of higher importance in their crop improvement programme. The success of phenotypic selection depends upon the genetic variability range present in the population. Hence, identifying genotypes with greater variability will serve as a potential genotypes for further generations. Also, it is not only about obtaining higher yield for the selection of brinjal genotypes since, yield is a complex character. So, the selection is influenced by many component characters [5]. Hence, the present investigation is used to evaluate and select the brinjal genotypes based on various quantitative and variability parameters.

2. Material and methods

The present investigation is carried at Horticultural College orchard, Tamil Nadu Agricultural University, Coimbatore during 2021-2022 which is situated at 11.5 ° latitude and 79.8° longitude and at an elevation of 426.6 m above sea level. The experimental design was Randomized Block Design with three replications. The experimental materials consisted of fifteen genotypes *viz.*,CBE -SM-083, CBE -SM-084, CBE -SM-085, CBE -SM-086, CBE -SM-93, CBE -SM-006, CBE -SM-104, CBE -SM-105, CBE -SM-106, CBE -SM-107, CBE -SM-108, CBE -SM-109, CBE -SM-110, CBE -SM-111, CBE -SM-112 which are local types and two checks viz., CO 2 and PLR-1 collected from various districts of Tamil Nadu. Randomized block design was followed with three replications and the crop was raised during Kharif 2021.

The sterilized cocopeat (300kg) is mixed with 5 kg neem cake along with Azospirillum and phosphobacteria each 1 kg. Overnight soaked brinjal seeds are sown in pro-tray at 1 seed per cell. Then, the portrays are kept one over the other and covered with polythene sheets and left undisturbed for 3-4 days. Once germination starts, they are kept individually on the raised beds inside the shadenet. Everyday the portrays are watered with rose-can and after 18 days after sowing it is drenched with 19:19:19 @ 0.5% (5g/l) . Plant protection measures were undertaken.

The seedlings at the age of 30 days are transplanted to the main field at the spacing 0f 60*60 cm. The average temperature, relative humidity, and light intensity recorded during the cropping period were 34.5° c, 63% and 34044 .54 respectively. All the package of practices were followed as per the standards given in the crop production guide 2019 [6].

2.1. Data collection and statistical analysis

Observations were recorded on the growth and yield parameters like plant height, number of branches per plant, days to flowering, days to 50 % flowering, days to first harvest, fruit length, fruit girth, fruit weight, number of fruits per plant, fruit yield per plant, shoot borer infestation, fruit borer infestation, marketable yield per plant. The mean values were subjected to statistical analysis. The statistical parameters like mean and standard error were calculated as per the standard methods of analysis [7] and R version 4.2.1 software was used to calculate ANOVA. In any statistical analysis of data, the *per se* performance is the true realized mean of the recorded data, and this estimate is directly based on observation rather than assumption. It is more reliable to select superior genotypes based on their performance *per se* than any other parameter.

3. Results and Discussion

The successful selection of genotypes depends in the selection of suitable parents. From long time, breeders use high mean values, which is considered and accepted as a basis for selection. The ANOVA for the observed traits were found to be significant so the traits can be taken under consideration for the selection programme (Table 1). In this concern, fifteen genotypes which were collected from different geographical location were evaluated for 13 characters. The *Per se* mean performance of all fifteen brinjal types is given in Table 2.

3.1. Plant Height

Plant height is considered as one of the vital character for growth and vigour of the plants. In this experiment, Among all the genotypes, significant variations were observed in the plant height ranged which ranged from CBE -SM-093 (95.15) to CBE -SM-083 (62.93). The genotype CBE-SM-093 was found to be taller (95.15 cm) followed by the genotype CBE-SM-105. Similar results were also found [8], [9].

3.2. Number of branches per plant

Number of branches per plant is another important character in brinjal which leads to increasing the yield. In this character, CBE -SM-006 (7.7) recorded the maximum number of branches followed by CBE –SM- 110 (6.72). This was in accordance with the results [10].

3.3. Days to first flowering

Earliness is considered as one of the most important characters in any crop improvement programme, and most of the germplasms are preferred when higher yield coupled with earliness. The present study also projected with significant earliness in days to first flowering. The genotype CBE-SM-086 recorded the least number of days to first flowering 29.9 days followed by CBE-SM-006 (30.01). The genotype CBE-SM-093 recorded the maximum days to flower 51.50 days. Similar findings were reported in [11].

3.4. Days to first harvest

Days to first harvest was ranged from 49.41 to 72.05 days with CBE-SM-111 showing the least value of 49.41 days followed by the accession CBE-SM-006 with 50.19 days (Table 2). The accession CBE-SM-108 took 72.05 days for first harvest as the maximum for this trait. Similar results were cited [12].

3.5. Fruit length and Fruit girth

Fruit length is an important character to be considered to select a brinjal type exhibiting high yield indirectly. The longest fruits were observed in the accession CBE –SM-083 (13.81 cm) followed by CBE-SM-006 (13.80 cm) and the lowest in CBE-SM-085 (9.33 cm). Greater fruit girth was recorded highest in the round type fruits. CBE-SM-084 (18.60 cm) was found to have the highest value of fruit girth among the accessions followed by the accession CBE-SM-106 (13.73 cm) and the range were found to be between 18.6 cm to 10.05 cm.

3.6. Fruit weight and Number of fruits per plant

The individual fruit weight was found to be highest in the genotype CBE-SM-006 (48.71 g) and CBE-SM-109 (36.89 g) recorded the minimum fruit weight (Table 2). Number of fruits per plant is the prime criterion for yield contributing characters and it is found to be influence the yield indirectly. CBE-SM-006 beared the maximum number of fruits (54.19) and the least was found in CBE-SM-086 (21.03). These findings are in agreement with the results obtained by Jayalakshmi and Praneetha. [13]

3.7. Fruit yield per plant

Among the fifteen genotypes investigated in the present study, the highest yield per plant is CBE-SM-006 (2.73 kg) and the least yield per plant is obtained in CBE-SM-086 (0.81 kg). Also, marketable yield was also the maximum in CBE-SM-006 (2.02 kg) which is the maximum among all the accessions. CBE-SM-086 recorded the least marketable yield per plant (0.55 kg).

3.8. Shoot borer infestation and Fruit borer infestation

The shoot borer infestation was found to be least in CBE-SM-006 with 13.67 % and fruit borer infestation also observed to be less around 12.28 %. Similar results were cited [14].

4. Conclusion

In respect to fruit yield per plant, the accessions CBE-SM-006 excelled the best followed by CBE-SM-105. CBE-SM-086 showed the least marketable yield per plant (0.55 kg). Highest marketable yield in CBE-SM-006 may be due to the very less fruit and shoot borer infestation comparing to the other genotypes. The stability of the above best genotypes CBE-SM-006 and

CBE-SM-105 can be assessed and these genotypes can be used for further breeding programme for improvement. Knowledge of morphological genetic variation on vegetative and yield-related traits plays a significant role in varietal improvement and production of brinjal (*Solanum melongena* L.). Therefore these accessions can be used in brinjal breeding programme to develop superior varieties/hybrids with high yield and low shoot and fruit borer infestation.

5. Future Prospects

The main initiatives for crop improvement have been focused on increasing the complex and polygenic traits, i.e., yield. The key emphasis of many researchers is selection and a breakthrough in yield could be possible through exploitation of superior divergent genotypes.

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7. Author's Contribution

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

8. Competing Interests

Authors have declared that no competing interests exist.

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Table 1: Analysis of variance for growth and yield characters

S.NO.	Characters	Replication (df=2)	Genotypes (df=16)	Error(df=32)
1	Plant height (cm)	0.160259	188.136193**	2.377478
2	Number of branches per plant	0.116531	2.652413**	0.026386
3	Days to first flowering	0.709073	199.598453**	2.062070
4	Days to 50 %flowering	2.318125	179.540984**	1.923553
5	Days to first harvest	4.712884	183.108056**	1.550495
6	Fruit length (cm)	7.860290	5.012996**	0.738490
7	Fruit girth (cm)	5.196606	11.670130**	1.345877
8	Fruit weight (g)	0.087083	25.776111**	1.532877
9	Number of fruits per plant	4.810524	360.282206**	1.538769
10	Fruit yield per plant (kg)	0.093625	0.973384**	0.009150
11	Shoot borer infestation (%)	3.788390	2.429122**	0.384696
12	Fruit borer infestation (%)	3.332990	3.146441**	0.624107
13	Marketable yield per plant (kg)	0.002053	0.525842**	0.001138

** Significance at 1 per cent level

Table 2: *Per se* Mean performance of brinjal genotypes for growth and yield parameters

ACC NO	PH	NOB	DFF	D 50%F	DFH	FL	FG	FW	NOF	FYP	SI	FI	MYP
CBE -SM-083	62.93	4.91	46.94	56.59	62.91	13.81	13.71	43.57	50.09	2.28	13.67	12.28	1.77
CBE -SM-084	83.34	5.1	30.5	42.25	50.57	12.22	18.6	40.12	49.98	2.12	14.11	15.04	1.61
CBE -SM-085	70.89	5.4	30.5	42.5	50.95	9.33	13.19	45.34	46.57	2.22	15	14	1.57
CBE -SM-086	74.13	5.19	29.9	40.17	49.83	10.17	12.95	37.71	21.03	0.81	16	15	0.55
CBE -SM-093	95.15	6.5	51.5	60.11	71.71	10.66	13.56	43.21	46.01	2.01	15	14	1.44
CBE -SM-006	85.6	7.7	30.01	40.35	50.19	13.8	12.05	48.71	54.19	2.73	13.67	12.28	2.02
CBE -SM-104	81.94	4.7	45.21	56.23	60.52	10.25	11.42	42.23	49.61	2.23	15.41	14.65	1.55
CBE -SM-105	86.12	7.5	34.12	46.03	59.08	12.14	10.81	46.91	52.88	2.57	13.88	13.98	1.85
CBE -SM-106	79.5	4.95	32.02	43.7	54.8	11.64	13.73	41.53	48.97	2.14	15	14.34	1.51
CBE -SM-107	75.1	5.6	34.1	44.5	52	13.74	12.71	38.82	47.09	1.92	16	15.4	1.34
CBE -SM-108	85.12	6.6	50.17	60.2	72.05	12.56	12.1	39.98	51.42	2.27	14	13.98	1.63
CBE -SM-109	68.6	5.2	30.12	43.82	51.81	11.43	11.15	36.89	22.39	0.92	16	15.8	0.65
CBE -SM-110	71.68	6.72	41.91	53.88	63.85	10.67	10.16	41.66	49.9	2.19	14.11	13.04	1.59
CBE -SM-111	73.7	5.67	30.12	42.62	49.41	11.72	12.45	43.28	47.08	2.13	14	15.9	1.69
CBE-SM-112	84.72	5.02	30.56	43.12	59.97	12.12	10.05	38.53	21.17	0.82	15	14.8	0.68
Co-2	83.5	4.8	45.12	57.2	66.15	9.89	12.75	42.87	47.09	2.13	15	14.56	1.47
PLR-1	80.2	5.6	44.21	56.31	65.32	10.45	11.43	41.21	46.17	2.12	14	13.98	1.52
Maximum	95.15	7.7	51.5	60.2	72.05	13.81	18.6	48.71	54.19	2.73	16	15.9	2.02
Minimum	62.93	4.7	29.9	40.17	49.41	9.33	10.05	36.89	21.03	0.81	13.67	12.28	0.55
Range	32.22	3	21.6	20.03	22.64	4.48	8.55	11.82	33.16	1.92	2.33	3.62	1.47
Mean	78.8906	5.7527	37.4790	49.1984	58.3802	11.6820	12.6282	41.8466	44.1335	1.9727	14.7961	14.3110	1.4400
S.E.	0.8902	0.0938	0.8291	3.2108	0.7189	0.4961	0.6698	0.7148	0.7162	0.0552	0.3581	0.4561	0.0195
CD 5%	2.5644	0.2702	2.3883	2.3066	2.0709	1.4292	1.9294	2.0591	2.0631	0.1591	1.0315	1.3139	0.0561
CD 1%	3.4476	0.3632	3.2108	3.1011	2.7842	1.9215	2.5940	2.7683	2.7736	0.2139	1.3868	1.7664	0.0754

CD - Critical Difference

SE – Standard Error

PH-Plant height (cm)	NOB-Number of branches plant	DFF-Days to first flowering
D 50 %F-Days to 50% flowering	DFH-Days to first harvest	FL-Fruit length (cm)
FG-Fruit girth (cm)	FW-Fruit weight (g)	NOF-Number of fruits plant
SI-Shoot borer infestation (%)	FI-Fruit borer infestation (%)	MYP-Marketable yield plant (kg)