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Evaluation of Tomato (*Solanum lycopersicum* L.) Genotypes for Growth and Yield Attributing Traits

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Authors' contributions

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

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Original Research Article

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Abstract

Tomato (*Solanum lycopersicum* L.) is an economically important vegetable crop, and improving its yield potential through the evaluation of diverse genotypes remains a key objective in breeding programmes. The identification of superior genotypes based on growth and yield attributes is essential for enhancing productivity under varying agro-climatic conditions. The study was conducted to evaluate the tomato

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genotypes for growth and yield attributing traits during *summer* 2024. The present investigation was conducted at PG Students Research Farm, College of Horticulture, Sri Konda Laxman Telangana Horticultural University, Rajendranagar, Hyderabad, India. The experimental material consisted of twenty-four tomato genotypes and followed randomized block design with two replications. Growth and yield attributing parameters were recorded such as plant spread, stem girth, leaf area, days to first flowering, number of flowers per cluster, days to last fruit harvest, number of fruits per cluster and number of fruit clusters per plant. Among the genotypes, maximum leaf area was recorded in the genotype EC 620516 (113.18 cm^2). Minimum days for first flowering were recorded in EC 620385 (25.50). Among the genotypes, maximum number of fruits per cluster were observed in EC 631373 (4.80). Maximum number of fruit clusters per plant were recorded in EC 620516 (8.60). The superior performed tomato genotypes for different growth and yield attributing traits can be used in further crop improvement programme.

Keywords: Evaluation; tomato genotypes; growth; yield; traits.

1. Introduction

Tomato (*Solanum lycopersicum* L.), a member of the Solanaceae family with a chromosome number of 2n = 24 (Peralta *et al.*, 2005), is believed to have originated in the Peru–Ecuador–Bolivia region (Rick, 1969). It is one of the most important solanaceous vegetable crops cultivated globally and plays a pivotal role in both subsistence and commercial agriculture. Owing to its versatility, tomato serves as a fundamental ingredient in a wide range of culinary preparations, contributing significantly to human nutrition through its rich content of vitamins, minerals, and antioxidants.

India is the second-largest producer of vegetables after China, with a total production of 219,674.29 thousand metric tonnes from an area of 11,750.76 thousand hectares. Within this, tomato occupies a prominent position, being cultivated over 821.98 thousand hectares with a production of 20,752.36 thousand metric tonnes. Major tomato-producing states in India include Andhra Pradesh, Karnataka, Madhya Pradesh, Telangana, Gujarat, Tamil Nadu, Odisha, and West Bengal. In Telangana alone, tomato is grown over an area of 12.06 thousand hectares, yielding 352.51 thousand metric tonnes (Ministry of Agriculture and Farmers Welfare, Government of India, 2024).

Despite its widespread cultivation, there remains considerable scope for improving yield potential and quality attributes through systematic evaluation and selection of superior genotypes. Therefore, the present study was undertaken to assess diverse tomato cultivars and breeding lines from varied agro-ecological and genetic backgrounds for key yield-attributing traits. The ultimate objective is to identify or develop high-performing genotypes that combine enhanced productivity with desirable quality characteristics, thereby contributing to sustainable tomato production.

2. Material and Methods

2.1 Experiment Details

The present investigation was conducted at PG Students Research Farm, College of Horticulture, Sri Konda Laxman Telangana Horticultural University, Rajendranagar, Hyderabad during *Summer*, 2024. Randomized block design was followed with two replications.

2.2 Experimental Material

The experimental material comprising twenty-four tomato genotypes (Table 1) among them twenty-two exotic collections from the National Bureau of Plant Genetic Resources, Regional Station, Hyderabad, Arka Vikas from Indian Institute of Horticultural Research, Bengaluru and PKM-1 from Tamil Nadu Agricultural University, Coimbatore were collected for conducting the experiment.

2.3 Seedlings Raising, Transplanting and Cultural Operations

Seeds of all tomato genotypes were sown in 98-celled plastic pro-trays filled with cocopeat, germination was observed at 5–7 days after sowing. Seedlings were maintained under shade net conditions with regular watering as required and proper care was provided until transplanting.

Table 1. Details of tomato genotypes

SI. No.	Genotypes	Source
1	EC 615039	NBPGR, Regional station, Hyderabad-30
2	EC 620366	NBPGR, Regional station, Hyderabad-30
3	EC 620385	NBPGR, Regional station, Hyderabad-30
4	EC 620510	NBPGR, Regional station, Hyderabad-30
5	EC 620516	NBPGR, Regional station, Hyderabad-30
6	EC 620543	NBPGR, Regional station, Hyderabad-30
7	EC 631399	NBPGR, Regional station, Hyderabad-30
8	EC 631957	NBPGR, Regional station, Hyderabad-30
9	EC 638522	NBPGR, Regional station, Hyderabad-30
10	EC 620414	NBPGR, Regional station, Hyderabad-30
11	EC 687423	NBPGR, Regional station, Hyderabad-30
12	EC 631477	NBPGR, Regional station, Hyderabad-30
13	EC 631455	NBPGR, Regional station, Hyderabad-30
14	EC 620388	NBPGR, Regional station, Hyderabad-30
15	EC 615040	NBPGR, Regional station, Hyderabad-30
16	EC 638518	NBPGR, Regional station, Hyderabad-30
17	EC 631436	NBPGR, Regional station, Hyderabad-30
18	EC 690982	NBPGR, Regional station, Hyderabad-30
19	EC 690989	NBPGR, Regional station, Hyderabad-30
20	EC 631373	NBPGR, Regional station, Hyderabad-30
21	EC 617055	NBPGR, Regional station, Hyderabad-30
22	EC 620360	NBPGR, Regional station, Hyderabad-30
23	PKM -1	Tamil Nadu Agricultural University, Coimbatore
24	Arka Vikas	Indian Institute of Horticulture Research, Bengaluru

EC: Exotic collection, NBPGR: National Bureau of Plant Genetic Resources

The main field was ploughed three times and brought to a fine tilth using a tractor-drawn cultivator. After leveling, raised beds were prepared according to the experimental design, drip lines were installed and farmyard manure along with NPK fertilizers (120:60:60 kg ha^{-1}) were applied as recommended by Sri Konda Laxman Telangana Horticultural University's Udyana Panchangam.

Mulching was applied and 30-day-old tomato seedlings were transplanted into the plots with 60 cm row-to-row and 45 cm plant-to-plant spacing. Wooden stakes provided support as needed, irrigation followed immediately post-transplanting for uniform establishment and subsequent watering occurred based on requirements, with hand weeding every 25–30 days.

Prophylactic plant protection involved sprays of insecticides (Imidacloprid 17.8% SL and Thiamethoxam 25% WG) and fungicides (Carbendazim 12% + Mancozeb 63% WP; Metalaxyl 4% + Mancozeb 64% WP).

2.4 Observations Recorded

2.4.1 Growth Traits

Plant spread was measured from tagged plants using a measuring scale in the east-west and north-south directions and the average value was expressed in centimeters (cm). The plant's stem girth was measured using a digital vernier caliper and the millimeter value was converted and expressed in centimeters. The leaf area was recorded using a leaf area meter (LI-3100 Area Meter) as well as expressed in square centimeters.

2.4.2 Yield Attributing Traits

The number of days taken from the date of transplanting to the day when the first flower appeared in each treatment was counted and noted at the flowering stage. The number of flowers in each selected cluster of tagged plants was counted and their mean was calculated. Days taken from the date of transplanting to the date of last fruit picking at the marketable stage were counted and recorded. Before the harvesting, the fruits in each selected cluster of the tagged plants were counted and recorded. The total number of fruit bearing clusters were counted up to the end of the crop cycle and recorded from five tagged plants of each replication.

2.5 Statistical Analysis

2.5.1 Analysis of Variance (ANOVA)

Combined analysis of variance (ANOVA) was carried out for each trait, with environments and genotypes included as factors. Mean sums of squares were determined for genotypes, environments and their interaction.

2.5.2 Mean

The mean value of each character was worked out by dividing the totals by the corresponding number of observations.

Mean (X) = $\frac{\sum Xij}{N}$

Where,

Xij = Any observation in the i^{th} genotype and j^{th} replication
N = Total number of observations.

2.5.3 Standard Error (S.E.)

The standard errors (S.E. (m)±) for genotypes were calculated with the help of the mean square due to error from the analysis of variance table by the following formula:

SE (m) ± = $\frac{\sqrt{MSE}}{\text{r}}$

Where,

MSE = Mean of squares due to error
r = Number of replications

2.5.4 Critical Difference

Critical difference was calculated to find out the superiority of one variety over the other by following the formula.

CD = S.E (d) x t value at 5 % and 1 % error degrees of freedom.

Where,

S.E (d) = $\frac{\sqrt{2\ X\ MSE}}{\text{r}}$
t = Table value of 't' distribution at error degrees of freedom on $P < 0.05$ and 0.01.

2.5.5 Coefficient of Variation (C.V.)

CV % = $\frac{\sqrt{MSE}}{\text{X}}\ X\ 100$

Where,

X = Grand mean

3. Results and Discussion

3.1 Growth Traits

3.1.1 Plant Spread (cm)

The analysis for plant spread in the genotypes ranged (Table 2) from 34.60 (cm) to 54.40 (cm) with overall mean (Fig. 1) of 45.67 (cm). Among the genotypes, minimum plant spread was recorded in EC 690982 (34.60 cm) followed by EC 690989 (36.35 cm), while maximum plant spread was recorded in EC 631399 (54.40 cm). The results for the trait plant spread are in confirmation with the findings of Raut *et al.* (2021).

Table 2. Mean performance of twenty-four tomato genotypes for growth traits

SI. No.	Genotypes	Plant spread (cm)	Stem girth (cm)	Leaf area (cm^2)
1	EC 615039	37.90	0.99	61.57
2	EC 620366	46.90	1.51	51.03
3	EC 620385	40.60	1.64	70.88
4	EC 620510	51.00	1.25	88.64
5	EC 620516	53.80	1.68	113.18
6	EC 620543	49.70	1.53	55.03
7	EC 631399	54.40	2.29	67.37
8	EC 631957	41.80	1.55	50.39
9	EC 638522	50.30	1.54	95.13
10	EC 620414	52.00	2.27	94.35
11	EC 687423	49.70	1.56	83.18
12	EC 631477	41.80	1.63	93.01
13	EC 631455	49.75	2.25	63.82
14	EC 620388	43.00	1.25	65.60
15	EC 615040	49.10	1.31	95.49
16	EC 638518	47.30	1.55	63.20
17	EC 631436	37.70	1.64	53.96
18	EC 690982	34.60	1.15	68.58
19	EC 690989	36.35	1.11	58.48
20	EC 631373	39.10	1.08	61.41
21	EC 617055	48.40	1.57	76.57
22	EC 620360	49.90	1.19	91.44
23	PKM -1	48.40	1.55	73.15
24	Arka Vikas	42.60	1.52	78.72
	Mean	45.67	1.53	73.92
	SE.(m)	1.82	0.10	3.40
	SE.(d)	2.57	0.14	4.80
	CD (5%)	5.32	0.30	9.95
	CV (%)	5.63	9.48	6.51

CD: Critical difference, CV: Coefficient of variance, SE.(m): Standard error mean, SE.(d): Standard error deviation

3.1.2 Stem Girth (cm)

The mean values for stem girth in the genotypes were varied (Table 2) from 0.99 (cm) to 2.29 (cm) with overall mean of 1.53 (cm). The genotype EC 631399 (2.29 cm) recorded maximum stem girth followed by EC 620414 (2.27 cm), whereas minimum stem girth was recorded in EC 615039 (0.99 cm). The results are in line with Swain (2022).

3.1.3 Leaf Area

Among the genotypes, mean values for leaf area were varied (Table 2) from 50.39 (cm^2) to 113.18 (cm^2) with overall mean of 73.92 (cm^2). Maximum leaf area was recorded (Fig. 2) in the genotype EC 620516 (113.18 cm^2)

followed by EC 615040 (95.49 cm^2), while minimum leaf area was found in EC 631957 (50.39 cm^2). The observations are in accordance with the findings of Oladimeji (2025).

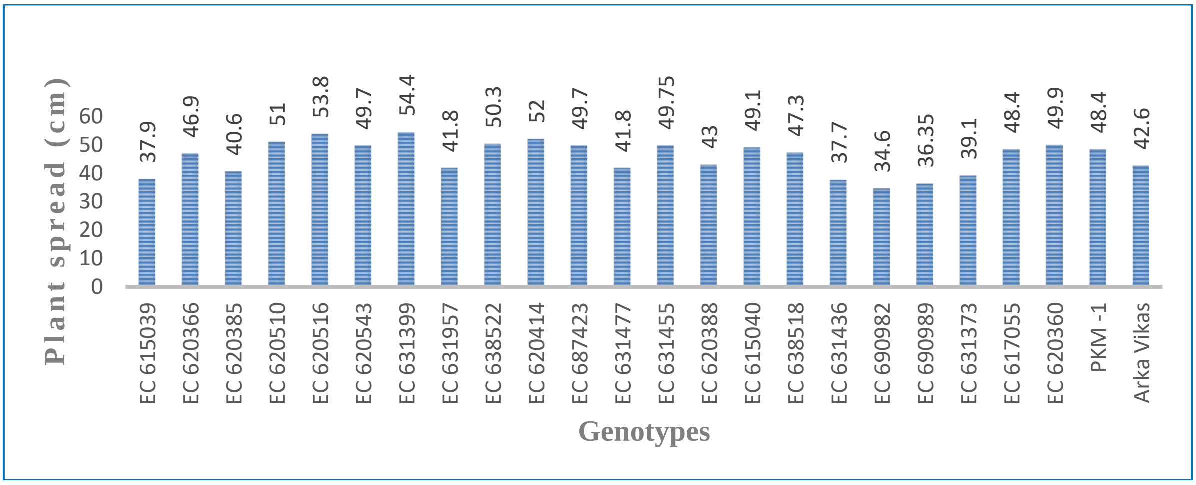

Fig. 1. Mean performance of twenty-four tomato genotypes for plant spread (cm)

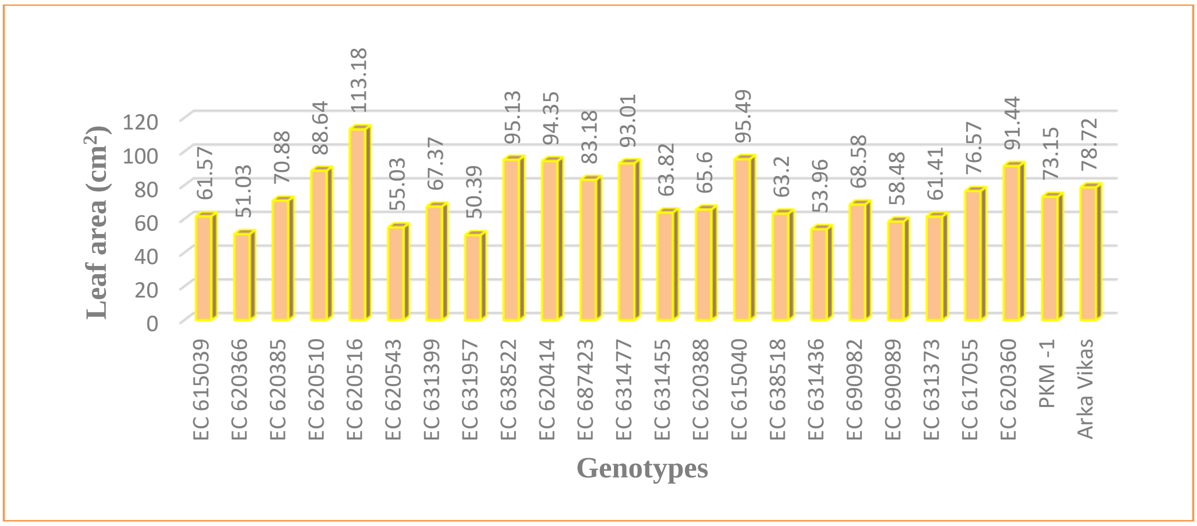

Fig. 2. Mean performance of twenty-four tomato genotypes for leaf area (cm^2)

3.2 Yield Attributing Traits

3.2.1 Days taken to First Flowering

Number of days taken to first flowering among the genotypes were varied from 25.50 to 30.50 days with overall mean of 28.21 days (Table 3). The genotypes EC 631957, EC 638522 and EC 690989 recorded maximum (30.50) number of days for first flowering followed by EC 620510 and EC 620360 (29.50), whereas, minimum days for first flowering were recorded in EC 620385 (25.50). The results are comparable with findings of Maurya *et al.* (2022).

3.2.2 Number of Flowers per Cluster

Among the genotypes number of flowers per cluster were ranged (Fig. 3) from 3.30 cm to 6.90 with overall mean of 5.02 (Table 3). Among the genotypes, EC 631373 (6.90) recorded highest number of flowers per cluster followed by EC690982 (6.50), while lowest (3.30) was observed in genotype, Arka Vikas. The observations are in accordance with the findings of Kumar *et al.* (2016), Maurya *et al.* (2022), Rasheed *et al.* (2023) and Oladimeji (2025).

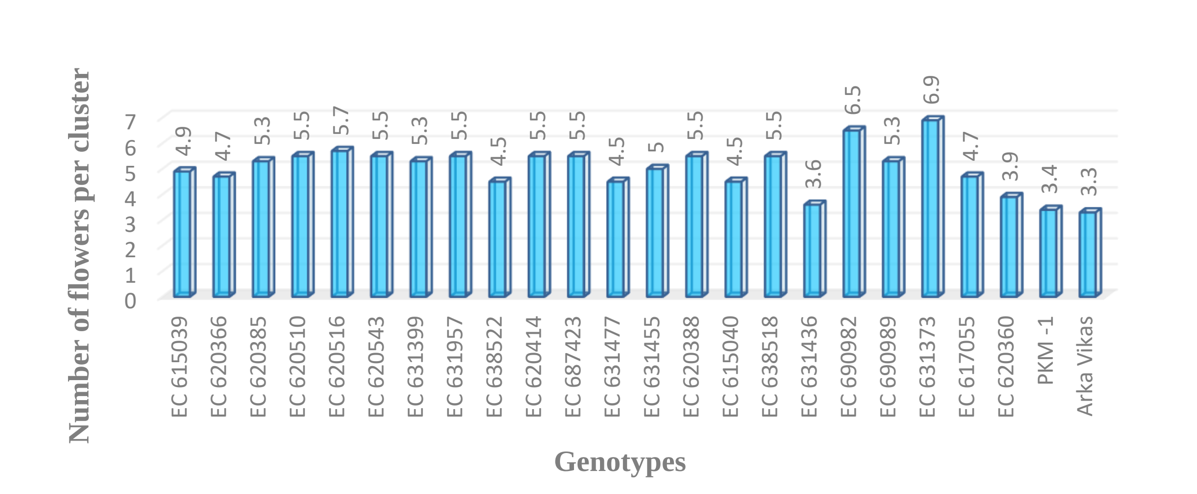

Fig. 3. Mean performance of twenty-four tomato genotypes for number of flowers per cluster

Table 3. Mean performance of twenty-four tomato genotypes for yield attributing traits

SI. No	Genotypes	Days taken to first flowering	Number of flowers per cluster	Days taken for last fruit harvest	Number of fruits per cluster	Number of fruit clusters per plant
1	EC 615039	28.50	4.90	97.50	2.40	5.50
2	EC 620366	27.50	4.70	92.50	2.60	6.40
3	EC 620385	25.50	5.30	84.50	2.60	6.50
4	EC 620510	29.50	5.50	109.50	2.50	7.70
5	EC 620516	28.50	5.70	107.50	4.20	8.60
6	EC 620543	28.50	5.50	103.50	3.10	8.30
7	EC 631399	28.50	5.30	98.00	3.30	7.70
8	EC 631957	30.50	5.50	101.00	3.50	4.70
9	EC 638522	30.50	4.50	103.50	2.80	6.30
10	EC 620414	28.50	5.50	104.00	3.50	8.30
11	EC 687423	28.50	5.50	98.00	2.70	5.20
12	EC 631477	28.50	4.50	100.50	2.90	5.90
13	EC 631455	26.50	5.00	89.50	2.50	5.90
14	EC 620388	27.50	5.50	89.00	3.30	8.50
15	EC 615040	27.50	4.50	90.00	3.00	6.50
16	EC 638518	26.50	5.50	95.00	3.60	4.30
17	EC 631436	29.50	3.60	99.00	2.30	7.70
18	EC 690982	27.50	6.50	96.50	3.50	6.00
19	EC 690989	30.50	5.30	96.00	3.50	5.70
20	EC 631373	28.50	6.90	95.50	4.80	5.90
21	EC 617055	27.50	4.70	96.50	3.40	6.10
22	EC 620360	29.50	3.90	98.50	2.60	5.30
23	PKM -1	26.50	3.40	89.50	2.50	8.30
24	Arka Vikas	26.50	3.30	94.50	2.30	8.50
	Mean	28.21	5.02	97.06	3.06	6.66
	SE.(m)	0.49	0.12	0.81	0.11	0.29
	SE.(d)	0.69	0.16	1.13	0.16	0.41
	CD (5%)	1.45	0.35	2.36	0.33	0.86
	CV (%)	2.48	3.37	1.17	5.27	6.26

CD: Critical difference, CV: Coefficient of variance, SE.(m): Standard error mean, SE.(d): Standard error deviation

3.2.3 Days Taken for Last Fruit Harvest

Number of days taken for last fruit harvest among the genotypes varied from 84.50 to 109.50 with overall mean of 97.06 (Table 3). The genotype EC 620510 (109.50 cm) recorded maximum days for last fruit harvest followed by EC 620516 (107.50 cm), whereas minimum days for last fruit harvest were recorded in EC 620385 (84.50). The results are in line with the findings of Reddy *et al*. (2014), Meitei *et al*. (2014), Kumar *et al.* (2016) and Shankar (2016).

3.2.4 Number of Fruits per Cluster

The analysis for number of fruits per cluster in the genotypes ranged from 2.30 to 4.80 with overall mean of 3.06 (Table 3). Among the genotypes, minimum number of fruits per cluster were recorded in EC 631436 (2.30) followed by EC 615039 (2.40), while maximum number of fruits per cluster were observed in EC 631373 (4.80). The results are in accordance with the findings of Ullah *et al*. (2015), Kumar *et al*. (2016), Rasheed *et al.* (2023) and Oladimeji (2025).

3.2.5 Number of Fruit Clusters per Plant

Among the genotypes number of fruit clusters per plant were ranged (Fig. 4) from 4.30 to 8.60 with overall mean of 6.66 (Table 3). Among the genotypes, EC 620516 (8.60) recorded highest number of fruit clusters per plant followed by EC 620388 and Arka Vikas (8.50), while lowest number of fruit clusters (4.30) were observed in EC 638518. The results are in accordance to the findings of Mehta and Asati (2008), Meena and Bahadur (2015), Jatav *et al.* (2016) and Rasheed *et al.* (2023).

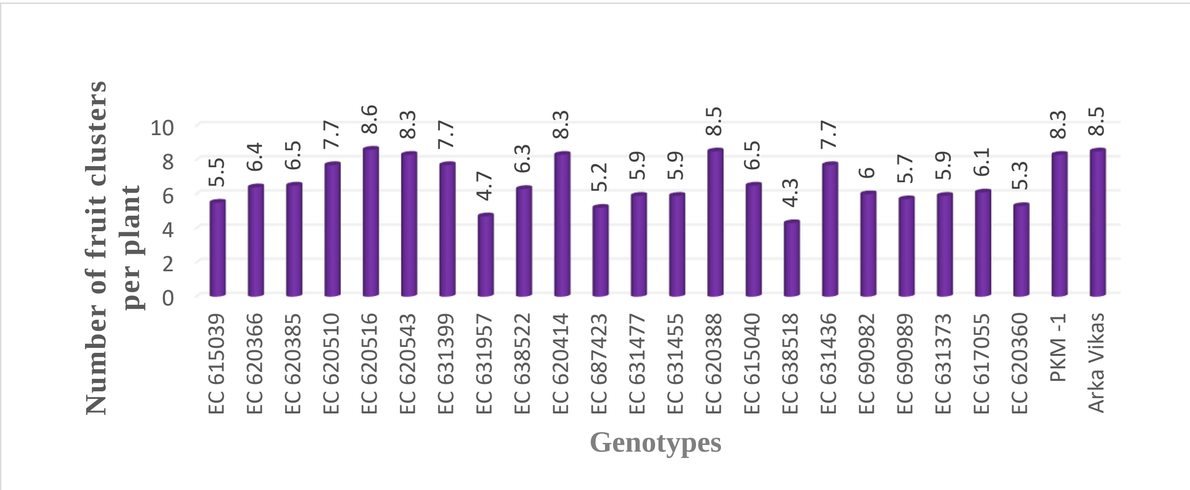

Fig. 4. Mean performance of twenty-four tomato genotypes for number of fruit clusters per plant

4. Conclusion

The study revealed significant variations in growth and yield attributing traits of tomato genotypes, including plant spread, stem girth, leaf area, days to first flowering, number of flowers per cluster, days to last fruit harvest, number of fruits per cluster and number of fruit clusters per plant. Genotypes such as EC 620516, EC 620388, Arka Vikas, EC 631399, EC 620385, EC 631373, EC690982 and EC 620510 stood out for their superior performance in terms of growth and yield attributing traits, respectively. Therefore, these genotypes can be effectively employed in future breeding initiatives to enhance fruit yield attributes.

Disclaimer (Artificial Intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

Competing Interests

Authors have declared that no competing interests exist.

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