

Studies on Variability in Growth, Foliage and Flowering characteristics of Seedling Origin Guava (*Psidium guajava* L.)

Murari Lal Chopra^{1*}, Krishan Kumar¹, Vikas¹, Megha Ahir¹ and Priynka Kumari Ja²

¹Department of Fruit Science,

Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, (Himachal Pradesh), India.

²Department of Horticulture,

Rajasthan Agricultural Research Institute, Durgapura, Jaipur, (Rajasthan), India.

(Corresponding author: Murari Lal Chopra*)

(Received 20 October 2021, Accepted 16 December, 2021)

(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The present study entitled “Studies on variability in growth, foliage and flowering characteristics of seedling origin guava (*Psidium guajava* L.)” was conducted to assess variation among existing guava trees of seedling origin. A total of 60 healthy and bearing guava trees of seedling origin were marked for detailed studies during 2017-18. Marked trees were observed to be erect, spreading and drooping in growth habit, varying in tree height (4.0-10.6 m), trunk girth (38.3-112.1 cm), extension growth of twigs (15.7-22.2 cm) and fruit yield (16.0-34.8 kg/tree). The variation was observed in shape of leaf (round, ovate, obtrullate, obovate and oblong) and colour of mature leaf (green to dark green). Predominant number of flowers in inflorescence showed variation (one, two and three flowers per inflorescence). The observed range of variation for flower size and flowering duration was 34.77-41.78 mm and 30-39 days, respectively. Out of 60 guava seedling trees studied four trees were designated as “elite” based on overall distinct attributes. These large variation characteristics will be utilized for guava breeding program, in order to select elite type, suitable genotype and propagate then vegetatively, on a commercial scale.

Keywords: Variation, Growth, Seedling, Habit.

INTRODUCTION

Guava (*Psidium guajava* L.) is a tropical fruit that is also known in India as "The Apple of the Tropics" and "Poor Man's Apple." It's tough, produces a lot of fruit, and pays well. It has a somatic chromosomal number of $2n=22$ and belongs to the Myrtaceae family. Guava is native to Central America, but it is now cultivated and naturalized across the tropics, and it is now produced in certain subtropical locations because to increased demand (Mishra *et al.*, 2005). India, Brazil, the United States, Egypt, South Africa, Algeria, Columbia, China, Malaysia, Israel, Panama, Costa Rica, Kenya, New Zealand, Indonesia, Pakistan, Cuba, Australia, Spain and the Philippines are among the nations where it is commercially grown. It was first brought to India in the 17th century. In area and production under fruits, it is fourth most important fruit crop after banana, mango and citrus. Uttar Pradesh leads in area under guava cultivation whereas Madhya Pradesh leads in terms of production.

Guava is one of the richest natural sources of Vitamin C, with 3 to 5 times the amount of Vitamin C found in oranges (Singh *et al.*, 2016). Guava also contains a

considerable amount of Vitamin A, niacin, calcium, iron and phosphorus. It is eaten fresh, both green and ripe, and is also used in small cakes, puddings, sauce, ice cream, butter, marmalade, chutney and other items like as pies. Guava fruits, on the other hand, are processed professionally into jellies, jams, cream, cheese, puree, juice, powder and nectar (Patra *et al.*, 2004).

Guava flower morphology favours self-pollination, with reports of 35 percent outcrossing. This results in a heterozygous, open-pollinated seedling population with sufficient genetic heterogeneity for commercial type selection (Yogendra, 2017). All guava trees were produced from seed many years ago, when the vegetative technique of multiplication was not used. As a consequence, variability accumulated, which was then used to select superior performing genotypes. As a consequence of this selection, a huge range of cultivars with varying tastes, flavours, sweetness and other traits have emerged. Most of the existing semi-wild plantation comprises of old seed-raised trees. Out of these, number of seedling guava trees in bearing may be potentially suitable as table types, processing types and some may possess resistance to biotic or abiotic stresses

or tolerant to physiological disorders. But there has not been a concerted effort to document and exploit this variable gene pool. Thus, there is an absolute need to determine and exploit existing genetic variability in guava.

MATERIALS AND METHODS

The experiment was place at Dhaulakuan's Regional Horticultural Research and Training Station (H.P.). During 2017-18, a total of 60 healthy and bearing guava trees of seedling provenance were marked for thorough study. The experimental plant material consisted of a 20-years old bearing seedling tree population of guava trees that were planted 7 metres apart and labelled.

The climate at the Regional Horticultural Research and Training Station, Dhaulakuan, is humid subtropical, with the warmest months being May and June and the coldest months being December and January. Between 35.5°N latitude and 77.5°E longitude, at an elevation of 468 metres above mean sea level, roughly 80% of the annual rainfall is reported during the months of July and September.

Height of tree was measured from ground level to the top of the tree and expressed in meters (m) and girth measured 30 cm above ground level with the help of measuring tape and expressed in centimeters (cm). Ten shoots of current season's growth were randomly selected from the periphery of the trees and the length was measured in the month of September with the help of measuring tape. Tree habit was described as per standard descriptor (Anonymous, 1987) for guava prescribed by UPOV (International Union for the Protection of New Varieties of Plants). Yield of each plant was recorded in kilograms on weight balance from first harvest to the last harvest of fruits and total yield of each plant was calculated by adding yield of all the harvests.

A total of 10 leaves sampled randomly from all directions from each individual tree were used for characterization and evaluation. Shape of mature leaf was assigned as per UPOV descriptors, leaf area was recorded with Li-COR 3100 leaf area meter and Leaf venation of mature leaf was observed visually. It was classified into reticulate or parallel venation. Leaf colour was assigned as per colour chart of Royal Horticultural Society (Wilson, 1941). The total chlorophyll contents of fully matured leaves were analysed the method by (Hiscox and Israelstam, 1979) and Leaf chlorophyll index was recorded directly on the tree using portable device SPAD 502 Plus chlorophyll meter.

A total of five representative branches well spread around the periphery of the trees were selected from each individual tree. The day 10-15 per cent of flowers have opened was considered as the date of initiation of

flowering and when > 75 per cent flowers have opened was considered as the date of end of flowering. The time period from the date of initiation of flowering to the date of the end of flowering was considered as the duration of flowering. Number of flowers in inflorescence were recorded by selecting the number which had more frequency as compared to others. The flower size was recorded by measuring length and width of the flower with the help of digital caliper. The mean values of data were subjected to analysis of variance as per the procedure outlined by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Tree characters: The tree height was found maximum (10.65 m) in Tree No. 31, whereas minimum tree height was observed (4.00 m) in Tree No. 45, with mean value of 7.45 m. Coefficient of variation was recorded as 18.36 per cent in pooled analysis (Table 1). The trunk girth was found maximum (112.15 cm) in Tree No. 37, whereas minimum trunk girth was observed (38.30 cm) in Tree No. 55, with a mean value of 69.50 cm. Coefficient of variation was recorded as 24.09 per cent in pooled data (Table 1).

Guava seedling trees exhibited spreading growth habit in 29 trees, drooping in 27 trees and erect growth habit in only 4 trees (Table 1). The nature and extent of variation in tree growth characters as observed in the present study is in confirmation with previous studies on guava (Phadnis, 1970; Marak and Mukunda 2007; Shukla *et al.*, 2012; Alam *et al.*, 2018; Eman *et al.*, 2019; Azam *et al.*, 2020) conducted in various other parts of the country. Substantial variation so observed in growth parameters can mainly be attributed to genotypic and environmental factors largely owing to heterozygous nature.

The extension growth of twigs was found maximum (22.21 cm) in Tree No. 26, whereas minimum (15.74 cm) in Tree No. 31, with mean extension growth of 19.32 cm. Coefficient of variation was recorded as 9.82 per cent in pooled data (Table 1).

The variation in terms of fruit yield ranged from (16.00 kg/tree) in Tree No. 22 to (34.28 kg/tree) in Tree No. 9 with a mean value of 24.64 kg per tree. Coefficient of variation was recorded as 17.35 per cent in pooled analysis (Table 1). The overall variation in yield per tree was recorded low in the present study on guava seedling trees. Several other workers have reported similar kind of variation in fruit yield per tree (Marak and Mukunda 2007; Ulemale and Tamba 2015; Anupa *et al.*, 2017; Eman *et al.*, 2019; Azam *et al.*, 2020). However, the low levels of fruit yield observed here may be due to inherent seedling nature compared to grafted trees.

Table 1: Variation in tree characters of guava seedling trees (two years pooled data).

Tree No.	Height of tree (m)	Trunk girth (cm)	Tree growth habit	Extension growth of twigs (cm)	Fruit yield (kg/tree)
1	8.40	54.40	Spreading	18.83	22.56
2	7.80	61.95	Spreading	17.38	22.41
3	6.60	91.00	Spreading	21.69	19.55
4	7.28	70.05	Spreading	21.75	22.94
5	6.20	99.40	Spreading	20.04	24.96
6	8.35	67.90	Drooping	17.59	23.41
7	7.55	88.80	Drooping	16.38	27.68
8	8.90	66.65	Erect	20.91	23.52
9	8.55	51.25	Drooping	17.35	34.28
10	9.45	76.00	Drooping	20.59	31.48
11	7.95	48.55	Drooping	17.66	25.31
12	8.75	45.55	Drooping	18.35	31.30
13	9.25	68.55	Spreading	15.96	34.12
14	7.65	72.45	Drooping	17.00	23.39
15	8.75	94.00	Spreading	20.14	21.94
16	8.15	98.30	Spreading	20.09	22.56
17	8.25	86.05	Spreading	18.66	31.35
18	8.00	83.90	Spreading	16.88	27.35
19	9.55	79.90	Drooping	17.65	21.88
20	9.80	47.50	Drooping	21.81	24.44
21	6.55	74.00	Erect	17.71	16.42
22	5.95	64.25	Spreading	17.69	16.00
23	6.23	65.95	Spreading	16.05	22.45
24	5.50	68.40	Spreading	19.00	22.95
25	5.95	102.60	Drooping	21.36	23.91
26	5.20	64.80	Drooping	22.21	21.95
27	5.40	69.00	Drooping	18.24	24.18
28	8.05	65.20	Drooping	20.68	22.97
29	8.45	83.00	Drooping	21.75	24.10
30	8.20	81.00	Spreading	17.21	21.91
31	10.65	81.10	Drooping	15.74	25.31
32	5.90	50.95	Spreading	21.35	22.04
33	8.00	87.75	Spreading	18.04	27.46
34	7.80	74.95	Drooping	17.29	31.40
35	7.40	74.75	Spreading	22.05	23.52
36	8.45	53.70	Drooping	21.14	24.39
37	8.80	112.15	Drooping	20.44	22.39
38	5.65	59.90	Drooping	20.99	22.98
39	6.90	79.20	Spreading	17.04	30.37
40	7.25	86.80	Drooping	21.18	29.36
41	8.50	78.00	Drooping	21.38	28.58
42	9.30	84.65	Drooping	18.60	24.35
43	7.55	75.25	Drooping	18.89	28.01
44	8.30	84.50	Spreading	21.79	21.43
45	4.00	38.15	Drooping	20.81	16.86
46	6.35	55.75	Drooping	19.11	27.06
47	7.40	63.65	Spreading	18.09	33.78
48	7.10	73.75	Spreading	20.73	25.03
49	7.50	66.20	Spreading	20.24	28.30
50	7.35	54.75	Spreading	19.40	25.42
51	6.20	48.45	Spreading	18.82	21.68
52	5.95	40.75	Spreading	22.19	17.88
53	6.60	56.30	Drooping	21.75	26.11
54	4.31	46.75	Erect	20.09	16.50
55	7.30	38.30	Drooping	17.30	27.89
56	6.20	43.25	Spreading	18.32	25.40
57	5.55	55.85	Drooping	18.52	21.50
58	7.00	64.00	Erect	16.55	17.88
59	7.75	79.65	Drooping	21.90	28.23
60	9.10	70.50	Spreading	20.81	23.89
Mean±SE	7.45±0.18	69.50±2.16	–	19.32±0.24	24.64±0.55
SD	1.37	16.74	–	1.90	4.27
CV (%)	18.36	24.09	–	9.82	17.35

Foliage characters: Leaf shape in guava seedling trees was found to be obtrullate in 51 trees, obovate in 4 trees, round in 3 trees and oblong and ovate in one tree each (Table 2). The leaf area was recorded maximum

(55.21 cm²) in Tree No. 8 and minimum (33.48 cm²) in Tree No. 56 with mean leaf area of 45.38 cm². Coefficient of variation was recorded 12.38 per cent in pooled data (Table 2).

Table 2: Variation in foliage characters of guava seedling trees (two years pooled data).

Tree No.	Leaf shape	Leaf area (cm ²)	Leaf venation	Colour of mature leaf	Colour of young leaf	Leaf chlorophyll index (SPAD meter)	Total chlorophyll content (mg/g)
1	Obtrullate	37.28	Pinnate	Dark green 139 C	Light green	41.40	1.195
2	Obtrullate	51.22	Pinnate	Dark green 139 A	Light green	45.20	1.461
3	Obtrullate	51.08	Pinnate	Dark green 139 C	Light green	46.25	1.388
4	Obtrullate	49.60	Pinnate	Green 137 A	Light green	47.10	1.312
5	Obtrullate	39.95	Pinnate	Dark green 139 C	Light green	46.25	1.317
6	Obtrullate	40.19	Pinnate	Dark green 139 C	Light green	51.35	1.448
7	Obtrullate	44.95	Pinnate	Dark green 139 C	Light green	44.15	1.341
8	Obovate	55.21	Pinnate	Green 137 A	Light green	40.45	1.283
9	Obtrullate	52.11	Pinnate	Green 137C	Light green	42.50	1.457
10	Obtrullate	50.47	Pinnate	Green 137C	Light green	42.95	1.428
11	Round	49.26	Pinnate	Green 137 C	Light green	37.45	1.101
12	Obtrullate	53.54	Pinnate	Green 137 A	Light green	44.00	1.200
13	Obovate	41.17	Pinnate	Green 137 C	Light green	41.10	1.701
14	Obtrullate	44.89	Pinnate	Green 137 C	Light green	40.15	1.362
15	Obtrullate	47.35	Pinnate	Dark green 139 C	Light green	50.30	1.729
16	Obtrullate	47.88	Pinnate	Dark green 139 C	Light green	45.55	1.258
17	Obtrullate	41.94	Pinnate	Green 138 C	Light green	51.85	2.220
18	Obtrullate	44.59	Pinnate	Green 137 A	Light green	33.85	1.316
19	Obtrullate	39.38	Pinnate	Green 137 A	Light green	34.30	1.110
20	Obtrullate	43.23	Pinnate	Green 137 A	Light green	47.00	1.911
21	Obovate	51.84	Pinnate	Green 138 B	Light green	48.35	2.183
22	Round	46.33	Pinnate	Green 137 C	Light green	44.60	1.504
23	Obtrullate	40.81	Pinnate	Green 137 C	Light green	47.45	1.346
24	Obtrullate	42.14	Pinnate	Dark green 139 C	Light green	44.65	1.472
25	Obtrullate	53.28	Pinnate	Green 138 A	Light green	42.10	1.326
26	Obovate	49.53	Pinnate	Green 138 A	Light green	48.15	1.410
27	Round	36.55	Pinnate	Green 137 D	Light green	49.90	1.453
28	Ovate	38.88	Pinnate	Green 137 A	Light green	48.80	1.148
29	Obtrullate	46.87	Pinnate	Green 137 A	Light green	47.10	1.315
30	Obtrullate	41.56	Pinnate	Green 137 A	Light green	49.00	1.354
31	Obtrullate	41.30	Pinnate	Green 137 C	Light green	44.35	1.130
32	Obtrullate	51.26	Pinnate	Green 138 A	Light green	41.90	1.637
33	Obtrullate	42.93	Pinnate	Green 138 A	Light green	46.15	1.544
34	Obtrullate	46.85	Pinnate	Green 137 C	Light green	34.30	1.270
35	Obtrullate	43.22	Pinnate	Green 137 A	Light green	49.35	1.362
36	Obtrullate	39.23	Pinnate	Dark green 139 B	Light green	46.20	1.486
37	Obtrullate	35.24	Pinnate	Dark green 139 B	Light green	45.90	1.258
38	Obtrullate	41.91	Pinnate	Dark green 139 C	Light green	44.80	1.740
39	Obtrullate	42.49	Pinnate	Green 137 C	Light green	50.50	1.346
40	Obtrullate	46.98	Pinnate	Green 138 C	Light green	39.50	1.568
41	Obtrullate	46.01	Pinnate	Green 138 A	Light green	50.70	1.582
42	Obtrullate	35.96	Pinnate	Dark green 139 C	Light green	40.50	1.434
43	Obtrullate	41.49	Pinnate	Green 137 A	Light green	41.15	1.127
44	Obtrullate	43.68	Pinnate	Green 138 A	Light green	51.75	1.422
45	Oblong	51.79	Pinnate	Green 138 A	Light green	40.45	1.406
46	Obtrullate	46.79	Pinnate	Green 137 C	Light green	36.05	1.298
47	Obtrullate	49.13	Pinnate	Green 137 C	Light green	48.80	1.117
48	Obtrullate	54.05	Pinnate	Green 138 A	Light green	46.75	1.315
49	Obtrullate	50.80	Pinnate	Dark green 139 D	Light green	34.40	1.339
50	Obtrullate	47.98	Pinnate	Green 137 C	Light green	44.10	1.191
51	Obtrullate	53.76	Pinnate	Green 137 A	Light green	42.15	1.679
52	Obtrullate	42.55	Pinnate	Green 137 A	Light green	44.20	1.621
53	Obtrullate	38.39	Pinnate	Green 137 A	Light green	39.30	1.346
54	Obtrullate	49.73	Pinnate	Green 137 D	Light green	44.25	1.517
55	Obtrullate	54.24	Pinnate	Green 137 A	Light green	54.75	1.594
56	Obtrullate	33.48	Pinnate	Green 138 C	Light green	42.75	1.357
57	Obtrullate	34.96	Pinnate	Dark green 139 D	Light green	42.70	1.315
58	Obtrullate	43.00	Pinnate	Dark green 139 D	Light green	44.40	1.550
59	Obtrullate	49.42	Pinnate	Green 137 C	Light green	43.30	1.443
60	Obtrullate	51.23	Pinnate	Green 137 A	Light green	45.10	1.092
Mean±SE	-	45.38±0.72	-	-	-	44.40±0.60	1.42±0.03
SD	-	5.57	-	-	-	4.62	0.23
CV (%)	-	12.28	-	-	-	10.42	16.11

The leaf venation was observed pinnate in all the trees. There was absolutely no variation in leaf venation (Table 2). Colour of mature leaves was observed as green in 44 guava trees whereas, it was dark green in rest of the 16 guava trees (Table 2). The results of present investigation find adequate support from the findings of various researchers (El-Sisy, 2013; Nasution and Haditai 2014; Ulemale and Tambe 2015; Abo-El-Ez *et al.*, 2017; Shiva *et al.*, 2017; Azam *et al.*, 2020) who also reported variation in foliage characters among different genotypes of guava.

There was no variation observed for colour of young leaf in the guava trees under investigation which exhibited only light green colour (Table 2) The leaf chlorophyll index was recorded maximum (54.75) in Tree No. 55 and minimum (33.85) in Tree No. 18 with a mean value of 44.40. Coefficient of variation was recorded 10.42 per cent in pooled data (Table 2). The

total chlorophyll content was recorded maximum (2.220 mg/g) in Tree No. 17 and minimum (1.101 mg/g) in Tree No. 11 with a mean chlorophyll content of 1.420 mg/g. Coefficient of variation was recorded 16.11 per cent in pooled analysis. Similar kind of variation for leaf chlorophyll content was also observed by (Ulemale and Tambe 2015; Singh *et al.*, 2016; Eman *et al.*, 2019) and it can be attributed to varied photosynthetic efficiency of seedling trees having heterozygous nature.

Flower characters: The time and duration of flowering in guava seedling trees during rainy season is presented in Table 3. The flower initiation was found to be earliest in 1st week of April in Tree No. 15, 16 and 19, whereas last in 4th week of April in Tree No. 49 during year 2017. In 2018, the earliest flower initiation was observed in 4th week of April in Tree No. 4, whereas last in 4th week of May in Tree No. 49 (Table 3).

Table 3: Variation in flowering characters of guava seedling trees (two years pooled data).

Tree No.	Initiation of Flowering		End of flowering (full bloom)		Flowering duration (days)		Flower size (mm)	Predominant No. of flowers in inflorescence
	2017	2018	2017	2018	2017	2018		
1	20/4/2017	28/4/2018	21/5/2017	30/5/2018	32	33	37.93	1
2	20/4/2017	2/5/2018	28/5/2017	30/5/2018	39	29	39.16	1
3	11/4/2017	11/5/2018	19/5/2017	10/6/2018	39	30	40.26	1
4	14/4/2017	25/4/2018	20/5/2017	23/5/2018	35	29	38.00	1
5	13/4/2017	5/5/2018	24/5/2017	2/6/2018	42	28	40.67	1
6	21/4/2017	2/5/2018	24/5/2017	30/5/2018	34	33	40.45	1
7	20/4/2017	1/5/2018	29/5/2017	30/5/2018	40	29	37.66	1
8	19/4/2017	3/5/2018	26/5/2017	26/5/2018	38	30	39.81	1
9	17/4/2017	12/5/2018	21/5/2017	12/6/2018	34	31	37.54	1
10	15/4/2017	15/5/2018	20/5/2017	8/6/2018	36	32	37.37	1
11	18/4/2017	26/4/2018	27/5/2017	30/5/2018	40	35	40.63	1
12	12/4/2017	5/5/2018	19/5/2017	3/6/2018	38	32	41.48	1
13	21/4/2017	8/5/2018	30/5/2017	6/6/2018	40	29	38.45	1
14	21/4/2017	30/4/2018	29/5/2017	2/6/2018	39	34	40.51	1
15	10/4/2017	8/5/2018	17/5/2017	11/6/2018	38	34	41.20	1
16	10/4/2017	11/5/2018	15/5/2017	8/6/2018	36	29	40.09	1
17	11/4/2017	6/5/2018	15/5/2017	5/6/2018	35	31	40.65	2
18	17/4/2017	11/5/2018	24/5/2017	9/6/2018	38	30	40.10	1
19	10/4/2017	1/5/2018	16/5/2017	5/6/2018	37	35	41.36	2,3
20	17/4/2017	8/5/2018	19/5/2017	7/6/2018	33	30	39.01	1
21	11/4/2017	4/5/2018	20/5/2017	2/6/2018	40	29	36.79	1
22	11/4/2017	11/5/2018	19/5/2017	10/6/2018	39	30	40.59	1
23	19/4/2017	30/4/2018	24/5/2017	7/6/2018	36	38	41.77	1
24	23/4/2017	2/5/2018	27/5/2017	30/5/2018	35	29	40.09	3
25	19/4/2017	29/4/2018	30/5/2017	1/6/2018	42	34	36.13	1
26	21/4/2017	6/5/2018	25/5/2017	12/6/2018	35	37	39.47	1
27	16/4/2017	1/5/2018	25/5/2017	6/6/2018	40	35	38.67	1
28	16/4/2017	4/5/2018	21/5/2017	2/6/2018	35	29	38.29	1
29	15/4/2017	12/5/2018	21/5/2017	10/6/2018	36	29	40.63	1
30	20/4/2017	8/5/2018	27/5/2017	7/6/2018	38	30	40.22	1
31	18/4/2017	12/5/2018	24/5/2017	10/6/2018	37	31	36.69	1
32	14/4/2017	8/5/2018	20/5/2017	12/6/2018	37	35	34.82	1
33	18/4/2017	18/5/2018	22/5/2017	16/6/2018	35	30	39.37	1
34	20/4/2017	12/5/2018	28/5/2017	15/6/2018	39	35	34.77	1
35	16/4/2017	15/5/2018	23/5/2017	12/6/2018	38	29	42.10	1
36	15/4/2017	12/5/2018	24/5/2017	20/6/2018	40	39	37.69	1
37	21/4/2017	8/5/2018	29/5/2017	14/6/2018	39	36	40.05	1
38	19/4/2017	18/5/2018	25/5/2017	22/6/2018	37	34	40.83	1
39	16/4/2017	16/5/2018	21/5/2017	19/6/2018	36	34	38.29	1
40	19/4/2017	4/5/2018	23/5/2017	6/6/2018	35	31	39.71	1
41	22/4/2017	7/5/2018	30/5/2017	10/6/2018	39	34	41.78	1
42	18/4/2017	5/5/2018	27/5/2017	13/6/2018	40	38	39.61	1

43	19/4/2017	14/5/2018	26/5/2017	12/6/2018	38	30	36.97	1
44	15/4/2017	5/5/2018	24/5/2017	2/6/2018	40	28	38.38	1
45	14/4/2017	17/5/2018	23/5/2017	20/6/2018	39	34	40.14	1
46	20/4/2017	22/5/2018	25/5/2017	26/6/2018	36	36	39.77	1
47	24/4/2017	15/5/2018	28/5/2017	16/6/2018	35	32	41.36	1
48	21/4/2017	10/5/2018	23/5/2017	12/6/2018	33	34	40.27	1
49	26/4/2017	23/5/2018	30/5/2017	25/6/2018	35	34	36.76	1
50	21/4/2017	18/5/2018	27/5/2017	23/6/2018	37	37	40.90	1
51	19/4/2017	15/5/2018	25/5/2017	12/6/2018	37	29	40.34	1
52	23/4/2017	22/5/2018	26/5/2017	20/6/2018	34	30	41.77	1
53	19/4/2017	6/5/2018	21/5/2017	7/6/2018	33	32	39.69	1
54	16/4/2017	16/5/2018	20/5/2017	22/6/2018	35	28	39.12	1
55	18/4/2017	22/5/2018	26/5/2017	22/6/2018	39	30	42.17	1
56	22/4/2017	15/5/2018	24/5/2017	10/6/2018	33	27	39.34	1
57	17/4/2017	2/5/2018	25/5/2017	4/6/2018	39	32	40.03	1
58	15/4/2017	17/5/2018	23/5/2017	20/6/2018	39	34	40.27	1
59	21/4/2017	12/5/2018	27/5/2017	9/6/2018	37	29	39.72	1
60	18/4/2017	18/5/2018	23/5/2017	23/6/2018	36	37	39.79	1
Mean±SE	-	-	-	-	37.1±0.31	32.03±0.39	39.46 ±0.22	-
SD	-	-	-	-	2.36	3.00	1.69	-
CV (%)	-	-	-	-	6.37	9.36	4.29	-

The end of flowering was observed earliest in 3rd week of May in Tree No. (16 and 17), whereas last in 4th week of May in Tree No. 25 during the year 2017. In 2018, the end of flowering earliest in 4th week of May in Tree No. 4, whereas last in 4th week of June in Tree No. 46. Flowering duration for rainy season crop ranged from 32 to 42 days in year 2017 and 28 to 39 days in year 2018 respectively. The longer flowering duration was observed (42 days) in Tree No. 5, whereas shorter duration was recorded (32 days) in Tree No. 1 during the year 2017. In 2018, longer flowering duration was recorded (39 days) in Tree No. 36, whereas shorter flowering duration was observed (28 days) in Tree No. 5, 44 and 54 (Table 3). Flower size was observed maximum (41.78 mm) in Tree No. 41 and minimum (34.77 mm) in Tree No. 34 with a mean value of 39.86 mm. Coefficient of variation was recorded 4.29 per cent in pooled analysis.

The variation in predominant number of flowers in inflorescence ranged from 1 to 3. The three flowers per inflorescence were observed only in Tree No. 24 but two flowers per inflorescence were observed in Tree No. 17 and 19. One flower per inflorescence was observed in rest of the trees during both the years (Table 3). Similar findings were also reported on guava genotypes by Kahlon *et al.*, (1987); Sandhu *et al.*, (1987); Singla and Dhaliwal (2003); Eman *et al.*, (2019). The variation in season of flowering, being a quantitative character, is highly influenced by the prevailing environment, however, number of flowers per inflorescence may be partially due to genetic make-up of individual trees.

CONCLUSION

In conclusion, it is obvious that guava seedling trees exhibit a great degree of morphological variation, as evidenced by observations made on the majority of horticulturally important characters. Their potential as selection criteria for future crop enhancement research is suggested by their high to moderate coefficients of variation.

FUTURE SCOPE

The large number of genotypes may be collected and utilized in crop improvement programme. This programme aimed to study the hybridization process between selected genotypes which would result in heterotic hybrid. Also it aimed to study red pulp genotypes for processing into various products like jelly and jam.

Acknowledgement. Authors wish to express their sincere thanks to for his valuable guidance and providing the required facilities to carry out this investigation.

Conflict of Interest. None.

REFERENCES

- Abo-El-Ez, A. T., Gowda, A. M., Gad-Elkareem, M. R. and Ahmed, M. M. (2017). Evaluation of some selected guava genotypes. *Journal of Sohag Agriscience*, 2: 14-27.
- Alam, F., Islam, K. D. and Rahman, S. M. M. (2018). Variability among selective guava (*Psidium guajava* L.) varieties revealed by morphology and RAPD marker. *Journal of Biological Science*, 7(2): 89-98.
- Anupa, T., Angadi, P. K. and Jaganath, S. (2017). Quantitative and morphological characters in different genotypes of Apple Color guava (*Psidium guajava* L.). *Environment and Ecology*, 35: 318-323.
- Azam, M. G., Uddin, M. S., Chowdhury, S. M. K. H., Rashid, A. S. M. H., Barua, H., Chhanda, R. F., Rahman, S., Bagum, S. A., Shamsunnahar, M. and Islam, M. N. (2020). Variability studies of guava (*Psidium guajava* L.) genotypes for growth, yield and quality attributes in Chattogram region of Bangladesh. *Journal of Agricultural Science and Engineering Innovation*, 1(2): 413-424.
- El-Sisy W. A. A. Z. (2013). Evaluation of some genotypes of guava trees grown under alexandria governorate condition 1st Vegetative growth, flowering and fruit quality. *World Applied Sciences Journal*, 28: 583-595.
- Eman, H. A., Nahla, A. A., Abd El-Aziz, Y. S. G., El-Bassel, E. H., Ismail, A. S. M. and Abdal-Galeel, M. M. (2019). Selection and Evaluation of Some Guava Strains under Behera Governorate Condition. *Middle East Journal of Agriculture Research*, 8(2): 469-481.

- Gomez, K. A. and Gomez, A. A. (1984). *Statistical Procedures for Agricultural Research*, John Wiley and Sons, New York 690p.
- Hiscox, J. D. and Israelstam, G. F. (1979). A method for extraction of chlorophyll from leaf tissue without maceration. *Canadian Journal of Forest Sciences*, 45: 1711-1719.
- Kahlon, G. S., Uppal, D. K., Bains, K. S. and Bajwa, G. S. (1997). Variability pattern for fruit yield and quality in seedling population of guava. *Indian Journal of Horticulture*, 54: 234-237.
- Marak, J. K. and Mukunda, G. K. (2007). Studies on the performance of open pollinated seedling progenies of guava cv. 'Apple Colour'. *Acta Horticulturae*, 735: 79-84.
- Mishra, M., Chandra, R., Pati, R., and Bajpai, A. (2005). Micro-propagation of guava (*Psidium guajava* L.). *In International Guava Symposium 735*: 155-158.
- Nasution, F. and Hadiati, S. (2014). Characterization and clustering of some guava germplasm collections based on leaf and fruit characters. *AGRIVITA*, 36: 91-100.
- Patra, R. K., Debnath, S., Das, B. C. and Hasan, M. A. (2004). Effect of mulching on growth and fruit yield of guava cv. Sardar. *Orissa Journal of Horticulture*, 32: 38-42.
- Phadnis, N. A. (1970). Improvement of guava (*Psidium guajava* L.) by selection in Maharashtra. *Indian Journal of Horticulture*, 27: 99-105.
- Sandhu, A. S., Bains, S. S. and Singh, S. N. (1987). Studies on the floral biology of guava (*Psidium guajava* L.) under Ludhiana conditions. 1st Flower bud development, time and duration of flowering and floral morphology. *Punjab Horticultural Journal*, 27: 203-207.
- Shiva, B., Nagaraja, A., Srivastav, M., Kumari, S., Goswami, A. K., Singh, R. and Arun, M. B. (2017). Characterization of guava (*Psidium guajava* L.) germplasm based on leaf and fruit parameters. *Indian Journal of Agricultural Sciences*, 87: 634-638.
- Shukla, A. K., Sarolia, D. K., Mahawer, L. N., Bairwa, H. L., Kaushik, R. A. and Sharma, R. (2012). Genetic variability of guava (*Psidium guajava* L.) and its prospects for crop improvement. *Indian Journal of Plant Genetic Resources*, 25: 157-160.
- Singh, A., Kumar, S. and Kulloli, R. N. (2016). Performance evaluation of guava introductions in arid conditions of Western Rajasthan. *Annals of Arid Horticulture*, 55(1-2): 25-28.
- Singla, R. and Dhaliwal, G. S. (2003). Floral morphology and flowering behaviour of different genotypes of guava. *Journal of Research*, 40: 371-374.
- Ulemale, P. H. and Tambe, T. B. (2015). Variability in growth parameters of red fleshed and white fleshed guava genotypes. *The Bioscan*, 10: 885-887.
- UPOV. (1987). Guava (*Psidium guajava* L.) International Union for Protection of New Varieties of Plants, Geneva, TG/1/3/1. pp. 48.
- Wilson, R. W. (1941). Horticultural Colour Charts I and II. Wilson Colour Ltd. In collaboration with Royal Horticultural Society, England.
- Yogendra Singh, (2017). Collection and evaluation of guava (*Psidium guajava* L.) genotypes in Chhattisgarh plants. Master of Science. Faculty of Agriculture in Indian.

How to cite this article: Murari Lal Chopra, Krishan Kumar, Vikas, Megha Ahir and Priynka Kumari Jat (2022). Studies on Variability in Growth, Foliage and Flowering characteristics of Seedling Origin Guava (*Psidium guajava* L.). *Biological Forum – An International Journal*, 14(1): 379-385.