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Variability assessment in fruits of seedling origin guava (*Psidium guajava*)

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ABSTRACT

The experiment was conducted to assess variation among existing guava (*Psidium guajava* L.) trees of seedling origin. A total of 60 healthy and bearing trees were marked for studies during 2017-18 at RHR&TS, Dhaulakuan, Himachal Pradesh. There was variation in fruit shape (round to pyriform), colour of fruit skin (yellow, yellow white and yellow green) and fruit shape at stalk end (rounded to broadly rounded). The variation in fruit weight, fruit length, fruit width, length/width ratio, number of seeds/fruit, fruit yield, yield efficiency, TSS, acidity, ascorbic acid, total sugars, reducing sugars, non-reducing sugars were 65.22-128.57g, 4.40-6.18, 4.90-6.51, 0.87-1.31cm, 12-411, 16.0-34.8kg/tree, 2.27-24.6g/cm^2, 7.35-11.83^{o}Brix, 0.270-0.627%, 138.19-249.43mg/100g, 5.13-8.38%, 3.22-5.44% and 1.81-2.83%, respectively. Out of 60 trees, four were designated as "elite" based on overall distinct attributes. The identification of one seedless (tree No. 22), one approximate seedless (tree No. 21), two red fleshed genotypes (tree No. 57 and tree No. 58) having desirable traits was a significant finding.

Key words: Fruit, Genotype, Seedling origins, TSS, Variability

Guava (*Psidium guajava* L.) is a tropical fruit crop. This resulted in the accumulation of variability followed by its exploitation to select better genotypes, a large number of varieties with different taste, flavour, sweetness and other qualities were developed through selection (Khalil *et al*., 2015). Most of the existing semi-wild plantation comprises old seed-raised trees. Out of these a number of seedling trees in bearing may be potentially suitable for table purpose. 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 (Patel *et al*., 2011).

MATERIALS AND METHODS

The experiment was conducted at Regional Horticultural Research and Training Station, Dhaulakuan, Himachal Pradesh, during 2017-18. A total of 60 healthy and bearing trees of seedling origin were marked. The 20-year-old bearing seedling tree planted 7m × 7m apart, were marked. The total annual rainfall of about 80% was recorded during July and September.

A total of 20 fruits were selected randomly from all directions from each individual tree for evaluation as per standard descriptor for guava prescribed by UPOV (UPOV, 1987). The fruit maturity, fruit weight, fruit length, fruit width, length/width ratio, fruit shape, fruit shape at stalk end, number of seeds/fruit and seed hardness were evaluated. Colour of fruit skin and flesh was assigned as per colour chart of Royal Horticultural Society (Wilson, 1941). Yield of each plant was recorded on weight balance from first harvesting to last harvesting. The yield efficiency of each selected tree was calculated as per Westwood (1993) and expressed in g/cm^2 TCSA using the formula:

$$\text{Yield efficiency (g/cm}^2\text{)} = \frac{\text{Yield (g/plant)}}{\text{TCSA (cm}^2\text{)}}$$

Total soluble solid (TSS) was determined with the help of digital refractometer. Biochemical analysis of fruit quality was done as per standard procedure described of AOAC (1980). The mean values of data were subjected to analysis of variance as per the procedure of by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The variation was observed in days from full bloom to maturity from 78 to 91 days during 2017 and 76 to 108 days during 2018. The maximum (91 days) fruit maturity was recorded in tree No. 16 and minimum (78 days) in tree No. (24 and 25) during 2017. In 2018, maximum (108 days) fruit maturity was observed in tree No. 4 and minimum (76 days) in tree No. 49. Mostly seedling guava trees produced green to yellowish type of fruits. There was significant variation in fruit skin colour. The fruits belonged to following classes: yellow green 151C (9), yellow green 151 A (3),

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yellow green 153 C (10), yellow green 153A (5), yellow green 145A (5), yellow white 148C (5), yellow 143 C (2), yellow 143A (4), yellow 142 C (11) and yellow 144 C (6).

Significant variation in flesh colour was also observed with red fleshed in 2 trees and white pulp in rest of the trees. Fruit shape round in all seedling trees except pyriform in tree No. 25. Fruit shape at stalk end was rounded in 41 trees and broadly rounded in 19 guava seedling trees. The variation in morphological characters of fruits is largely in accordance with those of Dubey *et al*., 2016; Nasution and Hadiati, 2014; and Ulemale and Tambe, 2015.

A significant variation in fruit weight was recorded. Mean fruit weight among 60 guava trees was 94.06g. The maximum fruit weight was observed in tree No. 47 (128.57g) and minimum fruit weight (65.22g) in tree No. 8. Coefficient of variation was recorded as 13.65 % in pooled analysis. Fruit length depicts fruit shape as fruits with higher values possess pyriform shape, while lower values indicate round fruit shape. The maximum fruit length was found in tree No. 25 (6.18cm) and minimum in tree No. 24 (4.40cm) with an average length of (5.25cm).

Coefficient of variation was recorded as 7.04 % in pooled analysis. A significant variation was observed in fruit width ranging from (4.90cm) in tree No. 56 to (6.47cm) in tree No. 47 with a mean value of 5.47cm. Coefficient of variation was recorded as 6.55 % in pooled data. The variation in length/width ratio was maximum (1.31) in tree No. 25 and minimum (0.87) in tree No. 18 with mean length/width ratio of 0.94. Coefficient of variation was recorded as 3.96 % in pooled data. Considerable variation in physical attributes of guava has been reported (Khalil *et al*., 2015; Singh *et* al., 2015; Patil *et al*., 2015; Dubey *et al*., 2016 and Abo-El-Ez *et al*., 2017. Variation in physical dimensions is, by and large, the outcome of both genetic constitution and crop regulation practices.

The mean number of seeds/fruit was of 270.18. The minimum number of seeds/fruit was recorded 12 seeds in tree No. 21 and maximum seeds (411) in tree No. 18. Coefficient of variation was recorded as 27.16 %. Interestingly, tree No. 22 produced seedless fruits, indicating its significant. The variation in seed hardness/ softness ranged from hard in 38 trees, semi-hard in 19 trees and soft in only 2 trees, tree No. 9 and tree No. 30. The latter two selections offer scope for bringing about genetic improvement. These results are in agreement with those of Khalil *et al*., 2015; Dubey *et al*., 2016; Anupa *et al*., 2017 and Abo-El-Ez *et al*., 2017. The number of seeds/fruit could be a potential selection index given its additive gene nature (Rajan *et al.,* 2005), as it also recorded considerably high coefficient of variation.

The variation in 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/tree. Coefficient of variation was 17.35 %. The significant variation was observed in yield efficiency, maximum (24.67 g/cm^2) in tree No. 55 and minimum (2.27 g/cm^2) in tree No. 37. The mean value was recorded as 7.81 g/cm^2 and coefficient of variation was 56.52 % in pooled data for yield efficiency. The overall variation in yield per tree was recorded low as compared to yield efficiency. Similar variation in fruit yield has been reported Marak and Mukunda (2007), Ulemale and Tambe (2015) and Anupa *et al*., (2017). However, low levels in fruit yield may be due to inherent seedling nature compared to grafted trees.

Total soluble solids varied between 7.35^o Brix in tree No. 26 and 11.83^o Brix in tree No. 7 with mean value of 10.17^o Brix. Coefficient of variation was recorded as 10.80 %. A significant variation was also observed in acidity with maximum (0.627%) in tree No. 56 and minimum (0.270%) in tree No. 15 with overall mean of 0.412%. Coefficient of variation was recorded as 22.92 % in pooled analysis. The ascorbic acid content in pooled values was maximum (249.43mg/100g) in tree No. 57 and minimum (138.19 mg/100g) was recorded in tree No. 28 with an overall mean of 181.45 mg/100g.

Coefficient of variation was found 14.95 % in pooled data. The minimum and maximum total sugar content were recorded in tree No. 26 (5.13%) and in tree No. 39 (8.38%), respectively. Mean total sugar content among 60 guava trees was 6.96 %. Coefficient of variation was recorded as 10.12 %. The maximum reducing sugar was observed in tree No. 39 (5.44%) and minimum (3.22%) in tree No. 26 and mean reducing sugars among 60 guava trees was 4.49 %. Coefficient of variation was recorded as 10.23 % in pooled data. A review of pooled data indicate that maximum non-reducing sugars were recorded in tree No. 25 (2.88 %) and minimum in tree No. 26 (1.81 %) with an overall mean of 2.35 %. Coefficient of variation was recorded as 10.55 % in pooled analysis. Similar results were obtained by Khalil *et al*., 2015; Dubey *et al*., 2016; and Abo-El-Ez *et al.,* 2017; Srivastava *et al*., 20022. The low levels of variation in major biochemical constituents of the fruits indicates lesser possibilities of exploitation of this gene pool for chemical fruit quality.

Table 1. Variation in fruit (biochemical) characters of guava seedling trees (two-year pooled data)

Tree No	TSS (°Brix)	Acidity (%)	Ascorbic Acid (mg/100g)	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)
1	9.07	0.374	151.57	6.48	4.19	2.18
2	10.78	0.457	140.04	7.32	4.73	2.46
3	10.74	0.307	159.49	7.15	4.60	2.42
4	9.50	0.357	144.61	6.76	4.36	2.28
5	11.76	0.337	157.23	8.10	5.24	2.71
6	10.08	0.508	208.05	6.77	4.36	2.28
7	11.83	0.355	188.17	8.30	5.36	2.78
8	7.94	0.484	190.39	5.73	3.70	1.92
9	7.75	0.309	174.27	5.82	3.76	1.95
10	9.31	0.458	203.60	6.38	4.13	2.14
11	8.94	0.454	147.19	6.39	4.11	2.16
12	11.30	0.296	178.79	7.84	5.09	2.60
13	9.50	0.347	199.11	7.08	4.61	2.34
14	8.84	0.562	178.89	6.12	3.96	2.04
15	10.79	0.270	152.79	7.31	4.60	2.57
16	9.85	0.324	185.87	6.92	4.36	2.43
17	10.56	0.430	167.41	7.12	4.48	2.51
18	8.80	0.385	188.76	6.44	4.05	2.26
19	9.45	0.478	151.30	6.61	4.16	2.32
20	10.26	0.289	156.40	7.05	4.42	2.50
21	10.88	0.323	217.66	7.31	4.60	2.57
22	10.75	0.316	203.07	6.95	4.38	2.44
23	11.60	0.548	186.28	7.84	4.92	2.76
24	9.90	0.312	169.67	6.61	4.16	2.33
25	11.35	0.472	179.23	8.01	5.03	2.83
26	7.35	0.604	196.25	5.13	3.22	1.81
27	10.63	0.301	185.39	7.12	4.48	2.51
28	10.75	0.378	138.19	7.15	4.50	2.51
29	11.55	0.471	180.29	7.89	5.03	2.72
30	9.75	0.483	168.43	6.53	4.17	2.23
31	10.56	0.519	193.11	7.51	4.76	2.61
32	8.74	0.321	181.25	6.18	3.94	2.12
33	10.34	0.371	206.67	7.39	4.78	2.47
34	10.60	0.376	216.03	7.21	4.68	2.40
35	9.70	0.434	188.66	6.48	4.20	2.17
36	11.51	0.541	199.00	7.94	5.17	2.63
37	9.80	0.300	215.19	6.57	4.27	2.19
38	9.80	0.428	147.66	6.49	4.22	2.16
39	11.80	0.508	178.74	8.38	5.44	2.79
40	11.50	0.313	147.64	7.98	5.18	2.66
41	9.55	0.301	232.80	6.79	4.41	2.26
42	11.25	0.340	172.38	7.99	5.18	2.66
43	11.35	0.572	231.79	7.44	4.84	2.47
44	11.10	0.502	167.05	7.32	4.76	2.44
45	9.66	0.378	161.77	6.69	4.35	2.22
46	8.00	0.319	146.79	5.72	3.71	1.91
47	11.00	0.493	246.81	7.63	5.04	2.46
48	9.90	0.286	183.39	6.66	4.40	2.15
49	10.90	0.331	151.42	7.40	4.88	2.39

50	9.55	0.561	180.26	6.76	4.46	2.18
51	11.80	0.410	219.51	7.95	5.25	2.57
52	9.80	0.371	191.06	6.59	4.31	2.16
53	11.10	0.352	186.90	7.17	4.69	2.35
54	8.45	0.454	201.80	5.74	3.76	1.88
55	10.55	0.609	147.44	6.24	4.09	2.04
56	10.15	0.627	168.26	6.68	4.37	2.19
57	8.70	0.510	249.43	5.97	3.91	1.96
58	9.73	0.431	205.08	6.65	4.35	2.18
59	11.35	0.380	146.73	7.30	4.78	2.39
60	10.20	0.435	164.24	6.73	4.41	2.21
Mean±SE	10.17±0.14	0.41±0.011	181.45±3.50	6.96±0.09	4.49±0.06	2.35±0.03
SD	1.10	0.09	27.13	0.70	0.46	0.25
CV (%)	10.80	22.98	14.95	10.12	10.23	10.55

CONCLUSION

Thus, there was high degree of morphological variation in guava seedling trees. High to moderate levels of coefficient of variation was recorded for yield efficiency and number of seeds/fruit suggesting their suitability as a selection criteria for crop improvement.

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