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CONTENTS

Morphological characterization of F_1 guava hybrids and varieties

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ABSTRACT: The present investigation was carried out to characterize the guava (*Psidium guajava*) germplasm at morphological level and to identify the promising F_1 hybrid amongst 15 hybrids using morphological traits. Observations were recorded for different traits *viz*., leaf characters like length and width of leaf, length to width ratio, leaf area, shape of leaf, shape of leaf apex and base, colour of leaves during winter, lamina thickness, pubescence, number of leaves, young leaf anthocyanin colouration, texture of leaves, colour of upper and lower surface and plant characters like plant height, stem girth and colour of young stem during winter season. Results revealed that significant variations were present with reference to various morphological characteristics amongst the 25 genotypes. On the basis of morphological description, the germplasm Hissar Safeda × Sardar was quite different and superior. Considering shape of leaf, shape of leaf apex and base and leaf colour during winters, these leaf morphological characters were quite informative and useful in characterizing these genotypes, as some genotypes could easily be identified using a combination of these characters.

Key words: Anthocyanin, germplasm, hybrid, morphological, pubescence, texture

Guava (*Psidium guajava* L.), belongs to Myrtaceae family, is one of the world's most important tropical and subtropical fruit crops, with basic chromosome no. x= 11 (2n= 2x= 22). *Psidium* is a genus with 150 species, but only 20 are edible, and the rest are wild with poor quality fruits. (Padilla - Ramirez *et al.,* 2010). After barbados cherry (1500 mg/100 g) and aonla (600 mg/100 g), it ranks 3rd in vitamin C content (299 mg/100 g). Guava grows well in both humid and dry climates and can withstand short periods of cold spell, but can survive only a few degrees of frost. It is a fruit crop that is open pollinated and heterozygous in nature, with enough genetic variation. Since guava is a major crop, therefore it is necessary to select the better genotypes out of the existing material available in India and characterize them for morphological traits for their identification and further use in breeding programmes. "Characterization" refers to the process of describing a plant's germplasm. Morphological or phenotypic parameters are the most prevalent way of determining and analysing genetic variation. For characterization of germplasm, a morphological approach is quite simple, easy, and cost-effective. It is the first and most important step in guava germplasm characterization. Plant height, disease response, photoperiod, form or colour of flowers, leaves, fruits or seeds, and other morphological markers are graded visually or their inheritance can be judged by naked eye. Without the use of laboratory equipment, these characteristics can be scored rapidly and easily (Bhat *et al.,* 2010). Furthermore, morphological characterization is a traditional approach that is still widely used today, and its importance will continue to grow (Nandini and Chikkadevaiah, 2005; Durgac *et al.,* 2006; Hussain *et al.,* 2007). For breeding purposes, morphological characterization would be useful in detecting heterogeneity and variability in germplasm. In fact, morphology has been used to define many of the important guava cultivars. Plant breeders used to choose breeding material solely on the basis of readily identifiable morphological characteristics in the past. While it is a time-consuming method that is affected by environmental and natural factors, it is still thought to be useful for germplasm evaluation and characterization. This study focuses on characterization of F_1 guava hybrids for different morphological characters and determining promising hybrid in terms of the plant and leaf parameters on the basis of morphological traits.

MATERIALS AND METHODS

***Experimental Site, plant material and growth conditions*:** The present study was conducted during 2020-2021 at Horticultural Research Centre, Patharchatta of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar on 2 year old plants of 25 different guava genotypes planted at a spacing of 5×2 m^2. The growth and vigor of all the plants selected were nearly identical. The university farm is situated at 29.5°N latitude, 79.30°E longitude and at an altitude of 243.84 meter above the mean sea level. The guava germplasm comprised of 10 cultivated varieties and 15 hybrids. The soil of the experimental site has been classified as silty loam soil which is dark in colour with moderately high organic matter content, high fertility, cation exchange capacity, water holding capacity etc. On the experimental site, a humid sub – tropical climatic condition prevailed.

Methodology: Observations on morphological parameters of guava genotypes were reported in accordance with 'Guava Descriptor' published by All India Coordinated Research Project on Subtropical Fruits (AICRP-STF), CISH, Lucknow, in the year 2011. Observations on guava genotypes were made for different plant and leaf characters *viz.,* plant height, stem girth, colour of young stem, shape of mature leaf, leaf base, leaf apex, leaf texture, colour of upper leaf surface, lower leaf surface, number of leaves, leaf blade length, leaf blade width, leaf blade length to width ratio and leaf area at fortnight interval to study the diversity.

Statistical analysis : The quantitative data was statistically analysed by method of analysis of variance using randomized block design using SPSS software version 19, whereas analysis of qualitative morphological data was done using DARwin5 software, version 5.0.158 developed by CIRAD, research unit: Genetic Improvement of Vegetatively Propagated Crops.

RESULTS AND DISCUSSION

Analysis of variance revealed significant differences amongst the 25 genotypes for all the traits (Table 1). Data in Table 2 indicates that plant height differed among different genotypes. Hybrid Hissar Safeda × Sardar (183.28 cm) had registered maximum plant height and it was minimum in Hissar Surkha (45.43 cm). Similar significant differences in height of guava varieties have also been reported by Pathak *et al.* (1989); Subramaniyam and Dinesh (1993) and Sharma *et al.* (1998). Leaf blade length was noted to be maximum in Hissar Safeda × Sardar (15.03 cm) whereas minimum leaf length was observed in Sangareddy × Arka Kiran (10.9 cm). Similar findings have been published by prior researchers, including Kumar *et al.* (2012), Santos *et al.* (2012), Singh (2013), Singh *et al.* (2015) and Dubey *et al.* (2016). Maximum leaf width (7.04 cm) was observed in Red Flesh × Local Germplasm. On the other hand Local Germplasm recorded minimum leaf width (4.53 cm). Maximum length and breadth ratio of leaves was observed in Local Germplasm (2.53) while minimum was observed in Red Flesh × Local Germplasm (1.64) during winter season. Maximum leaf area was noted in Hissar Safeda × Sardar (100.48 cm^2) while minimum leaf area was observed in Local Germplasm (47.04 cm^2). Leaf area is entirely determined by leaf length and width, while leaf length and width are influenced by the genetic make-up of germplasm, climatic conditions, management practices, and the age of the tree. Observations regarding leaf area are in accordance with finding of Raghava (2004) who found maximum leaf area in Pant Prabhat and minimum in *P. chinensis*. Maximum number of leaves was observed in Hissar Safeda × Sardar (69) while minimum number of leaves was observed in Red Flesh × Local Germplasm (56). Maximum stem girth was observed in hybrid Hissar Safeda × Sardar (52.91 mm) while the hybrid Hissar Surkha × Local Germplasm (37.89 mm) recorded minimum stem girth. According to Kumar (1998), Allahabad Safeda and Sardar were the most vigorous, producing the highest stem girth. The variation in growth and vigour of various genotypes might be due to the genetic variability as well as the agro-climatic conditions of the region. The qualitative traits that could not be numerically counted were rated on the basis of categories described in descriptor designed by CISH, Lucknow

Table 1: Analysis of Variance (ANOVA) for quantitative morphological characters on 75 days

S.No.	Mean sum of squares	Plant height	Stem girth	Number of leaves	Leaf blade length	Leaf blade width	Leaf length / width ratio	Leaf area
1.	Between genotypes	4132.5**	39.90**	34.35**	4.83**	1.22**	0.086**	628.96**
2.	Error	185.5	5.33	4.27	0.22	0.08	0.01	26.42

**Highly significant

Table 2: Characterization of guava genotypes on the basis of morphological traits (Quatitative Characters) on 75 days

S. No.	Genotypes	Plant height (cm)	Stem girth (mm)	Leaf blade length (cm)	Leaf blade width (cm)	Leaf length / width ratio	Leaf area (cm^2)	Number of leaves
1.	Arka Kiran	143.67	40.21	11.51	5.46	2.11	57.87	62.78
2.	Hissar Safeda	136.68	49.01	13.56	6.22	2.18	79.35	61.56
3.	Hissar Safeda × Sardar	183.28	52.91	15.03	7.02	2.14	100.48	69.00
4.	Hissar Safeda × Lalit	159.62	51.51	15.00	6.64	2.26	94.57	63.67
5.	Hissar Safeda × Pant Prabhat	122.30	44.63	13.95	6.71	2.08	88.63	55.78
6.	Hissar Surkha	45.43	43.66	11.62	5.56	2.09	59.59	64.44
7.	Hissar Surkha × Sardar	48.16	44.37	12.08	6.51	1.85	73.64	66.00
8.	Hissar Surkha × Lalit	134.01	47.16	12.56	6.06	2.07	71.11	66.89
9.	Hissar Surkha × Local Germplasm	99.33	37.89	11.70	6.10	1.92	66.79	64.56
10.	Hissar Surkha × Pant Prabhat	148.41	40.80	12.39	6.47	1.91	75.14	65.67
11.	Lalit	143.55	44.99	13.79	6.38	2.17	83.30	62.67
12.	Local Germplasm	84.74	38.48	11.48	4.53	2.53	47.04	60.67
13.	One Kg	155.34	44.04	12.20	5.94	2.05	67.49	61.11
14.	One Kg × Sardar	135.97	40.28	12.89	6.72	1.92	81.59	63.67
15.	One Kg × Local Germplasm	106.66	41.21	11.96	5.77	2.07	63.96	67.56
16.	Pant Prabhat	140.92	40.05	13.74	6.62	2.07	85.94	63.33
17.	Red Flesh	129.73	44.88	12.24	6.19	1.98	70.82	62.11
18.	Red Flesh × Sardar	122.36	43.28	13.37	6.79	1.97	85.85	62.56
19.	Red Flesh × Local Germplasm	55.86	44.24	11.42	7.04	1.64	75.42	55.78
20.	Red Flesh × Pant Prabhat	141.40	44.86	14.95	6.71	2.23	95.41	61.33
21.	Sangareddy	127.13	44.11	11.06	5.09	2.18	51.57	59.67
22.	Sangareddy × Arka Kiran	105.77	43.21	10.90	5.15	2.12	51.11	62.67
23.	Sangareddy × Sardar	171.64	45.39	11.13	6.05	1.84	62.30	61.78
24.	Sangareddy × Pant Prabhat	158.27	43.21	11.62	5.76	2.02	61.94	56.22
25.	Sardar	171.74	47.45	13.10	6.66	1.97	82.29	65.44
	Trait Mean	126.89	44.07	12.61	6.17	2.06	73.33	62.68
	SE(m)	7.86	1.33	0.27	0.17	0.06	2.97	2.86
	CV	10.73	5.24	3.75	4.73	4.90	7.01	7.89
	CD at 5%	22.36	3.79	0.78	0.48	0.17	8.44	8.12

(Table 3). Considerable differences were observed amongst 25 genotypes considering leaf shape, shape of leaf apex and base and leaf colour during winters. Because some genotypes could easily be identified using a combination of these traits, these leaf morphological characters were extremely informative and valuable in identifying these genotypes.

This study would be quite helpful for the documentation, management and conservation of guava genetic resources. Registration of the guava genotypes, establishment of guava germplasm units and availability of true-to-type plants can play a significant role in improving the guava production in the country that will lead to better returns for the growers.

There was significant variation in morphological characters of various cultivars and hybrids of guava. On the basis of morphological characterization, hybrid Hissar Safeda × Sardar differs significantly from all other genotypes and was superior to other guava hybrids.

Table 3: Characterization of guava genotypes on the basis of morphological traits (Qualitative Characters)

S. No.	Genotypes	Texture of leaves	Pubescence	Colour of upper leaf surface	Colour of lower leaf surface	Young leaf anthocyanin colouration	Colour of leaf during winter	Lamina thickness	Colour of young stem	Leaf shape	Shape of leaf base	Shape of leaf apex
1	Arka Kiran	Smooth	Sparse	Green	Light Green	Present	Brick red	Intermediate	Red	Oblanceolate	Rounded	Obtuse
2	Hissar Safeda	Smooth Glabrous	Dense	Light Green	Green	Present	Brick red	Intermediate	Yellow green	Oblong	Rounded	Rounded
3	Hissar Safeda × Sardar	Smooth Glabrous	Very Dense	Light Green	Green	Absent	Brick red	Intermediate	Yellow green	Oblanceolate	Obtuse	Apiculate
4	Hissar Safeda × Lalit	Smooth Glabrous	Medium	Light Green	Green	Absent	Brick red	Intermediate	Yellow green	Oblong	Rounded	Apiculate
5	Hissar Safeda × Pant Prabhat	Smooth Glabrous	Dense	Light Green	Green	Absent	Brick red	Intermediate	Yellow green	Oblong	Rounded	Obtuse
6	Hissar Surkha	Smooth Glabrous	Medium	Green	Light Green	Absent	Coppery	Thick	Red	Oblong	Rounded	Apiculate
7	Hissar Surkha × Sardar	Smooth Glabrous	Dense	Green	Light Green	Present	Coppery	Thick	Red	Oblong	Rounded	Obtuse
8	Hissar Surkha × Lalit	Smooth Glabrous	Medium	Green	Light Green	Present	Coppery	Thick	Red	Oblanceolate	Rounded	Obtuse
9	Hissar Surkha × Local Germplasm	Smooth Glabrous	Medium	Green	Light Green	Present	Coppery	Thick	Red	Oblong	Rounded	Apiculate
10	Hissar Surkha × Pant Prabhat	Smooth Glabrous	Medium	Green	Light Green	Present	Coppery	Thick	Red	Oblong	Rounded	Apiculate
11	Lalit	Smooth	Sparse	Light Green	Light Green	Present	Brick red	Intermediate	Yellow green	Oblanceolate	Obtuse	Rounded
12	Local Germplasm	Smooth	Absent	Green	Green	Present	Brick red	Intermediate	Yellow green	Oblong	Rounded	Obtuse
13	One Kg	Smooth	Absent	Green	Green	Present	Pink	Intermediate	Red	Oblong	Rounded	Obtuse
14	One Kg × Sardar	Smooth	Medium	Green	Green	Present	Pink	Thick	Red	Oblong	Rounded	Obtuse
15	One Kg × Local Germplasm	Smooth	Absent	Green	Green	Present	Pink	Intermediate	Red	Oblanceolate	Obtuse	Obtuse
16	Pant Prabhat	Smooth	Sparse	Green	Light Green	Present	Brick red	Intermediate	Green	Oblong	Rounded	Obtuse
17	Red Flesh	Smooth Glabrous	Sparse	Green	Light Green	Present	Coppery	Intermediate	Red	Oblanceolate	Rounded	Obtuse
18	Red Flesh × Sardar	Smooth Glabrous	Medium	Green	Light Green	Present	Coppery	Intermediate	Red	Oblanceolate	Obtuse	Obtuse
19	Red Flesh × Local Germplasm	Smooth Glabrous	Sparse	Green	Light Green	Present	Coppery	Intermediate	Red	Oblanceolate	Rounded	Obtuse

20	Red Flesh × Pant Prabhat	Smooth Glabrous	Sparse	Green	Light green	Present	Coppery	Intermediate	Red	Oblanceolate	Rounded	Obtuse
21	Sangareddy	Smooth	Absent	Light green	Light green	Absent	Brick red	Intermediate	Green	Oblanceolate	Obtuse	Obtuse
22	Sangareddy × Arka Kiran	Smooth	Absent	Light Green	Light green	Absent	Brick red	Intermediate	Green	Oblanceolate	Obtuse	Obtuse
23	Sangareddy × Sardar	Smooth	Sparse	Light Green	Light green	Absent	Brick red	Intermediate	Green	Oblanceolate	Obtuse	Obtuse
24	Sangareddy × Pant Prabhat	Smooth	Sparse	Light green	Light green	Present	Brick red	Intermediate	Green	Oblanceolate	Obtuse	Obtuse
25	Sardar Pant Prabhat	Smooth	Medium	Green	Green	Present	Red	Thick	Red	Oblong	Obtuse	Rounded
25.	Sardar	Smooth	Medium	Green	Green	Present	Red	Thick	Red	Oblong	Obtuse	Rounded

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