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RESEARCH ARTICLE

FRUIT MORPHOLOGICAL CHARACTERS OF WINTER SEASON GUAVA UNDER EASTERN PLATEAU OF INDIA: BASIS OF COMMERCIAL SELECTION

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ABSTRACT

Thirty two guava genotypes were evaluated at ICAR-RCER, Research Centre Ranchi, on the basis of winter production during 2009-10. The fruit bud differenciation took place in growing vegetative bud and the differences between peak flowering and peak harvesting were about to 4 months for all cultivars. The eight cultivars like Mild Fleshed, Chittidar Alllabad Safeda, Sardar, CHG-1, CHG-2, Kairala Seedling and Nasik were very promising under eastern plateau and hill region. To sudy of the botany of these crop had emense imporatance to breeder, researcher and students. The maximum fruit weight was recored in cultivar Chittidar 265.67g, followed by Sardar (234.3g) and Allahabad Safeda (232.0g). The maximum TSS of the fruit was found in cv.Chittidar 13.87^0B while the maximum acorbic acid was found in cv. Florida Fleshed which had 358.67 mg/100 g pulp being comparable with Kairala Seedling (357.67 mg/100g pulp). The maximum seed cavity diameter was found in Sardar and Sangam, which are 7.24 cm. The former also exhibited maximum weight of seed cavity tissue (95.98g) followed by Mild Fleshed (95.70g) and Chittidar (75.23g). Very small seed was found in cv. Florida Fleshed (seed no.443.40) as compared to Allahabad Safeda which produced soft and big seeds (no.91.38). Regarding shape of the fruit, cv.Nasik was pyriform whreas CHG-1, CHG-2, Mild Fleshed, Kairal Seedling and Allahabad Safeda were round while Chittiar but oval.

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INTRODUCTION

The Guava (*Psidium guajava* L.), is a lucious and faboulos fruit from family Myrtaceae under order Myrtale and class Magnoliopsida. It is popularly known as poor-man's apple due to low fetching prices. There are certain characteristics of guava that make it distinct from the other fruits. As for example its shape, texture, taste, color, varieties, and palatability. It is one of the most referred and legendary fruits because of its hardy (Dhaliwal and Singla, 2002) and prolific bearing nature. It is an excellent source of Vitamin C and pectin content (Dhaliwal and Dhillon, 2003). It is also a good source of other vitamins (A, B, & B_2) and minerals like calcium, iron and phosphorus. Seeds of the fruit are also rich source of iron. Guava fruits, after removal of seeds are used for preparation of processed products like jam, jelly, paste, juice and nectar in addition to fresh consumption. Guava production is vital for overall growth of horticulture in India as it contributes 4% of the total fruit production (Singh, 2009). In the world, guava is one of the most important fruit crops. It is believed to be originated in tropical America stretching from Mexico to Peru. India contributes 45% of world production of guava after China (10%) and Thailand (6%) (NHB DATABASE 2010). In India it is cultivated in an area of 219.7 th ha with a total production of 2571 th MT of fruit (NHB DATABASE 2010). The major guava growing states are Uttar Pradesh, Bihar, Jharkhand, Madhya Pradesh and Maharashtra. But best quality of guava is produced in Uttar Pradesh particularly in Allahabad. Guava is an important fruit crop which is successfully grown over a wide range of climatic conditions due to its greater adaptability. The Chotanagpur region of eastern plateau and hills agro-climatic zone has been a traditional guava growing region where the crop is mostly grown under rainfed conditions. The guava produced in this region is known for its high TSS and long keeping quality. Thus development of guava genotypes with higher yield potential under the eastern plateau condition is one of the

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important strategies for increasing the profitability of guava orcharding in the region. Keeping this in view the present study rgarding cultivars with respect to fruit characters wereessential for market acceptance and production of winter crop for quality guava which may resulted in their commercial production in this micro climate.

MATERIALS AND METHODS

The study was conducted in second farm of ICAR-RCER,research centre Ranchiduring 2009-10. Under this experiment, 32 guava genotypes conserved at Field gene bank of the centre were used as the experimental material. The genotypes for evaluation were Kairala Seedling (T_1), Barkhana (T_2), Florida Fleshed (T_3), Chittidar A.C. (T_4), Mild Fleshed (T_5), Seed Drop (T_6), Barbadose Superior (T_7), Surkhaguddi (T_8), Chittidar (T_9), Allahabad Collection (T_{10}), Sangam (T_{11}), Sardar (T_{12}), Allahabad Safeda (T_{13}), Mustafapur (T_{14}), Behat Coconut (T_{15}), Pear Shaped (T_{16}), Apple Colour (T_{17}), Harijha (T_{18}), Banarasi (T_{19}), Superior (T_{20}), White Fleshed (T_{21}), Guatemala (T_{22}), CHG-1(T_{23}), CHG-3(T_{24}), CHG-5(T_{25}), CHG-2(T_{26}), Spear Acid (T_{27}), Nasik (T_{28}), Eskwala (T_{29}), Sindh (T_{30}), Patiala (T_{31}) and Smooth Green (T_{32}). This area is situated 620 m above mean sea level and at 23^0 25' N latitude and 85^0 20' East longitudes experiencing an average annual rainfall (110-140 cm). High humidity (78.14 %-84.14 %) and low evaporation rate (4.04 mm/day) is experienced after June which continues up to onset of winter (Singh, 1999). Soil is acidic and pH range from 5.0-6.5. The following methodologies were followed to coduct the experiment successfully.

Total Soluble Solids

T.S.S. of the guava fruits were measured by Digital Refractometer (ATAGO Pocket Refractometer PAL-1). It measured T.S.S. in term of per cent Brix ranged from 0-53 %.

Ascorbic Acid

Vitamin C content of the sample was determined by 2,6-Dichlorophenol-indophenol visual titration method (Ranganna, 1996). This method involved three steps. The steps were as follows:

A. Preparation of sample:

After standardization of dye, fruit pulp was mixed thoroughly with the help of grinder. In case of hard ripe fruits, 100 gm fruit pulp was mixed with 100 ml water and mixed thoroughly in grinder. Juice was separated through filtration with the help of muslin cloth. 10 ml of sample was taken and volume was made up to 100ml with 3 % HPO3.

B. Assay of Extract:

An aliquot of 10 ml of the HPO_3 extract of the sample was taken and titrate with the standard dye to a pink end point which persisted for at least 15 sec. Titration was done rapidly and a preliminary determination of the titre was made. In the next determination, most of the required dye was added and then titrated accurately.

Mg of ascorbic acid in 100 gm or ml

$$= \frac{\text{Titre X Dye factor X Volume made up X 100}}{\text{Aliquot of extract taken for estimation x Wt or Volume of sample taken for estimation}}$$

Fruit morphological descriptions

Fruit morphological parameters were described per the descriptions given in the "Proceedings of the group workers meeting on subtropical fruits (AICRP on Sub-tropical fruits)" in India 2007 (Annonymous 2007).

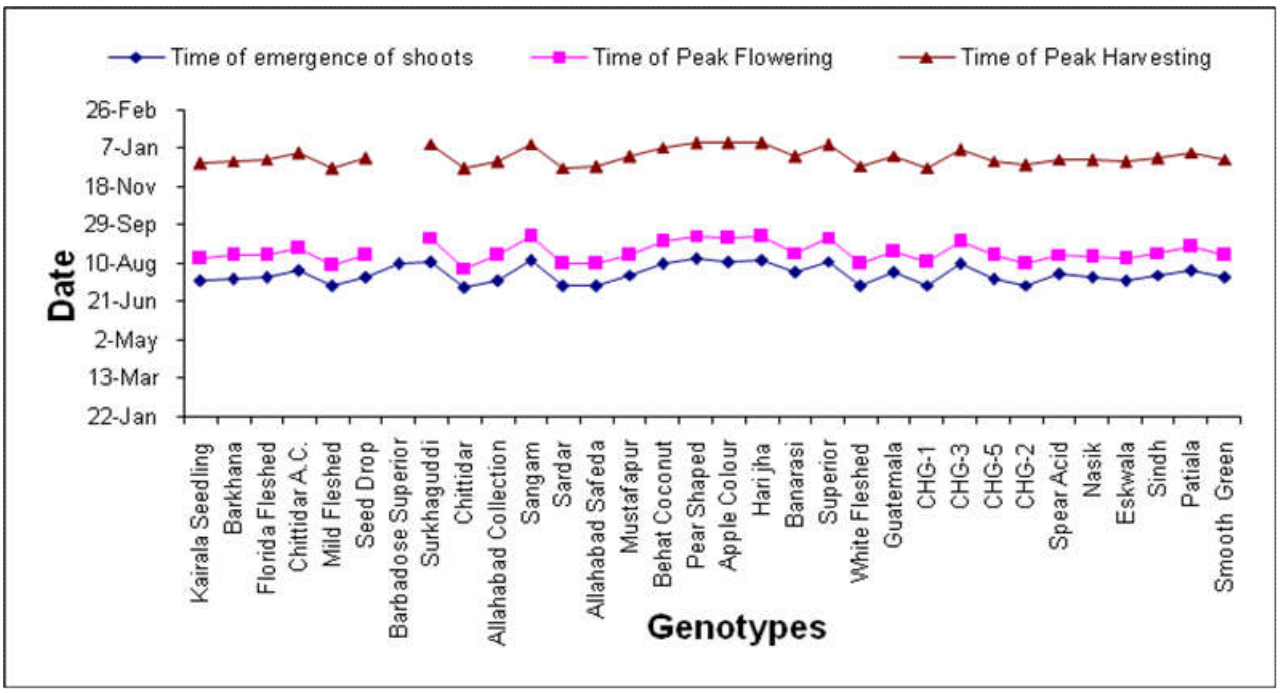

Fig. 1. Phenology of winter guava (*Psydium guajava* L.)

Fruit morphology of different guava genotypes:

Data on morphological descriptions of guava fruit of different genotypes are presented in Table 1.

Plate -1. Genotype Mild Fleshed

Plate-2. Genotype Sardar

Plate-3 genotype Allahabad Safeda

Plate 4: Genotype Chittidar

Plate-5 Genotype CHG-1

Plate-6 Genotype CHG-2

Plate-7. Genotype Kairala Seedling

Plate-8. Genotype Nasik

Plate-9. Genotype Seed Drop

Table 1. Fruit Characteristics of winter season Guava

Genotypes	Pulp thickness (cm)	Seed cavity diameter(cm)	Weight of seed cavity tissue(g)	Number of seeds / fruit	100 air dried seed weight(g)	Pulp : seed ratio	Fruit Weight(g)	T.S.S(^{0}B)	Ascorbic acid (mg/100g pulp
Kairala Seedling	1.04	5.93	61.81	323.19	1.77	21.90	131.00	10.97	357.67
Barkhana	1.64	6.98	87.86	349.79	1.39	31.50	158.00	9.87	287.33
Florida Fleshed	1.55	5.66	76.19	443.40	1.96	17.14	157.67	7.27	358.67
Chittidar A.C.	1.48	4.61	62.27	187.21	1.85	75.71	265.67	13.87	266.83
Mild Fleshed	1.36	6.32	95.70	344.87	1.90	22.76	155.67	8.87	263.33
Seed Drop	1.36	5.00	43.23	408.91	1.18	31.88	158.67	8.50	287.33
Barbadose Superior	**	**	**	**	**	**	**	**	**
Surkhaguddi	1.80	5.79	71.89	189.18	1.39	47.93	128.67	10.10	276.67
Chittidar	1.44	7.11	95.23	390.19	1.88	18.45	142.67	8.20	250.67
Allahabad Collection	1.08	6.32	52.19	206.92	2.12	44.44	199.33	12.40	236.67
Sangam	1.28	7.24	84.68	256.19	1.98	41.06	213.33	11.70	266.67
Sardar	1.28	7.24	95.98	257.67	1.60	55.84	234.33	11.97	286.67
Allahabad Safeda	1.28	6.19	42.34	91.33	1.06	238.65	232.00	11.17	308.67
Mustafapur	1.44	6.06	60.69	131.05	2.50	55.87	186.33	9.97	209.00
Behat Coconut	1.20	6.58	70.02	206.92	2.58	30.34	167.33	11.17	274.00
Pear Shaped	1.44	4.35	42.11	389.21	1.89	18.08	140.33	14.67	219.00
Apple Colour	1.12	6.58	66.57	325.16	1.47	32.54	160.33	7.57	215.00
Harijha	1.36	5.93	63.77	192.14	2.47	34.89	170.33	11.90	254.00
Banarasi	1.80	5.93	51.72	311.37	1.62	25.90	135.67	11.40	269.00
Superior	1.36	5.93	83.56	369.50	2.54	13.70	138.00	7.40	309.00
White Fleshed	1.68	5.93	44.35	275.89	1.54	32.19	141.00	7.10	221.67
Guatemala	1.48	5.27	53.69	201.99	2.71	29.87	169.00	8.70	290.67
CHG-1	1.28	5.53	54.90	201.01	1.95	41.86	168.00	7.10	250.67
CHG-3	1.28	5.00	54.38	275.89	1.52	31.19	135.00	7.30	190.67
CHG-5	1.28	5.53	55.37	285.75	1.44	33.27	141.00	8.60	235.67
CHG-2	1.50	5.53	61.34	285.75	1.37	37.32	150.00	7.70	225.67
Spear Acid	1.80	7.24	77.59	275.89	2.41	26.62	183.67	13.03	214.67
Nasik	1.28	6.45	54.90	273.92	1.60	32.69	147.67	11.00	251.00
Eskwala	1.23	5.46	63.86	310.01	1.58	28.13	142.67	8.90	241.50
Sindh	1.64	5.53	59.89	325.16	1.65	37.71	207.67	7.60	196.00
Patiala	1.55	6.06	71.89	239.44	1.78	34.82	152.67	7.10	206.00
Smooth Green	1.12	5.93	74.74	287.72	1.86	26.22	145.67	8.90	228.00
SE(d)	0.030	0.420	3.940	12.125	0.055	7.460	2.924	0.156	8.849
CD at 5%	0.06	0.84	7.88	24.25	0.11	14.92	5.848	0.312	17.698

- 1CHES- Central Horticultural Experiment Station, *CHG- CHES Guava
- A.C.-Allahabad Collection

*Cultivar Barbadose Suprior did not produce flower during winter season

Table 2. Fruit morphology of different guava genotypes

Genotypes	Fruit Shape	Apex	Base	Peel Colour	Pulp Colour	Dots presents	Blush colour	Pulp Texture
Kairala Seedling	Round	Broadly round	Tapering	Light Green	White	Absent	Absent	Gritty
Barkhana	Round	Broadly round	Rounded	Creamy White	White	Absent	Absent	Gritty
Florida Fleshed	Round	Broadly round	Rounded	Light Green	White	Absent	Absent	Non Gritty
Chittidar A.C.	Oval	Flat	Tapering	Light Green	White	Present	Absent	Non Gritty
Mild Fleshed	Round	Broadly round	Rounded	Creamy White	White	Absent	Absent	Non Gritty
Seed Drop	Round	Broadly round	Rounded	Yellowish Reddish	White	Absent	Absent	Non Gritty
Barbadose Superior	Round	Broadly round	Rounded	Light Green	Cream	Absent	Absent	Non Gritty
Surkhaguddi	Oval	Broadly round	Tapering	Light Green	White	Absent	Absent	Non Gritty
Chittidar	Oval	Flat	Tapering	Light Green	White	Present	Absent	Non Gritty
Allahabad Collection	Round	Broadly round	Rounded	Yellowish Reddish	Cream	Present	Coloured	Non Gritty
Sangam	Oval	Broadly round	Tapering	Light Green	Cream	Absent	Absent	Non Gritty
Sardar	Ovate	Broadly round	Tapering	Light Green	White	Absent	Absent	Non Gritty
Allahabad Safeda	Round	Broadly round	Rounded	Creamy White	Cream	Present	Absent	Non Gritty
Mustafapur	Round	Broadly round	Rounded	Creamy White	White	Absent	Absent	Non Gritty
Behat Coconut	Oval	Flat	Tapering	Creamy White	Cream	Present	Absent	Gritty
Pear Shaped	Pyriform	Broadly round	Tapering	Light Green	White	Absent	Absent	Non Gritty
Apple Colour	Round	Broadly round	Rounded	Yellowish Reddish	White	Present	Coloured	Non Gritty
Harijha	Round	Broadly round	Rounded	Light Green	White	Absent	Absent	Non Gritty
Banarasi	Round	Broadly round	Rounded	Yellowish Reddish	Cream	Absent	Absent	Non Gritty
Superior	Round	Rounded obtuse	Tapering	Light Green	Cream	Absent	Absent	Gritty
White Fleshed	Oval	Flat	Tapering	Light Green	White	Absent	Absent	Non Gritty
Guatemala	Oval	Broadly round	Tapering	Light Green	White	Absent	Absent	Non Gritty
CHG-1	Round	Broadly round	Rounded	Creamy White	Pinkish	Absent	Absent	Non Gritty
CHG-3	Round	Broadly round	Rounded	Light Green	White	Present	Absent	Gritty
CHG-5	Round	Broadly round	Rounded	Yellowish Reddish	Cream	Absent	Absent	Gritty
CHG-2	Round	Broadly round	Rounded	Yellowish Reddish	Pinkish	Absent	Absent	Non Gritty
Spear Acid	Pyriform	Flat	Tapering	Creamy White	White	Absent	Absent	Non Gritty
Nasik	Pyriform	Broadly round	Tapering	Creamy White	White	Absent	Absent	Non Gritty
Eskwala	Round	Broadly round	Rounded	Light Green	White	Absent	Absent	Gritty
Sindh	Round	Broadly round	Rounded	Creamy White	Cream	Absent	Absent	Gritty
Patiala	Round	Broadly round	Rounded	Creamy White	White	Absent	Absent	Non Gritty
Smooth Green	Oval	Flat	Tapering	Light Green	White	Absent	Absent	Non Gritty

Design and Treatments

In this experimentation, the genotypes were evaluated only for winter seasons. Each genotype represented one treatment. The experiment was laid out in randomized block design with three replications. Observations were recorded from 8 years old guava plants.

RESULTS AND DISCUSSION

Botanical descriptions of different types of guava cultivar were examined on the basis on climate and phenology, fruit quality and external features of fruits. Horticultural evaluation along with botanical description of 32 cultivars of guava given below:

Phenology of winter season guava: In 2009, the time of peak flowering and time of peak harvesting of these genotypes were 2nd week of September and 2nd week of January (2010), respectively. In the year 2009, the genotype CHG-2 exhibited early and the genotype Behat Coconut exhibited late bearing tendency. The genotype Barbadose Superior did not produce flower during this season. It had been found that the early bud breaking genotypes were high yielder. The fruit bud differenciation took place in growing vegetative bud (Singh *et al.,* (1999). In general, we found that bud breaking times for three crops of guava were; December for summer season crop, March for rainy season crop and July for winter season crop. These results are in conformity with those of Singh *et al.,* (1999). In winter crops, the differences between peak flowering and peak harvesting were about to 4 months for all the cultivars. This finding corroborates the results of Menzel and Paxton (1986) whre maturirity timeswere almost 100 days at Australian condition. But under Chhattisgarh (India) condition Singh and Jain (2007) found that the genotype Allahabad Safeda grown in showed the fruit quality atrributes under150 days of maturity respectively The cultivar babadose superior did not produce flowerduring winter season (Fig-1)

Fruit Quality of winter season guava: Data on fruit characteristics of winter season guava during 2009 are presented in Table 1. A close observation of the table revealed that the genotypes Surkhaguddi, Banarasi and Spear Acid recorded the highest pulp thickness of 1.80 cm. The maximum TSS of the fruit was found in Cv. Pear Shaped 14.67^0B followed by chittidar 13.87^0B this findings corroborates the result of Singh and Jain (2007) whre Allahabad Safeda grown in Chhattisgarh (India) showed the maximum T.S.S. of 14.93^0B. This were also confirmed by the Singh, (2003b) and Patel *et al*. (2005). The genotype Florida Fleshed exhibited the maximum ascorbic acid content (358.67 mg/100 g pulp) being comparable with Kairala Seedling (357.67 mg/100g pulp). The genotype Florida Fleshed exhibited the maximum ascorbic acid content (358.67 mg/100 g pulp) being comparable with Kairala Seedling (357.67 mg/100g pulp). In another study, Babu *et al*. (2007b) also found that the vitamin-C content was highest in Hybrid-3 (258.5mg/100g pulp) followed by Hybrid-

1(240.00 mg/100g pulp). The seeds of Allahabd Safeda was bold but soft and few in number (91.38). This result was similar to findings obtained by Gohil *et al*. (2006). It was very much clear that winter seaon of guava recorded superior fruit quality (Singh *et al.*, 2002) Aulakh (2004) and Patel *et al*. (2007).

External feature of the fruit

Rodriquez *et al*. (1971) observed difference in the shape of the fruit among different guava genotypes. Most of them were having roundish appearance. In our study among most accepted cultivars CHg1, CHG-2, Mild Fleshed, Kairal Seedling and Allahabad Safeda were round whie Chittidar was oval and Nasik was Pyriform. As explained by Rodriquez *et al*. (1971), yellowish ground colour with straw yellow skin at maturity was usual feature which was prominent in our study also. However, blush colour seemed to be a genuine marker imparting significant change in skin colour to genotype. In our study cultivar Chittidat and Allahab Safeda and Apple Colour prominent red drops were observed. In previuos study the presence of red dots on fruits of Chittidar and Safeda was reported by Sehgal and Singh (1965). Kumar *et al.* (2006) also reported that red skin of Apple Colour and red dots on Chittidar were valuable identifying characters. Even, Mitra and Bose (1996) also referred that the genotypes Chittidar and Behat Coconut had small dots present on the fruit surface.

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