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Dileshwar Kumar Chandel
Research Scholar, Department of Horticulture, College of Agriculture Raipur, Indira Gandhi Agricultural University, Purena, Chhattisgarh, India

Yogendra Chandel
Research Scholar, Department of Horticulture, College of Agriculture Raipur, Indira Gandhi Agricultural University, Purena, Chhattisgarh, India

Yogesh Chandrakar
Research Scholar, Department of Horticulture, College of Agriculture Raipur, Indira Gandhi Agricultural University, Purena, Chhattisgarh, India

GL Sharma
Scientist, Department of Horticulture, College of Agriculture Raipur, Indira Gandhi Agricultural University, Purena, Chhattisgarh, India

Hemant Kumar Panigrahi
Scientist, Department of Horticulture, College of Agriculture Raipur, Indira Gandhi Agricultural University, Purena, Chhattisgarh, India

Corresponding Author:
Dileshwar Kumar Chandel
Research Scholar, Department of Horticulture, College of Agriculture Raipur, Indira Gandhi Agricultural University, Purena, Chhattisgarh, India

Genetic variability studies of guava (*Psidium guajava* L.) in Balod District of Chhattisgarh

Dileshwar Kumar Chandel, Yogendra Chandel, Yogesh Chandrakar, GL Sharma and Hemant Kumar Panigrahi

Abstract
The present experiment was conducted under Department of Fruit Science College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G) through the survey conducted on different villages of Balod district to identify superior guava genotypes in Chhattisgarh plains. The experiment consisting of thirty genotypes of guava was laid out under Randomized Complete Block Deign (RBD) with three replications to study the biodiversity of guava (*Psidium guajava* L.) in Balod district of Chhattisgarh. The results revealed the BG-27 among the different genotypes proved significantly superior over rest of the genotypes with respect to tree height (8.27 m), number of fruits per plant (186), Fruit yield per tree (46.53 kg) and The genotypes BG-15 recorded the maximum TSS (12.42°Brix), Reducing sugar (5.81%), Total sugar (8.59%) and Non-reducing sugar (2.48%) while genotype BG-11 observed maximum Ascorbic acid (243.86 mg/100 g pulp).

Keywords: Guava, vitamins, variability, evaluation

Introduction
Guava (*Psidium guajava* L.) popularly known as "Apple of Tropics" is a tropical fruit but also grows well under sub-tropical condition also. It is one of the most common fruits in India and considered the fifth most important fruit in terms of area and production after mango, citrus, banana and apple. Guava is a hardy, prolific bearer and highly remunerative fruit. It is found favour with the fruit growers due to its wide adaptability and higher return per unit area. Guava is such a fruit which is grown all over the country in the kitchen gardening, near the well and tube well premises and on a commercial scale (Bal, 2014) [5]. It is believed to be introduced in India early in the 17th century. It belongs to family Myrtaceae and genus Psidium which contains about 150 species (Hayes, 1974) [11]. Most of the commercial cultivars of guava are diploid (2n=22), while the seedless cultivar is triploid in nature and a shy bearer. Cultivated guava is a native of tropical America where it occurs wild.

Guava requires an annual rainfall of 1,000 to 2,000 mm with optimum temperature of 23 °C to 26 °C, though it can withstand up to 46 °C (Radha and Mathew, 2007) [19]. In the areas having distinct winter, the yield tends to increase as well as quality also improves. Nature has endowed guava plants liberally to tolerate the drought and flood condition and adaptability to a wide range of soil and climatic conditions. Its cultural requirement is also very limited. Besides other factors of crop production, varieties play an important role. The present commercial varieties of guava *viz*., Allahabad Safeda, Sardar, Chittidar, Dharidar and Red Fleshed are commonly grown in different agro-climatic regions. The performance of a particular variety in one agro-climatic region may not prove suitable for other regions due to their inherent characters. Its cultivation 2 is common in India, which is concentrated mainly in Uttar Pradesh, Bihar, Madhya Pradesh, Maharashtra and Chhattisgarh. It is widely distributed with highest productivity in M.P, although best quality fruits are produced in Uttar Pradesh. Uttar Pradesh is one of the most important states of India where about half of the total area is under guava and the district Allahabad has reputation of growing the best quality guava in the country as well as in the world (Bose and Mitra, 1985) [7].

Guava is a perennial, evergreen shrub or small tree, the tree can reach 10 meters in height, with spreading branches. The guava tree can easily be recognizable for its smooth, thin, brown bark that flakes off, exposing a greenish layer underneath. Guava tree has perfect flowers with male and female parts in same flower; flowers are white, fragrant, 4 cm wide, borne singly or a few together at leaf axils.

Fruit is round, oval and pear-shaped berry, growing up to 5.0-12.5 cm length. 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) [20]. The food value of whole ripen, guava fruit per 100 g edible portion is calories (36-50 kcal) moisture (77-86 g), crude fiber (2.8 to 5.5 g), protein (0.9 to 1.0 g), fat (0.1 to 0.5 g), carbohydrates (9.5 to 10 g), ash (0.43 to 0.7 g), calcium (9.1 to 17.0 mg), phosphorus (0.03 to 0.04 mg), thiamine (0.0469 mg), niacin (0.6 to 1.068 mg), vitamin A (200 to 400 I.U.), vitamin B3 (40 I.U.)), vitamin- G4 (35 I.U.) (Morton, 1987) [14]. It is found to have pectin up to 2.15 per cent (Adsule and Kadam, 2005) [1].

Guava being a cross-pollinated crop has large variability in size of fruit as well as colour of pulp. This natural variability available within the species is often exploited to identify superior genotypes. Chhattisgarh plains has availability of lines of guava and exists in the form of land races, hence there exists a lot of scope to identify best one amongst wild strains available in plenty. Till date no systematic collection and evaluation of guava cultivars has been carried out in Chhattisgarh. Thus, there is an urgent need for identification, characterization and evaluation of high-yielding genotypes which can be successfully grown on commercial scale in Chhattisgarh.

Material and Methods

The present experiment was carried out during 2021-22 at Department of Fruit Science College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G) in Randomized Block Design with thirty genotypes at which were replicated thrice to identify superior guava genotypes in Chhattisgarh plains.

In-situ genotypes of guava available in different villages in Balod Districts were identified on the basis of information collected from local people which are BG-1, BG-2, BG-3, BG-4, BG-5, BG-6, BG-7, BG-8, BG-9, BG-10, BG-11, BG-12, BG-13, BG-14, BG-15, BG-16, BG-17, BG-18, BG-19, BG-20, BG-21, BG-22, BG-23, BG-24, BG-25, BG-26, BG-27, BG-28, BG-29 and BG-30. The observation were recorded on selected plants for each replication for tree height, number of fruits per plant, Fruit yield per tree (kg), TSS (°Brix), Reducing sugar (%), Total sugar (%) and Non-reducing sugar (%) and Ascorbic acid (mg/100g pulp).

The region has a sub-tropical monsoon climate with three distinct seasons i.e. summer, monsoon and winter. The southwest monsoon starts from June and continues till middle of September, winter season spreads from October to February whereas; summer season extends from March to middle of June. Rainfall is the major source of ground water recharge in the area and receives maximum (85%) rainfall during the southwest monsoon season. The winter rainfall is meagre (10 - 15%). The zone receives high rainfall coupled with comparatively lower temperatures and higher humidity. The average annual rainfall (mean of 50 years) ranges from 1200 to 1600 mm mostly received from June to September with its peak in July and August. The maximum and minimum temperatures during peak summer and winter touch up to 43 °C and 5 °C, respectively.

Result

The presented data (Table 1) revealed that the tree height (m) ranged from 3.79 to 8.27 m with a mean of 6.37. The perusal of data showed that the maximum tree height (8.27 m) was recorded in BG-27 which was at par with the genotype BG-30 (8.17 m) and BG-9 (8.07 m) whereas, the minimum tree height (3.79 m) was recorded in BG-19. As a consequence of the genetic makeup of selected genotypes, they showed variability under different locations. The soil and microclimatic conditions also added in exhibiting the inherent characters of different genotypes. The presence of strong apical dominance in genotypes BG-27, BG-30 and BG-9 may be attributed to maximum tree height. Similar results were obtained in guava by Singh *et al.* (2011) [22], Ulemale and Tambe (2015) [23] and Pandey *et al.* (2016) [15, 16] in guava.

Data regarding number of fruits per plant are presented in Table 1 and observation was drawn regarding the variation in total number of fruits per tree in different genotypes. The maximum number of fruits per plant was observed in the genotype BG-27 (186) which was at par with genotypes BG-8 and BG-30 (184) whereas, minimum number of fruits per plant was found in the genotype BG-19 41 (133). The variation among the genotypes as regards number of fruits per plant might be due to genetic variation, inherent characters, soil condition and climatic adaptability in a particular region, which might prove an important diagnostic character for selection of genotypes for local condition. In many genotypes, number of fruits increased but fruit yield decreased. This may be due to distribution and diversion of available food material in more number of fruits. The variability for a number of fruits per plant have also been reported by Singh (2003) [21] and Athani *et al.* (2007) [2] in guava.

The perusal of data presented in Table 1 indicated a wide variation in fruit yield recorded among different genotypes. The highest fruit yield per plant was observed in the genotype BG-27 (46.53 kg) followed by BG-30 (43.45kg) whereas, lowest yield per plant found in the genotype BG-19 (20.57 kg). The significant variation in yield per tree was reported in present study. Although, the size of the fruit is having varietal character, it may be up to some extent influenced by the total number of fruits born on the tree, age of tree, soil moisture, source sink relation and other factors. Similar results were obtained by Ghosh and Chhattopadhyay (1996) [8] and Aulakh (2005) [3] in guava. However, higher yield in genotypes RJMG-1 and BSPG-2 may be due to maximum spread of the tree produced more number of fruits per tree with greater size of fruits. The result are in agreement of the earlier worker (Babu *et al.*, 2007) [4] in guava.

The data regarding total soluble solids in different genotypes of guava are presented in Table 1. The genotype BG-15 (12.42 ºBrix) recorded the highest TSS, which was found to be at par with BG-14 (12.39°Brix) and BG-28 (12°Brix). The lowest TSS recorded in genotype BG-29 (8.51°Brix). Total soluble solids indicate higher sugar content in the fruits and is considered as one of the important criterion for dessert quality. Higher TSS in the genotypes BG-15, BG-14 and BG-28 might be due the favourable temperature and humidity during the fruit growth period which might have influenced the retention of higher TSS in the ripe fruits. Increase in TSS might be due to conversion of starch and their insoluble carbohydrate into soluble form of sugar content as reported by Bal and Dhaliwal (2004) [5], Gohil *et al.* (2006) [10], Babu *et al.* (2007) [4] and Ghosh *et al.* (2013) [9] in guava.

The data on total sugar of different guava genotype under study are presented in Table 1. The genotype BG-15 recorded the highest total sugar (8.59%) followed by BG-14 (8.14%). The lowest total sugar was recorded in genotype BG-26

(6.12%). The variation observed in total sugar might be as an inherent effect and also influence of agro-climatic conditions. These results are in agreement with Patel *et al.* (2007) [18], Pandey *et al.* (2007) [17] and Mahour *et al.* (2012) [12] in guava.

The data on reducing sugar of different guava genotype under study showed in Table 1 revealed that the genotype BG-15 recorded maximum reducing sugar (5.81%) followed by BG-14 (5.77%) whereas, the minimum reducing sugar was recorded in genotype BG-18 (4.34%). The reducing sugar of fruits from different genotypes varied due to difference in genetic makeup of the genotypes. High reducing sugar in genotypes BG-15 and BG-14 might be attributed to presense of more monosaccharide and disaccharides like glucose and fructose in these genotype's fruits during maturity. This results are in agreement with the findings of Mahour *et al.* (2012) [12], Meena *et al.* (2013) [13] and Pandey *et al.* (2016) [15, 16] in guava.

The data on non-reducing sugar of different guava genotypes under study are presented in Table 1. The genotype BG-15 recorded significantly highest non-reducing sugar (2.48%) followed by BG-14 and BG-21 (2.44%). Whereas, the lowest non-reducing sugar recorded in genotype BG-19 (1.34%). The non-reducing sugar of fruits from different genotypes varied due to difference in genetic makeup of the genotypes. These parameters may vary from place to place depending on climatic factors and management practices. Similar results were also reported by Patel *et al.* (2007) [18], Mahour *et al.* (2012) [12] and Meena *et al.* (2013) [13] in guava.

Table 1: Growth, yield and quality attributes of different guava genotypes.

Genotypes	Tree height (m)	Number of fruits per tree	Fruit yield per tree (kg)	TSS (°Brix)	Reducing sugar (%)	Total sugar (%)	Non reducing (%)
BG-1		169	36.30	10.53	4.35	6.66	2.33
BG-2	6.87	164	25.43	10.49	5.56	7.79	2.34
BG-3	6.56	146	31.40	8.89	4.44	6.27	1.76
BG-4	5.35	167	28.32	11.46	5.29	7.41	1.93
BG-5	7.86	143	30.54	8.82	4.36	6.25	1.87
BG-6	4.65	164	42.47	10.90	4.46	6.72	2.34
BG-7	6.96	165	35.57	10.75	5.16	7.70	1.94
BG-8	7.57	184	35.49	9.18	4.40	6.60	2.35
BG-9	5.31	174	31.23	8.55	5.30	7.44	1.95
BG-10	8.07	164	42.11	8.65	5.63	7.58	2.13
BG-11	7.80	164	24.24	10.28	5.36	7.15	1.86
BG-12	7.82	174	27.26	11.47	5.51	7.83	2.35
BG-13	7.17	161	23.55	10.53	5.61	7.54	1.94
BG-14	5.68	175	42.33	12.39	5.77	8.14	2.44
BG-15	3.83	152	25.35	12.42	5.81	8.59	2.48
BG-16	4.81	174	35.94	9.34	5.46	7.30	1.95
BG-17	4.50	167	41.48	9.95	5.24	6.92	1.66
BG-18	7.94	163	32.48	10.61	4.34	6.57	2.24
BG-19	7.60	133	20.57	9.37	5.62	6.94	1.34
BG-20	3.79	152	32.91	11.20	4.87	6.55	1.68
BG-21	5.14	171	42.39	12.05	4.63	6.88	2.44
BG-22	6.81	167	41.92	11.84	4.56	7.06	2.43
BG-23	5.80	174	25.64	9.71	4.83	6.45	1.88
BG-24	5.66	154	32.08	10.50	4.35	6.59	2.22
BG-25	7.22	167	42.96	11.15	4.63	6.87	2.39
BG-26	7.15	164	25.73	8.74	4.62	6.12	1.68
BG-27	5.84	186	46.53	8.73	5.17	7.19	1.75
BG-28	8.27	163	24.19	12.00	5.21	7.77	2.36
BG-29	5.28	166	24.26	8.51	4.35	6.42	2.13
BG-30	7.81	184	43.45	9.18	5.56	7.24	1.85
Mean	8.17	165	33.14	10.27	5.01	7.09	2.07
C.D.	6.37	2.50	1.90	0.45	0.38	0.38	0.04
SE(m)	0.32	0.88	0.67	0.16	0.14	0.13	0.01
C.V.	0.11	0.93	3.50	2.69	4.67	3.29	1.13

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