Plant Archives Vol. 23, No. 1, 2023 pp.293-297 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2023.v23.no1.049

PHYSICO-CHEMICAL CHARACTERISTICS OF DIFFERENT GUAVA (*PSIDIUM GUAJAVA* L.) CULTIVARS: A REVIEW

Krishan Kumar Singh[1]*, Prabhat Kumar[2], Pooja Rani[1], Pravin Kumar Sharma[1], M.K. Rana[1], Devi Singh[1], O.P. Mehla[1] and Amanpreet Singh Sran[1]

[1]Department of Agriculture, Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala,Haryana, India
[2]Horticulture Commissioner, Ministry of Agriculture & Farmer Welfare, Department of Agriculture & Farmers Welfare Government of India, New Delhi
*Corresponding Author Email: forekrishna@gmail.com
(Date of Receiving : 06-12-2022; Date of Acceptance : 12-03-2023)

ABSTRACT

Guava is commonly known for its food and nutritional value across the world. The medicinal properties of guava fruit, leaf and other parts of the plant are also well known in traditional system of medicine. Since each part of guava plant possesses economic value, it is cultivated on commercial scale. Guava because of its high nutritional value is considered as *poor man's apple* in tropics. Guava is rich in tannins, phenols, triterpenes, flavonoids, essential oils, saponins, carotenoids, lectins, vitamins, fiber and fatty acids. Guava fruit is higher in vitamin C (80 mg/100 g of fruit weight)than citrus andcontains an appreciable amount of vitamin A as well. Guava fruits are also a good source of pectin, which is considered a useful dietary fiber responsible for bowel movement. Its fruits are very rich in antioxidants and vitamins and high in lutein, zeaxanthin and lycopene.Guava being source of flavonoids and quercetin demonstrates antibacterial, antidiarrhea and antidysentery activity, relaxes intestinal muscle and inhibits bowel contractions. Several value-added products, *viz*. jam, jelly, cheese, marmalade,nectar, squash, dried powder, ice cream, *etc*. can be prepared from guava fruits.

Keywords: *Psidium guajava*, cultivar, physical properties, minerals.

Introduction

Guava (*Psidium guajava* L.) is one of the most important commercial fruit crops of India (Tandon *et al.*, 1983), which is the major producer of guava in the world. It is claimed to be the fourth most important fruit in term of area and production after mango, banana and citrus (Jagtiani *et al.,* 1998). It is cultivated in almost all tropical and subtropical parts of the country, *viz*. Uttar Pradesh, Bihar, Madhya Pradesh, Maharashtra, Andhra Pradesh, Tamil Nadu, West Bengal, Assam, Orissa, Karnataka, Kerala, Rajasthan and many more states, however, Allahabad is famous to produce best quality guava in India as well as in the world (Mitra and Bose, 1985).The important varieties cultivated in India are Allahabad Safeda, Lucknow-49, Chittidar, Nagpur Seedless, Bangalore, Arka Mridula, Arka Amulya, Harijha, Hafshi and Allahabad Surkha. Guava bears flowers 2-3 times in a year in North India, *viz.* rainy (July-August), winter (October-November) and spring (March-April) season and distinctly three times in south (Kumar *et al*., 2011; Saroj *et al*., 2020).

Guava is a rich source of minerals like calcium, iron and phosphorus, vitamin A, B_1, B_2, B_3, C, D, E and K including proteins with unique quality to safeguard the human body against many diseases caused due to the deficiency of minerals and vitamins, therefore, it is considered a protective food (Dhaliwal and Dhillon, 2003). Guava fruits are rich in pectin content thus, extensively used for the preparation of jelly. Besides its dietetic value, the fruit is also used for preparing cheese, butter, paste, juice, juice concentrate, powder, canned slice/shell, nectar, puree and ice cream. Guava bark is used medicinally as an astringent to treat diarrhea in children. The flowers are used to treat bronchitis, eye sores and to cool the body. Besides its use as a tonic and laxative, the guava fruitsare also used to prevent and treat scurvy and for the treatment of bleeding gums (Raw *et al*., 2018). Rajore *et al*. (2021) observed that Plant height was maximum in Nasik and L-49 but plant spread was higher in apple colour and chittidar. Maximum fruit length and diameter and fruit weight were observed in cultivar L-49 and Apple colour. The maximum pulp percentage was noted in chittidar and minimum number of seed per fruit and minimum acidity was found in strawberry cultivar.

Physical Characteristics

Fruit weight

The weight and size of the fruit show wide variation due to genetic makeup of various cultivars or genotypes. It is a major quantitative inherited factor determining yield, fruit quality and consumer acceptability. Therefore, the genotype may be expected to produce larger fruits under better cultural practices. In guava, attractive medium-sized fruits are desired by the consumers in the market. Phandis (1970) found that

the weight of guava fruits ranged from 198.4g (Sel. Lucknow 49) to 85g (Sel. Dharwar 34) under Pune conditions. Prakash (1976) compared two cultivars of guava for quality characters and noted maximum fruit weight of cv. Sardar (171g) than the fruit weight of cv. Dharwar (133g). Thonte and Chakrawar (1982) evaluated 11 guava strains under Parbhani conditions and revealed that the average weight of fruit ranged from 327g (ABD1) to 117.50g (BHR1). The weight of fruit ranged between 220.9g (Guness) and 118g (White Flesh) under Lucknow conditions (Tandon *et al.,* 1983). Singh (1988) evaluated 25 guava cultivars under Basti (U.P.) conditions and found that the fruit weight of cv. Florida Seedling and Barafkhana ranged from 51.6to 220g, respectively. Babu *et al.* (2007) evaluated the performance of eight years old guava selections and found the maximum weight of guava fruit for the cultivar Selection 11 (144.20g) followed by Lucknow 49 (140.50g). Biochemical studies of guava done by Kaur *et al*. (2011) who observed a significant variation in fruit yield and fruit weight of different guava cultivars, fruit size (6.5 cm x 5.4 cm) and fruit weight (95g/fruit) being maximum of cultivar Lucknow 49. Miano *et al.* (2010) reported maximum fruit weight (241 g) after four days of storage at room temperature when stored at green stage after wrapping in tissue paper, while at fridge temperature, fruits wrapped in newspaper proved better and had maximum fruit weight (244g). After 8 days of storage, the fruit wrapped in tissue paper had maximum weight (222.63g) at room temperature, while at fridge temperature, the fruit wrapped in newspaper had maximum weight (239.80g). However, in case of yellow and no yellow fruits wrapped in tissue paper had maximum weight on 4th (242.40 g) and 8th day of storage (218.80g) at room and fridge temperature. Patel *et al.* (2011) noticed that the genotype RCGH4 produced largest fruits (184.50g), whereas, the cv. Sangam produced smallest fruits (92.48g). Deshmukh *et al*. (2013) recorded the maximum fruit weight of genotype RCGH4 (183.52g) and minimum of cv. Lalit (138.06 g) followed by RCGH7 (143.15g). Khan *et al*. (2013) revealed that the fruit size of guava cv. Gola was more in winter (133.6g) than in summer (82.5g).In another experiment of Guava, Aslam *et al*. (2014) observed that the cultivar Surahi exhibited bigger fruit size (131.41 g) than thecultivar Gola (99.68 g) during both the seasons. Mehta *et al*. (2016) recorded maximum fruit weight of guava cv. Lucknow 49 (158.08 g).

Fruit length

While comparing the quality characteristics of two guava cultivars fruits, Prakash (1976) recorded fruit length of Sardar cultivar (6.16 cm) more than the fruit length of Dharwar cultivar (6.03 cm). However, under Parbhani conditions, Thonte and Chakrawar (1982) found that ABD1 exhibited maximum fruit length (8.99 cm). Mitra *et al*. (1983) reported length of guava fruit between 5.8(cv. Lucknow49) and 4.2(cv. Seedless) cm under West Bengal conditions. Patel *et al*. (2011) observed that the length of guava fruit varied from 5.16(cv. Sangam) to 7.08(genotype RCG2) cm. Deshmukh *et al*. (2013) noticed maximum fruit length in guava genotype RCG4 (6.54 cm).While working on guava cultivars during 2010 and 2011, Aslam *et al.* (2014) observed that the cultivar Surahi (81.64 mm in winter and 49.74 mm in summer) showed more fruit length as compared to cv. Gola (62.32 mm in winter and 37.63 mm in summer). Mehta *et al*. (2016) recorded maximum fruit length of cultivar Lucknow 49 (6.10 cm).

Fruit diameter

According to Patel *et al.* (2011), the cultivar RCGH 4 produced the fruits of maximum diameter (7.08 cm), while the cultivar RCG1 produced the fruits of minimum diameter (5.25 cm). However, it was recorded 5.80(cv. Seedless) to 4.60(cv. Strawberry) cm under Punjab conditions (Aulakh, 2005). Among 11 cultivars of guava, the cultivar Pant Prabhat produced fruits ofmore diameter (7.13 cm) followed by IIHR Hybrid21 (6.75 cm) as reported by Pandey *et al*. (2007). Patel *et al*. (2007) evaluated five years old six genetically diverse hybrids / cultivars under Meghalaya conditions and found that the fruit diameter ranged from 6.91(cv. Lucknow-49) to 5.63(Hybrid2) cm. Deshmukh *et al*. (2013) harvested fruits of maximum diameter from the plants of genotype RCGH4 (6.99 cm) and of minimum diameter from the plants of cv. Allahabad Safeda (6.15 cm). Binepal *et al.* (2013) noticed maximum fruit diameter (7.91 cm), fruit length (7.52 cm) and volume of fruit (217.41 ml) in cultivar T9 under conditions of Madhya Pradesh Malwa plateau. Aslam *et al.* (2014) noted 65.21 mm width of Gola fruits in winter and 47.29 mm in summer, which was more than the width of Surahi cultivar fruits in winter (61.07 mm) and in summer (47.85 mm). Mehta *et al*. (2016) showed maximum diameter of guava fruits of Lucknow 49 cultivar (6.45 cm).

Fruit volume

Under Bangalore conditions, the volume of guava fruits ranged from 119.40(TG sel. 6/8) to 69.20(TG sel. 5/5) ml among ten seedling progenies of Taiwan guava (Biradar and Mukunda, 2007). While studying 12 different guava cultivars under Pantnagar conditions, Raghav and Tiwari (2008) observed variation in fruit volume ranging from 17.88 to 209.68 ml. Dolkar *et al.* (2014) conducted a trial on growth and yield attributes of commercial guava (*Psidium guajava* L.) cultivars under subtropical conditions of Jammu (India) and recorded maximum fruit volume in cultivar L49 (141.25 ml) followed by Hisar Safeda (132.75 ml), Hisar Surkha (126.24 ml), Allahabad Safeda (119.75 ml), Lalit (110.25 ml), ArkaAmulya (109.50 ml) and minimum in cv. Pant Prabhat (108.20 ml).Mehta *et al*. (2016) noted maximum volume of fruits (160.87 ml) in cultivar Lucknow 49.

Number of seeds per 100 g fruit weight

In a study conducted on 272 open pollinated seedling progenies of Apple Colour, Marak and Mukunda (2007) noticed that the fruits of A.C. Sel. 6/10 had a smaller number of seeds per fruit (142). The study of Patel *et al.* (2011) reveals that the genotype RCG11 had minimum number of seeds per 100g fruit weight (53.29 seeds),whereas, the genotype RCG 2 had maximum number of seeds per 100 g fruit weight (361.44 seeds) followed by RCG3 (358.08 seeds) and RCG1 (310.32 seeds). Shukla *et al.* (2012) recorded seeds in the range of 125 to 450 per fruit. Among the hybrids and cultivars of guava, Deshmukh *et al.* (2013) observed a wide variation with respect to number of seeds per 100g fruit weight, which was recorded minimum in cultivar RCGH7 (111.18 seeds) and maximum in cultivar Lalit (169.07 seeds), followed by RCGH 1 (140.31 seeds) and Allahabad Safeda (145.41 seeds). Bisen *et al.* (2014) noticed maximum number of seeds (327.37 and 325.96) in fruits harvested from the plants supplied with T_{16} (C_3+G_3) and minimum (299.00 and

304.51 seeds) in fruits harvested from the control plants in 2009-10 and 2010-11, respectively. Dolkar *et al.* (2014) noticed maximum number of seeds in fruits of cultivar Arka Amulya (380.25) followed by Pant Prabhat (300.50) and minimum in fruits of cultivar Lalit (205.75).Kumar *et al.* (2015) observed that smaller number of seeds per fruit is a desirable character, which is due to the more pulp area of fruit though different genotypes. They also found maximum number of seeds in fruits of genotype GWS8 (352.89) followed by the genotype GWS5 (314.77) and lowest number of seeds in fruits of genotype GRS4 (194.33) followed by GRS2 (209.55). Mehta *et al*. (2016) showed maximum number of seeds per 100 g fruit weight (146.51 gm) in fruits of Lucknow 49 cultivar.

Specific gravity

In a trail on storage of guava, Miano *et al.* (2010) observed that yellow fruits had the maximum specific gravity (0.96 and 1.11) after 4 days of storage at room temperature respectively under plastic bags. However yellow fruits of fridge temperature after 12 days of storage had the maximum specific gravity (1.84) under tissue wrappers. Mehta *et al*. (2016) recorded maximum specific gravity of fruit (0.99 ml) under guava fruit cultivar Lucknow 49.

Chemical Characteristics

Total soluble solids

Taste is a balance between acids, sugars and volatiles present in fruits. Babu *et al.* (2002) estimated 11.88, 10.20 and 9.35% total soluble solids in fruits of genotype RCG11, RCGH7 and Lalit, respectively. The lower total soluble solids content among varieties of different regions might be due to difference in soil and climatic conditions of the growing region (Aulakh, 2004). Dutta *et al*. (2009) measured total soluble solids 11.80° Brixin fruits of Sardar Guava cultivar. Adrees (2010) analysed nutritional value of different guava varieties, which revealed total soluble solids between 7.64 and 11.87%, with maximum value in fruits of Safaida cultivar. Miano *et al.* (2010) recorded maximum increase in total soluble solids of green mature guava fruits after 4 days of storage in tissue wrappers (11.36^{o} Brix) followed by news papers (11.33^{o}Brix) after 8 days of storage, however, the yellow fruits had the maximum total soluble solids (12.23^{o}Brix) after 8 days of storage at room temperature in news papers followed by storage after 4 days (12.08^{o}Brix). Kaur *et al*. (2011) noticed significant variation in total soluble solids of different cultivars fruits with more total soluble solids (11.0%) in fruits of Allahabad Safeda cultivar than the fruits of Lucknow 49 cultivar (10.8%). In Bangladesh, Nag *et al.* (2011) found chemical changes in fruits of different guava varieties during different ripening stages and observed maximum total soluble solids in fruits of Swarupkathi cultivar (11.60%) at last ripening stage followed by the cultivar Mukundapuri (10.75%), Local (9.48%) and Kazipiara (7.93). The total soluble solids (11.82°Brix) were recorded maximum in guava fruits of Lucknow 49 cultivar (Mehta *et al*., 2016).

Acidity (Citric acid)

In fruits of Sardar Guava cultivar, Dutta *et al*. (2009) estimated 0.441% acidity. Patel *et al.* (2011) recorded minimum acidity in fruits of cultivar RCGH7 (0.45%) followed by RCG11 (0.46%), RCG1 (0.48%), RCG2 (0.49%), RCGH1 (0.51%), RCG3 (0.52%) and L49 (0.55%) and maximum in fruits of Sangam cultivar (0.65%). In Bangladesh, Nag *et al.* (2011) observed maximum acidity in fruits of Local variety (0.39%) than the acidity in fruits of Kazipiara (0.32%), Swarupkathi (0.31%) and Mukundapuri (0.24%) at ripening stage. Aslam *et al.* (2014) estimated titrable acidity in fruits of cultivar Surahi and Gola 0.88 and 0.98% in summer and 0.70 and 0.83% in winter, respectively.

Total sugars

Sugar is one of the important ingredients for the preparation of value-added durable products from guava, and its high content offers pleasant taste to the fruit. As the guava ripens, the total soluble solids and total sugars increase in both peel and pulp, whereas, the titratable acidity declines after reaching its climacteric peak. In general, the climacteric fruits undergo considerable changes in sugar content during ripening. Dutta *et al*. (2009) observed total sugars 9.58% in fruits of Sardar Guava cultivar. Shukla *et al*. (2009) obtained significantly higher fruit weight (153.30 g), total soluble solids (14%), ascorbic acid (198.30 mg/100 g pulp), reducing sugars (4.77%) and total sugars (8.10%) with the combined application of 50% dose of recommended NPK + 50kg farmyard manure + 250g *Azotobacter*. A trial conducted in Pakistan on nutritional quality evaluation of by Adrees (2010) who estimated the content of total sugars from 4.33 to 6.36% in guava fruits of different varieties. Among different cultivars, Kaur *et al*. (2011) noticed that the content of total sugars varied significantly, being highest in fruits of Allahabad Safeda cultivar (3.60%) followed by Lucknow49 (3.41%). Patel *at el*. (2011) studied variability among guava genotypes in Meghalaya and recorded maximum total sugars in fruits of genotype RCGH7 (8.39%) followed by genotype RCGH1 (8.28%) and GCG11 (8.12%), while minimum in genotype RCG3 (6.04%). A trial conducted on comparative studies of guava hybrids at mid hills of Nagaland (India) by Deshmukh *et al*. (2013) who estimated the maximum total sugars in fruits of genotype RCGH1 (8.07%) followed by the cultivar RCGH7 (8.05%), while the minimum in cultivar RCGH4 (6.42%) followed by the cultivar Lalit (6.58%). Mehta *et al*. (2016) recorded maximum content of total sugars (7.38%) in fruits of guava cv. Allahabad Safeda.

Pectin content

High pectin content leads to high production of ascorbic acid in guava as pectin degradation is linked with ascorbic acid production. The galacturonic acids are substrate needed in the synthesis of ascorbic acid and period of ascorbic acid accumulation corresponded with falling of pectin content in fruit. Chyan *et al*. (1992) reported higher pectin content in guava fruit at mature green stage than in the ripe stage, while in fruits of a Shambati and Shendi cultivars, the total pectin content was higher at ripe stage than at mature green stage. The explanation for this difference may lie in chemical activity as well as quantitative differences between pectic enzymes of the cultivars. Babu *et al*. (2002) observed maximum pectin content in fruits of guava genotype RCGH7 (1.38%) followed by the genotype RCGH1 (1.35%), RCG3 (1.30%) and RCH11 (1.29%), while lowest in fruits of genotype RCG2 (0.82%) followed by the genotype RCG1 (0.87%). According to Deshmukh *et al*. (2013), the pectin content was maximum in fruits of genotype RCGH1 (1.33%) followed by the genotype RCGH7 (1.31%). Simultaneously, they found significant variations among the hybrids and cultivars with respect to pectin content. Mehta *et al*. (2016)

observed maximum pectin content (0.98%) in fruits of guava cv. Allahabad Safeda.

Ascorbic acid

Guava is considered as an outstanding source of ascorbic acid, which is three to six times higher than the content of an orange, and after acerola cherries, it has the second maximum concentration among all the fruits. Fruit variety is one of the main factors affecting ascorbic acid content in guava, influencing more than ripening stage or storage conditions (Mitra, 1997). Ram and Rajput (2000) reported that ascorbic acid increased with the increase in moisture content, being maximum in guava fruits of Sardar and Allahabad Safeda cultivar (336.34 and 261.51 mg/100 g, respectively) at 23.30% soil moisture during third week of December. Within the fruit, the ascorbic acid is concentrated in the fruit skin followed by mesocarp and endocarp. Bashir and Abu-Goukh (2002) reported 800 and 670 mg ascorbic acid per kilogram fruit weight for white and pink cultivar of guava, respectively. Dutta *et al*. (2009) noted 128.52 mg ascorbic acid per 100 g fruit pulp of Sardar Guava cultivar. In another study on evaluation of nutritional quality of different guava varieties by Adrees (2010), the content of ascorbic acid ranged from 136.5 to 220.4mg/100g fruit weight. Among different genotypes, Patel *et al*. (2011) revealed maximum value of ascorbic acid (246mg/100g) in fruits of genotype RCGH1 and lowest in fruits of genotype RCG 3 (149.13 mg/100g). Deshmukh *et al.* (2013) recorded maximum ascorbic acid in fruits of guava genotype RCGH 1 (231.86 mg/100 g) followed by the genotype RCGH 7 (205.26 mg/100 g) and minimum in fruits of Lalit cultivar (168.78 mg/100 g). In summer, Aslam *et al.* (2014) estimated ascorbic acid in fruits of guava cultivar Surahi and Gola and found maximum ascorbic acid in fruits of cultivar Surahi and Gola (729.04 and 279.04 mg/100 g, respectively). Bisen *et al.* (2014) noticed that pre-harvest treatments with calcium nitrate alone (247.18 and 266.56 mg/100g) or in combination with higher concentration of GA_3 (246.62 and 269.12 mg/100g) showed greater ascorbic acid at different storage period, respectively. Mehta *et al*. (2016) showed maximum ascorbic acid in fruits of guava cv. Allahabad Safeda (230.44 mg/100 g).

Conclusion

Guava is cultivated in almost all parts of the country. Allahabad is famous to produce best quality fruits of guava in India as well as in the world. The weight and size of the fruit show wide variation due to genetic makeup of various genotypes. It is a major quantitative inherited factor determining yield, fruit quality and consumer acceptability. Therefore, the genotype may be expected to produce larger fruits under better cultural practices. In guava, medium-size attractive fruits are preferred by the consumers in the market.

References

Adrees, M.; Younis, M.; Farooq, U. and Hussain, K. (2010). Nutritional quality evaluation of different guava varieties. *Pak. J. Agri. Sci*., 47(1): 1-4.

Aslam, H.K.W.; Shakeel, A.; Naheed, N.; Raheem, M.I.; Shoaib, M.; Sakandar, H.A. and Ramzan, R. (2014). Comparative study of physical and biochemical characteristics of guava fruit (*Psidium guajava* L.) cv. Gola and Surahi during summer and winter season.*J. Glob. Innov. agric. Soc. Sci*., 2(2): 88-92.

Aulakh, P.S. (2004). Effect of seasonal variation on yield and fruit quality of some promising guava cultivars under arid irrigated region of Punjab. *Haryana J. hortic. Sci*., 33: 170-171.

Aulakh, P.S. (2005). Performance of different guava cultivars under the arid irrigated conditions of Punjab. *Prog. Hort*., 37: 328-330.

Babu, K.D. and Yadav, D.S. (2002). Screening of guava hybrids for yield and quality traits. *South Indian Hort*., 50: 190-194.

Babu, K.D.; Dubey, A.K. and Yadav, D.S. (2002). Evaluation of guava cultivars for their performance under mid hill altitude of Meghalaya. *Indian J. Hill Farming*, 15: 119-121.

Babu, K.D.; Patel, R.K. and Yadav, D.S. (2007). Comparative evaluation of guava selection under North-Eastern region of India. *Acta Hort*., 735: 99-103.

Bashir, H.A. and Abu-Goukh, A. (2002). Compositional changes during guava fruit ripening. *Food Chem*., 80: 557-563.

Bashir, H.A. and Abu-Goukh, A.A. (2003). Compositional changes during guava fruit ripening. *Food Chem*., 80(4): 557-563.

Binepal, M.K.; Tiwari, R. and Kumawat, B.R. (2013). Effect of integrated nutrient management on physico-chemical parameters of guava under malwa plateau conditions of Madhya Pradesh. *Ann. Pl. Soil Res.,* 15(1): 47-49.

Biradar, S.L. and Mukunda, G.K. (2007). TG Seln. 5/12 A promising genotype of taiwan guava from Bangalore. *Acta Hort*., 735: 85-89.

Bisen, S.; Thakur, R.S. and Tembhare, D. (2014). Effect of calcium nitrate and gibberellic acidapplication on growth, fruit quality and post-harvestbehaviour of guava fruit. *The Ecoscan*., 6: 55-62.

Chyan, C.C.; Chen, S.Y. and Wu, C.M. (1992). Differences of volatile and non-volatile constituents between mature and ripe guava (*Psidium guava* L). *J. Agric. Food Chem*., 40: 846-849.

Deshmukh, N.A.; Lyngdoh, P.; Jha, A.K.; Patel, R.K. and Deka, B.C. (2013). Comparative study on newly developed guava hybrids with commercial cultivars under mid-hills of NE-India. *The Bioscan*., 8(4): 1467-1470.

Dhaliwal, G.S. and Dhillon, S.K. (2003). Effect of tree size on physico-chemical characteristics of fruits of guava cv. Sardar. *Indian J. Hort*., 60: 312-317.

Dolkar, D.; Bakshi, P.; Wali, V.K.; Bhushan, B. and Sharma, A. (2014). Growth and yield attributes of commercial guava (*Psidium guajava* L.) cultivars under sub-tropical condition. *Indian J. Plant Physiol.,* 19: 79-82.

Dutta, P.; Maji, S.B. and Das, B.C. (2009). Studies on the response of bio-fertilizer on growth and productivity of guava cv. Sardar. *Indian J. Hort*., 66(1): 39-42.

Jagtiani, J.; Chang, H.T. and Sakai, W.S. (1999). *Guava: Tropical Fruit Processing*. Academic Press, New York, USA.

Kaur, N.; Kumar, A.; Monga, P.K. and Arora, P.K. (2011). Biochemical studies in fruits of guava cultivars. *The Asian J. Hort*., 6(1): 122-123.

Khan, A.S.; Khan, M.R.G.; Malik, A.U.; Rajwana, I.A. Tayyaba Shaheen, T. and Bakhsh, A. (2013). Influence of defoliation and deblossoming on fruit quality of guava (*Psidium guajava* L.) Cv. Gola.*Pak. J. Bot*., 45(2): 563-570.

Kumar, B.; Mistry, N.C.; Singh, B. and Gandhi, C.P. (2011). Indian Horticulture Database, National Horticulture Board (NHB), Gurgaon. Department of Agriculture and Cooperation, Government of India, pp. 76-83.

Kumar, P.; Ulemale, H. and Tambe, T.B. (2015). Performance of guava genotype to qualitative and yield attributes. *The Bioscan*., 10(2): 781-784.

Marak, J.K. and Mukunda, G.K. (2007). Studies on the performance of open pollinated seedling progenies of guava cv. Apple Colour. *Acta Hort*., 735: 79-84.

Mehta, S.K.; Singh, K.K.; Jat, D.K. and Rana, D.K. (2016). Comparative studies of physico-chemical characteristics of various cultivars of guava (*Psidium guajava* L.) under sub tropical valley condition of Garhwal Himalaya Uttarakhand, India. *Pl. Arch.,* 16(1): 361-364.

Miano, T.F.; Jokhio, J.A. and Miano, T.F. (2010). Effect of different packaging materials and storage conditions on physico-chemical characteristics of guava var. Allahabadi. *J. Agrofor. Environ*., 4(2): 33-36.

Mitra, S.K. and Bose, T.K. (1990). *Fruits: Tropical and Subtropical*. Naya Prokash, 206 Bidhan Sarani, Calcutta, West Bengal, India, pp. 280-301.

Mitra, S.K.; Maiti, S.C.; Sen, S.K. and Bose, T.K. 1983. Physico-chemical characters of some guava varieties of West Bengal. *South Indian Hort*.; 31: 62-69.

Nag, A.R.; Chatterjee, D.D.; Roy, T.; Hossain, A.M.M.Z. and Haque, M.A. (2011). Study on chemical changes of different guava varieties during different ripening stage. *Bangladesh Res. Pub. J.,* 6(2): 217-224.

Pandey, K.K.; Sharma, A.B. and Patel, M.P. (1997). The varietal evaluation of guava (*Psidium guajava* L.). *Adv. Pl. Sci*., 10: 157-163.

Patel, R.K.; Yadav, D.S.; Babu, K.D.; Singh, A. and Yadav, R.M. (2007). Growth, yield and quality of various guava (*Psidium guajava* L.) hybrids/cultivars under mid hills of Meghalaya. *Acta Hortic*., 735: 57-59.

Phandis, N.A. 1970. Improvement of guava (*Psidium guajava* L.) by selection in Maharashtra*. Indian J. Hort*., 27: 99-105.

Prakash, N.A. (1976). Studies on growth and fruiting in sardar guava (*Psidium guajava* L.). M.Sc. (Agri.) Thesis, Univ. Agric. Sci.; Bangalore, Karnataka (India).

Raghav, M. and Tiwari, J.P. (2008). Genetic variability and correlation analysis in guava. *Indian J. Hort*., 65(3): 263-270.

Rajore, M.; Kanwar, J.; Rathore, G.P.S. and Kachouli, B. (2021). Evaluation of guava (*Psidium guajava* L.) cultivars for morphological, yield and quality attributes under Malwa plateau conditions. *Journal of Pharmacognosy and Phytochemistry*, 10(2): 483-485.

Ram, R.A. and Rajput, M.S. (2000). Effect of frequent winter rains on fruit quality of two commercial cultivars of guava (*Psidium guajava* L.). *Ann. Agri. Res*.; 21: 369-373.

Rao, R.K. and Chaudhary, S.P. (2018). Guava (*Psidium Guajava* L.): A Comprehensive Review. Indian *J. Agri. and Allied Sci*.; 4(2): 88-100.

Saroj and Singh, K.K. (2020). Vegetative Propagation of Guava (*Psidium Guajava* L.) Through air Layering: A review. *Plant Archives*., 20(1): 1179-1188.

Shukla, A.K.; Sarolia D.K.; Kumari, B.; Kaushik, R.A.; Mahawer, L.N. and Bairwa, H.L. (2009). Evaluation of substrate dynamics for integrated nutrient management under high density planting of guava cv. *Sardar. Indian J. Hort.,* 66(4): 461-464.

Shukla, A.K.; Sarolia, D.K.; Mahawar, L.N.; Bairwara, H.L.; Kaushik, R.A. and Sharma, R. (2012). Genetic variability of guava (*Psidium guajava* L.) and its prospects for crop improvement. *Indian J. Plant Genet. Res*., 25(2): 157-160.

Singh, M. (1988). Performance of some cultivars of guava (*Psidium guajava* L.) with special reference to their commercial significance in the Central Gangatic Plains. *Punjab Hort. J*.,; 28(1-2): 50-55.

Tandon, D.K.; Kalra, S.K.; Singh, H. and Chadha, K.L. (1983). Physico-chemical characteristics of some guava varieties. *Prog. Hort*., 15: 42-44.

Thonte, G.T. and Chakrawar, V.R. (1982). Physico-chemical characters of the certain types/strains of guava (*Psidium guajava* L.).*Prog. Hort*., 14: 269-272.