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Studies on flowering behavior in guava genotypes of Jabalpur region

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Abstract

A study was conducted to assess the flowering behaviour of 33 guava genotypes of Jabalpur district of MP. Under this study, various guava genotypes were evaluated for their flowering characteristics over two consecutive years. Genotype JG-309 consistently exhibited the earliest flowering, while late flowering was observed in genotypes JG-311 and JG-330. The timing of full bloom varied among genotypes as influenced by both genetic factors and environmental conditions. Significant diversity was observed in the number of floral buds (11.66 to 16) and open flowers per shoot (11.33 to 13.16) across genotypes, reflecting variations in reproductive capacity. Understanding these variations is crucial for effective orchard management, including pruning, fertilization and pest control. Moreover, the duration of flowering (23 to 48 days) varied widely among genotypes, with implications for harvest timing and fruit quality. Genotypes were categorized into short, medium and long flowering duration groups, highlighting the influence of varietal characteristics and local climate on flowering dynamics. These findings contribute to our understanding of guava flowering patterns and provide insights for optimizing cultivation practices to enhance yield and fruit quality.

Keywords: guava genotypes, *Psidium guajava* L, Genotype JG-309, Jabalpur region

Introduction

Guava (*Psidium guajava* L.), an indigenous tree to Central America is now grown in many subtropical and tropical areas throughout India and is known for its exquisite fruit and several health advantages. According to Singh *et al.* (2016) [8], guava is considered one of the most delectable tropical fruit harvests globally, including in India. Guava is highly admired for its remarkable blossoming behaviour. In tropical climates, where there is an abundance of heat and moisture, fruit production occurs almost continually. However, in a sub-tropical environment, there are three separate seasons of development and fruiting. Guava trees generally undergo three annual blooming cycles, with the frequency and intensity of flowering being subject to variations influenced by variables such as climate, soil conditions, tree age and variety. If the temperatures are high and the humidity is low, the fruit setting and fruit growth are adversely affected (Dhaliwal and Singla, 2002) [2]. The Ambe bahar in which blooming occurs from February to March and fruit ripening takes place in July to August. The Mrig bahar season, on the other hand, has flowering from June to July and fruit ripening from October to December. Lastly, the Hast bahar season has flowering from October to November with fruit ripening occurring from February to April (Shukla *et al.*, 2008) [7]. In areas characterised by a warm and humid environment, guava trees have the ability to bloom consistently all year round, but in colder places, blooming tends to occur during certain seasons. The guava tree produces little, white blossoms that often allure bees, butterflies and other pollinators. The blooms are produced individually or in groups inside the leaf axils. Guava blooms are usually hermaphroditic, meaning they have both male and female reproductive organs (Sehgal 1965) [5]. However, some varieties of guava may have flowers with either functional stamens and non-functional pistils, or functional pistils and non-functional stamens. India is a leading worldwide producer of guava, with a total output of 50 lakh metric tonnes in 2022 (Ministry of Agriculture and Farmers Welfare, 2022). Madhya Pradesh accounts for around 17.20% of India's total output.

The timing and amount of blooming in guava trees have a substantial effect on fruit yield. Timely blooming, followed by effective pollination, is crucial for achieving maximum fruit production and crop output. Temperature, rainfall, pollinator availability and varietal characteristics are key factors that significantly influence the success of blooming and the subsequent production of fruit. Studying the blooming behaviour may be beneficial for choosing genotypes with certain traits like as early flowering, early maturity and increased fruit setting. A broad spectrum of variability consistently offers a greater potential for choosing favourable kinds (Vavilov, 1951)^[9]. In 2011^[6], Sharma proposed that the continuous variation seen in qualitative characteristics, which are the focus of plant breeders, is made up of both heritable and non-heritable factors.

Materials and Methods

Plant Material

A total of 33 genotypes were chosen to explore the floral diversity in guava. Out of them, three genotypes were designated as checks, namely Allahabad Safeda, L-49 and Chittidar variety. The 27 genotypes were marked for study at the Fruit Research Station, Imaliya, Department of Horticulture, College of Agriculture, JNKVV, Jabalpur (M.P.), while the remaining 6 were identified at farmers' field in the Kundam and Majhauhi blocks of Jabalpur district. These plants ranged in age from 8 to 13 years. An experiment was conducted in the years 2022 to 2024 for floral diversity in respect to date of full bloom, number of floral buds per shoot, number of open flowers per shoot, date of end of flowering and duration of flowering (days). The methodologies adopted for these parameters are as follows:

Date of first flowering

The marked trees/genotypes included in the research were consistently observed on regular basis from June to September for two consecutive years (2022 to 2023) to document the first occurrence of flowering.

Date of full bloom

The study monitored the trees regularly from June to September for two consecutive years (2022 to 2023) to record the specific day when each genotype reached its peak blooming period.

Number of floral buds per shoot

The number of floral buds per shoot was determined by counting in randomly chosen five tagged shoots with 50 cm length in each direction and the average was calculated.

Number of open flowers per shoot

The number of open flowers per shoot was determined by counting in randomly chosen five tagged shoots with 50 cm in each direction and the average was calculated.

Date of end of flowering

The study monitored the trees regularly from June to September for two consecutive years (2022 to 2023) to record the specific date when each genotype reached its end of flowering.

Duration of flowering (Days)

The trees included in the research were consistently observed every other day from June to September in two consecutive years (2022 to 2023) to document the duration of flowering by count days between first flowering to end of flowering in each genotype.

All the genotypes were categorized into three different groups

(Short duration, Medium duration and long duration) of flowering duration. Genotypes which flowers less than 25 days are considered short duration of flowering, medium duration of flowering includes genotypes that flowers between 26 to 40 days and the genotypes which have more than 40 days of flowering are classified under long duration of flowering.

Statistical analysis:

For analyzing the survey data of these genotypes, descriptive statistics provided the measure of mean, minimum, maximum, standard deviation and coefficient of variation.

Result and Discussion

The earliest date of first flowering in both years, 9 July, 2022 and 21 July, 2023, respectively was recorded in genotype JG-309. The genotype JG-311 showed a delay in the first flowering's commencement in the first year i.e. 9 October, 2022. In a similar vein, the genotype JG-330 exhibited a delay in the first flowering's onset on 16 October 2023, during the second year (Deshpande (2006)^[11] and Sastry (1965)^[12]. Chatterjee *et al.* (1992)^[13]. Syamal (1980)^[14] also demonstrated changes in the flowering duration under various environmental circumstances in previous experiments. The results showed how different guava genotypes have different blooming dynamics. The differences in flowering dates across guava genotypes are largely due to genetic and environmental variables. Every genotype has innate characteristics that control when it's flowering and how it reacts to external cues. Singh *et al.*, (2015)^[15] reported that different genotypes with early blooming inclinations and others that may flower later in the season can result in different flowering times due to variations in their genetic makeup.

Genotype JG-305 had the earliest full bloom date (20 July 2022) and JG-311 had the last full blooming date (17 October 2022). In the subsequent year, genotype JG-309 revealed an early date of full bloom (5 August 2023), while JG-311 showed a prolonged date of full bloom (29 October 2023).

The first-year data of the experiment indicated that genotype JG-322 had the highest number of floral buds per shoot (16.33), while genotype JG-314 had the lowest number of floral buds (11.67). The mean value was 13.37 with an 8.54% coefficient of variance. Additionally, it was found that genotype JG-322 had a maximum of 15.67 floral buds per shoot in the second year of observation while JG-314 had a minimum of 11.67 floral buds per shoot. According to pooled data, the number of floral buds per shoot ranged from 11.67 (JG-314) to 16 (JG-322), with a mean value of 13.77. The coefficient of variance for the pooled data was 8.26%. Floral bud and flower output variability is essential for successful guava growing techniques. It offers information about the reproductive capacity of various genotypes, which can help with decisions about best to prune, fertilise and control pests in orchards. Furthermore, understanding flowering patterns can help to maximise the timing of harvest and pollination techniques, which will eventually improve fruit quality and output. These results are in consistent with Menzel & Paxton (1986)^[4], Lal & Goswami (2013)^[16]. And Rathore & Singh (1974)^[10].

The data pertaining to open flowers per shoot in which during the initial year, genotype JG-305 was found to have the highest number of open flowers per shoot (13) while genotypes JG-322 and JG-325 have the lowest number of open flowers (11.33). The trait's mean value was 12.19 and its coefficient of variance was 3.60%. In the second year, JG-307 recorded the largest number of open flowers per shoot (13.67), while JG-322

recorded the lowest number of open flowers per shoot (11.33), with a mean trait value of 12.36 and coefficient of variance was 4.36%. Pooled data showed that open flowers per shoot were

ranged 11.33 (JG-322) to 13.17 (JG-307) with mean value 12.28. The coefficient of variance was 4.31% for the pooled data.

Table 1: Date of first flowering and date of full bloom in different guava genotypes

Genotypes	Date of first flowering		Date of full bloom	
	2022	2023	2022	2023
JG-301	17 July 2022	01 Aug. 2023	28 July 2022	12 Aug. 2023
JG-302	04 Aug. 2022	18 Aug. 2023	14 Aug. 2022	28 Aug. 2023
JG-303	02 Aug. 2022	23 Aug. 2023	17 Aug. 2022	07 Sept. 2023
JG-304	25 July 2022	12 Aug. 2023	05 Aug. 2022	23 Aug. 2023
JG-305	10 July 2022	28 July 2023	20 July 2022	07 Aug. 2023
JG-306	04 Aug. 2022	22 Aug. 2023	12 Aug. 2022	30 Aug. 2023
JG-307	15 Aug. 2022	02 Sept. 2023	29 Aug. 2022	16 Sept. 2023
JG-308	25 Aug. 2022	09 Sept. 2023	13 Sept. 2022	28 Sept. 2023
JG-309	09 July 2022	21 July 2023	24 July 2022	05 Aug. 2023
JG-310	04 Aug. 2022	16 Aug. 2023	12 Aug. 2022	24 Aug. 2023
JG-311	03 Sept. 2022	15 Sept. 2023	17 Sept. 2022	29 Sept. 2023
JG-312	17 July 2022	29 July 2023	27 July 2022	08 Aug. 2023
JG-313	21 Aug. 2022	02 Sept. 2023	02 Sept. 2022	14 Sept. 2023
JG-314	30 July 2022	14 Aug. 2023	09 Aug. 2022	24 Aug. 2023
JG-315	18 July 2022	02 Aug. 2023	02 Aug. 2022	17 Aug. 2023
JG-316	09 Aug. 2022	24 Aug. 2023	20 Aug. 2022	04 Sept. 2023
JG-317	05 Aug. 2022	22 Aug. 2023	24 Aug. 2022	10 Sept. 2023
JG-318	07 Aug. 2022	22 Aug. 2023	23 Aug. 2022	07 Sept. 2023
JG-319	13 Aug. 2022	28 Aug. 2023	03 Sept. 2022	18 Sept. 2023
JG-320	09 Aug. 2022	27 Aug. 2023	29 Aug. 2022	16 Sept. 2023
JG-321	07 Aug. 2022	22 Aug. 2023	21 Aug. 2022	05 Sept. 2023
JG-322	02 Aug. 2022	17 Aug. 2023	12 Aug. 2022	27 Aug. 2023
JG-323	05 Aug. 2022	30 Aug. 2023	25 Aug. 2022	19 Sept. 2023
JG-324	03 Aug. 2022	18 Aug. 2023	24 Aug. 2022	08 Sept. 2023
JG-325	23 Aug. 2022	14 Sept. 2023	04 Sept. 2022	26 Sept. 2023
JG-326	27 Aug. 2022	11 Sept. 2023	04 Sept. 2022	19 Sept. 2023
JG-327	25 Aug. 2022	09 Sept. 2023	01 Sept. 2022	16 Sept. 2023
JG-328	19 Aug. 2022	04 Sept. 2023	11 Sept. 2022	27 Sept. 2023
JG-329	13 Aug. 2022	29 Aug. 2023	24 Aug. 2022	09 Sept. 2023
JG-330	31 Aug. 2022	16 Sept. 2023	10 Sept. 2022	26 Sept. 2023
Allahabad Safeda	09 Aug. 2022	25 Aug. 2023	16 Aug. 2022	01 Sept. 2023
L-49	07 Aug. 2022	23 Aug. 2023	15 Aug. 2022	31 Aug. 2023
Chittidar	23 July 2022	08 Aug. 2023	02 Aug. 2022	18 Aug. 2023

Table 2: Date of end of flowering in different guava genotypes

Genotypes	Date of end of flowering	
	2022	2023
JG-301	14 Aug. 2022	31 Aug. 2023
JG-302	09 Sept. 2022	23 Sept. 2023
JG-303	07 Sept. 2022	02 Oct. 2023
JG-304	04 Sept. 2022	22 Sept. 2023
JG-305	19 Aug. 2022	08 Sept. 2023
JG-306	04 Sept. 2022	22 Sept. 2023
JG-307	11 Sept. 2022	26 Sept. 2023
JG-308	03 Oct. 2022	18 Oct. 2023
JG-309	20 Aug. 2022	02 Sept. 2023
JG-310	04 Sept. 2022	20 Sept. 2023
JG-311	02 Oct. 2022	14 Oct. 2023
JG-312	18 Aug. 2022	05 Sept. 2023
JG-313	23 Sept. 2022	05 Oct. 2023
JG-314	30 Aug. 2022	14 Sept. 2023
JG-315	20 Aug. 2022	08 Sept. 2023
JG-316	13 Sept. 2022	28 Sept. 2023
JG-317	07 Sept. 2022	27 Sept. 2023
JG-318	16 Sept. 2022	01 Oct. 2023
JG-319	22 Sept. 2022	12 Oct. 2023
JG-320	20 Sept. 2022	08 Oct. 2023
JG-321	05 Sept. 2022	20 Sept. 2023
JG-322	16 Sept. 2022	07 Oct. 2023

JG-323	03 Sept. 2022	28 Sept. 2023
JG-324	02 Sept. 2022	25 Sept. 2023
JG-325	19 Sept. 2022	11 Oct. 2023
JG-326	17 Sept. 2022	09 Oct. 2023
JG-327	17 Sept. 2022	02 Oct. 2023
JG-328	16 Sept. 2022	28 Sept. 2023
JG-329	07 Sept. 2022	23 Sept. 2023
JG-330	04 Oct. 2022	28 Oct. 2023
Allahabad Safeda	13 Sept. 2022	29 Sept. 2023
L-49	16 Sept. 2022	06 Oct. 2023
Chittidar	15 Aug. 2022	31 Aug. 2023

Table 3: Descriptive statistics for number of floral buds per shoot, number of open flowers per shoot and duration of flowering.

SN	Traits	Year	Max.	Min.	Mean	SD	C.V.%
1.	Number of floral buds per shoot	2022-23	16.33	11.66	13.73	1.15	8.35
		2023-24	15.66	11.66	13.81	1.14	8.27
		Pooled	16.00	11.66	13.77	1.14	8.26
2.	Number of open flowers per shoot	2022-23	13.00	11.33	12.19	0.44	3.61
		2023-24	13.66	11.33	12.36	0.54	4.37
		Pooled	13.16	11.33	12.28	0.43	3.50
3.	Duration of flowering (Days)	2022-23	45.00	21.00	32.97	6.20	18.80
		2023-24	51.00	23.00	34.69	7.27	20.96
		Pooled	48.00	23.00	33.83	6.59	19.47

First-year observations revealed that genotype JG-301 finished flowering early on August 14, 2022, while JG-308 finished flowering later on October 3, 2022. In the following year, genotype JG-301 and Chittidar showed an early end to flowering on August 31, 2023 whereas JG-330 showed a late end to flowering on October 28, 2023. Genotype JG-322 had the longest flowering period (45 days) and JG-326 had the shortest (21 days) during the first year of flowering. The coefficient of variance was 18.80% with a mean value of 32.97 days. Genotype JG-322 had the longest flowering period (51 days), while JG-327 had the shortest (22 days) during the second year of flowering, with a mean characteristic value of 34.69 days. The coefficient of variance was 20.69%.

All genotypes were divided into three groups based on flowering duration: short, medium and long. The genotypes JG-301, JG-302, JG-303, JG-306, JG-310, JG-311, JG-312, JG-313, JG-314, JG-315, JG-316, JG-317, JG-318, JG-321, JG-323, JG-324, JG-325, JG-328, JG-330, Allahabad and JG-304, JG-305, JG-319, JG-319, JG-320, JG-322, L-49 demonstrated a short period of flowering. Safeda displayed a medium duration of flowering. While the genotypes JG-304, JG-305, JG-309, JG-319, JG-320 and JG-322 had long duration flowering. Dubey *et al.* (2004) [3] noted that varietal characteristics impacted by local climate include the timing and length of flowering. As a result, different cultivars and locations have different flowering times and durations.

Table 4: Categorization of genotypes based on their flowering duration

Category	Genotypes
Short duration flowering (<25 days)	JG-304, JG-305, JG-309, JG-319, JG-320, JG-322, L-49
Medium duration flowering (26 to 40 days)	JG-301, JG-302, JG-303, JG-306, JG-308, JG-310, JG-311, JG-312, JG-313, JG-314, JG-315, JG-316, JG-317, JG-318, JG-321, JG-323, JG-324, JG-325, JG-328 JG-330, Allahabad Safeda
Long duration flowering (>40 days)	JG-304, JG-305, JG-309, JG-319, JG-320, JG-322

Conclusion

This experiment concludes the study of 33 guava genotypes for their flowering observations as date of first flowering, date of full bloom, date of end of flowering, number of floral buds per shoot, number of open flowers per shoot and duration of flowering were observed. Genotype JG-309 consistently showed the earliest first flowering whereas delay in first flowering was observed in JG-330 and JG-311. Full bloom was seen between 20th July to 17th September in 2022 and 5th August to 29th September in 2023. The range of duration of flowering was found between 23 days (JG-327) to 48 days (JG-322). The range for number of floral buds per shoot 11.67 (JG-314) to 16 (JG-322), whereas open flowers per shoot were ranged 11.33 (JG-322) to 13.17 (JG-307). Thus seven genotypes were observed with short duration of flowering, twenty genotypes had medium duration flowering and six genotypes were found with long duration of flowering. Acquiring this information is crucial for advancing the development of better cultivars that possess desired flowering traits, eventually boosting the productivity and resilience of guava cultivation. The timing and length of blooming are contingent upon the surrounding conditions and

these variables are crucial for developing a variety specifically for the particular place or location or weather conditions.

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Competing Interest

The authors have declared that no competing interests exist.

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