



Research Article

Evaluation of mango (*Mangifera indica* L.) different cultivars for flowering attributes of Chhattisgarh plain zone under rained condition

Gangaram Rana, G. L. Sharma, Roshan Lal Sahu

Abstract

A conducted field experiment that is an investigation of flowering characteristic attributes of some mango varieties in the Chhattisgarh plain zone at a field of Horticulture Farm, CoA, IGKV, Raipur (C.G.) in the years 2019-20 and 2020-21. In the results of research work of both the years, the difference in flower buds was different. It was noticed that the Chhattisgarh Raj variety was the earliest panicle emergence and the late variety Amarpali experimental years. In the same way are varieties Chhattisgarh Raj is earliest and late is Amrapali different parameters like-flower bud differentiation, the emergence of inflorescence, the start of the first flowering date, 25% flower opening, 50% flower opening, and days of full bloom and start date of a bearing. The both years (2019-20 and 2020-21) observed that in total number of flowers in panicle¹ was the maximum variety Chhattisgarh Gaurav (1780.16) and the minimum is Chhattisgarh Pawan (704.50), in case number of hermaphrodite flower panicle¹ Dashehari (518.00) highest and lowest Chhattisgarh Raj (68.33) and several male flower panicle¹ is highest Chhattisgarh Gaurav (1265.16) and least value Chhattisgarh Pawan (522.833), sex ratio is highest is Chhattisgarh Raj (14.21) and the minimum is Langra (1.56).

Keywords flowers, panicle, sex ratio, varieties

Introduction

The mango (*Mangifera indica* L.) is a very important and popular fruit in the tropical world. Mango fruits are the richest source of vitamin A (389 mcg_ RE**) [1], with excellent flavor, attractive fragrance, beautiful color, and delicious taste and a good source of vitamin C, minerals, and other nutrients. The mango cultivation in India was 2.291 million hectares with a production of around 20.444 million tonnes and India's highest mango-producing state is Uttar Pradesh producing 4.54 million tonnes from 265.82 thousand hectares area [2]. The mango tree, a diploid fruit tree with $2n = 40$ chromosomes, is one of the most popular tropical and subtropical fruits in the world [3]. The earliest annual mango flowering event occurs in South India out of all the Indian regions that produce mangoes. This process establishes an earlier harvesting date and leads to fruit development. Therefore, mangoes earliest fruit to reach the market in particular in Tamil Nadu, Karnataka, and Andhra Pradesh. The mango tree usually flowering comes in variations due to climatic factors and genetic characteristics. Male and hermaphrodite flowers are both produced by the mango inflorescence, a flowering shoot known as a

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Authors:

G. Rana ✉, G. L. Sharma, R. L. Sahu
Department of Fruit Science, College of
Agriculture, Indira Gandhi Krishi
Vishwavidyalaya, Raipur, India

✉ gangaramrana095@gmail.com

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panicle. Within panicles, trees, and cultivars, the sex ratio varies. The ratio of perfect flowers to the initial fruit set is directly correlated [4]. The onset of cold temperatures during the dry season is the mechanism responsible for the flowering of central regions, particularly Chhattisgarh. This happens in January and continues until April, depending on the cultivar, the region, and the variability of the yearly weather [5]. According to a study on the flowering and bearing behavior of five different mango varieties, cultivar "Bombai" showed the earliest bud appearance in the panicle during the second and final week of January in 2015–16, followed by cultivar "Zardalu." Moreover, flowering buds started to emerge on the cultivators Bangalora, Hemsagar, and Langra in the third and first weeks of February. Measuring the mango's susceptibility to climate change requires an understanding of the factors and drivers that lead to flowering. When flowers bloom in the winter, the temperature is below 12°C, which can be harmful to the induction and growth of flowers [6]. The result is finding similarly, why, rainfall major role in the flowering and fruit development. Flowers start opening early morning but a maximum number of flowers open between (9-10 a.m). The mode of pollination is entomophily; nectar is present to attract the insects (common house fly). Flowering is a very short duration only 2nd to 3rd weeks and produces mainly found andromonoecious flowers. The number of flowers in panicle⁻¹ depends on varieties and climatic conditions that range from 1000 to 6000. A study on mango inflorescences⁻¹ regarding the flowers panicle⁻¹ was more number in Langra (1003). In terms of the number of male flowers, Langra (705) was found to have the highest number of hermaphrodite flowers, which was also at its highest (298) in Langra [7].

Methodology

Experimental area

The current study was conducted over some years (2019-2020 and 2020-21) in 10 to 20-year-old trees namely Chhattisgarh Swarnprabha, Chhattisgarh Pawan, Chhattisgarh Achar, Chhattisgarh Raj, Chhattisgarh Gaurav, Chhattisgarh Nandiraj, Dashehari, Langra, Mallika and Amarpali planted with planting distant of 10 meter × 10 meter at Research Horticultural Farm, Fruit Science Department, College of Agriculture, IGKV, Raipur, (C.G. The orchard's plants are kept in a uniform cultural practice (plows with a disk harrow, irrigation in a check basin, and the application of Imidachlopid to control mealy bugs and hopper bugs, as observed). Observations of plants in mango descriptors [8].

Flower descriptors

Ten mango varieties are researched with Randomized Block Design (RBD). Their three replications will be based on experimental material. The observations were recorded on flower bud differentiation, date of panicle emergence, the start of first flowering, 25% flower opening, 50% flower opening, days of full bloom, the start date of bearing, total number of flowers panicle¹, number of male flowers panicle¹, number of hermaphrodite flowers panicle¹, percentage of male and hermaphrodite flowers panicle¹ and sex ratio.

Data analysis

For all the studies of the evaluation of mango (*Mangifera indica* L.) different cultivars for flowering attributes of the Chhattisgarh Plain zone under rained conditions were calculated using MS-Excel and OPSTAT software. The data from these studies were properly calculated, tabulated, and analyzed as indicated by Gomez and Gomez [9].

Results and Discussion

Flowering characteristics

During the study investigation on the time in flowering characteristics, considerable variation was observed among mango varieties in the Chhattisgarh plain zone area. Table 1 displays data on flower bud differentiation, panicle emergence date, first flowering date, and 25% flower opening.



Table 2 shows data on 50% flower opening, full bloom date, and start date of bearing.

Table 1. Studies on flower bud difference, Inflorescences emergence date, coming fist flowering and 25% in panicle¹ of mango varieties during years 2019-20 to 2020-21

Varieties	Flower bud difference		Inflorescences emergence date		Coming fist flowering		25 % flowering	
	2019-2020		2019-2020		2019-2020		2019-2020	
Chhattisgarh Swarnprabha	10 th -Dec-2019	1 st -Dec-2020	25 th -Dec-2019	17 th -Dec-2020	30 th -Dec-2019	20 th -Dec-2020	12 th -Jan-2020	05 th -Jan-2021
Chhattisgarh Pawan	01 th -Dec-2019	20 th -Nov-2020	10 th Dec-2019	2 nd Dec-2020	18 th -Dec-2019	10 th Dec-2020	05 th -Jan-2020	31 th Dec-2020
Chhattisgarh Achar	15 th -Nov-2019	3 rd -Nov-2020	25 th -Nov-2019	18 th -Nov-2020	30 th -Nov-2019	23 rd -Nov-2020	30 th -Dec-2019	25 th -Dec-2020
Chhattisgarh Raj	05 th -Nov-2019	25 th -Oct-2020	17 th -Nov-2019	10 th -Nov-2020	23 rd -Nov-2019	15 th -Nov-2020	10 th -Dec-2019	05 th -Dec-2020
Chhattisgarh Gaurav	20 th -Nov-19	10 th -Nov-2020	27 th -Nov-2019	20 th -Nov-2020	30 th -Nov-2019	25 th -Nov-2020	25 th -Dec-2019	20 th -Dec-2020
Chhattisgarh Nandiraj	31 st -Dec-2019	20 th -Dec-2020	10 th -Jan-2020	05 th -Jan-2021	15 th -Jan-2020	08 th -Jan-2021	27 th -Jan-2020	20 th -Jan-2021
Dashehari	05 th -Dec-2019	25 th -Nov-2020	18 th -Dec-2019	15 th -Dec-2020	22 nd -Dec-2019	20 th -Dac-2020	22 nd -Dec-2019	30 th -Dec-2020
Langra	10 th -Jan-20	1 st -Jan-2021	18 th -Jan-2020	10 th -Jan-2021	22 nd -Jan-2020	19 th -Jan-2021	22 nd -Jan-2020	25 th -Jan-2021
Mallika	10 th -Jan-20	5 th -Jan-2021	25 th -Jan-2020	15 th -Jan-2021	28 th -Jan-2020	25 th -Jan-2021	28 th -Jan-2020	31 st -Jan-2021
Amrapali	15 th -Jan-20	7 th -Jan-2021	22 nd -Jan-2020	15 th -Jan-2021	28 th -Jan-2020	20 th -Jan-2021	28 th -Jan-2020	05 th -Feb-2021

Table 2. Studies on 50% flowering, date of full bloom and starting date of bearing (DDMMYY) in panicle¹ of mango varieties during years 2019-20 to 2020-21

Varieties	50% flowering		Date of full bloom		Starting date bearing (DDMMYY)	
	2019-2020	2020-2021	2019-2020	2020-2021	2019-2020	2020-2021
Chhattisgarh Swarnprabha	12 th -Jan-2020	05 th -Jan-2021	21 st Jan-2020	15 th Jan-2021	28 th Jan-2020	23 rd -Jan-2021
Chhattisgarh Pawan	05 th -Jan-2020	31 th -Dec-2020	12 th -Jan-2020	10 th -Jan-2021	30 th -Jan-2020	28 th -Jan-2021
Chhattisgarh Achar	30 th -Dec-2019	25 th -Dec-2020	10 th -Jan-2020	2 nd -Jan-2021	15 th -Jan-2020	10 th -Jan-2021
Chhattisgarh Raj	10 th -Dec-2019	05 th -Dec-2020	18 th -Dec-2019	15 th -Dec-2020	31 st -Dec-2019	31 st -Dec-2020
Chhattisgarh Gaurav	25 th -Dec-2019	20 th -Dec-2020	3 rd -Jan-2020	30 th -Dec-2020	15 th -Jan-2020	15 th -Jan-2021
Chhattisgarh Nandiraj	27 th -Jan-2020	20 th -Jan-2021	7 th -Feb-2020	30 th -Jan-2021	12 th -Feb-2020	10 th -Feb-2021
Dashehari	22 nd -Dec-2019	30 th -Dec-2020	10 th -Jan-2020	7 th -Jan-2021	17 th -Jan-2020	15 th -Jan-2021
Langra	22 nd -Jan-2020	25 th -Jan-2021	10 th -Feb-2020	5 th -Feb-2021	17 th -Feb-2020	15 th -Feb-2021
Mallika	28 th -Jan-2020	31 th -Jan-2021	12 th -Feb-2020	10 th -Feb-2021	21 st -Feb-2020	21 st -Feb-2021
Amrapali	28 th -Jan-2020	05 th -Feb-2021	23 rd -feb-2020	20 th -Feb-2021	3 rd -March-2020	01 st -March-2021

Flower opening characteristics

The data presented in the varying show in flower bud differentiation, date of panicles emergence, start first flowering date, flower opening 25 %, 50 %, full bloom, and starting date of bearing in all ten cultivars during research both the years in earlier Chhattisgarh Raj and late is variety Amarpali. The variation of bearing habits might be due to the inherent genetic variation among varieties, the physiological stress of the trees, and the prevailing environmental conditions. In South India, mangoes begin to grow in the third week of September and finish by the third week of November that is similar outcome was observed [10]. Variation in the date of panicle emergence among the mango varieties. Genetic variations and the combination of environmental factors could be the reason for this variation [11]. Studies on similar observations for variation in time of full bloom among mango varieties [12].



Number of flowers panicle⁻¹

The total number of flowers in panicle-1 of both years (2019-20 and 2020-21) showed (Table 3) that is maximum was noted in Chhattisgarh Gaurav (1780.167) which was significantly higher over all the other nine varieties, followed by statistical superiors (1713.833) Dashehari and the lowest value is Chhattisgarh Pawan (704.500). Genetic variations and the combination of environmental variables might explain this variance. Research on mango panicle-1 showed that Langra (1003) had the highest number of panicle flowers. It was discovered that Langra (705) had the greatest number of hermaphrodite flowers, which were also at their peak (298) in Langra [7].

Table 3. Studies on number of hermaphrodite flower per panicle, number of male flower per panicle and total number of flowers per panicle of mango varieties during years 2019-20 to 2020-21

Varieties	Number of hermaphrodite flower panicle ⁻¹			Number of male flower panicle ⁻¹			Total number of flowers panicle ⁻¹		
	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled
Chhattisgarh Swarnprabha	156.66	133.00	144.83	716.66	691.66	704.16	873.33	1,053.00	963.16
Chhattisgarh Pawan	103.33	84.33	93.83	546.66	499.00	522.83	650.00	759.00	704.50
Chhattisgarh Achar	163.33	149.33	156.33	1,154.33	1,161.33	1,157.83	1,317.67	1,778.33	1,548.00
Chhattisgarh Raj	76.66	60.00	68.33	856.66	847.00	851.83	933.33	1,230.66	1,082.00
Chhattisgarh Gaurav	291.66	282.33	287.00	1,303.33	1,227.00	1,265.16	1,595.00	1,965.33	1,780.16
Chhattisgarh Nandiraj	112.76	103.66	108.21	789.66	768.00	778.83	902.43	1,136.00	1,019.26
Dashehari	577.33	458.66	518.00	1,050.00	985.66	1,017.83	1,627.33	1,800.33	1,713.83
Langra	373.33	354.00	363.66	566.66	570.66	568.66	940.00	979.00	959.50
Mallika	291.66	278.66	285.16	806.66	771.33	789.00	1,098.33	1,303.33	1,200.83
Amrapali	415.00	392.00	403.50	810.00	870.33	840.16	1,225.00	1,369.00	1,297.00
SE(m)±	44.68	69.92	56.38	83.49	123.01	99.86	94.84	120.99	61.10
C.D. at 5%	133.78	209.37	168.81	249.98	368.31	299.01	283.99	362.28	182.96

In the case of the number of male flowers panicle-1 highest in variety is Chhattisgarh Gaurav (1265.167) followed by Chhattisgarh Achar (1157.833). Apart from this, the least number of male flowers (522.833) were found in Chhattisgarh Pawan. The highest number of hermaphrodite flowers inflorescences-1 (518) was observed in Dashehari, followed by Langra (363.667) while, the minimum was Chhattisgarh Raj (68.33) which was at par with Chhattisgarh Pawan (93.833), Chhattisgarh Nandiraj (108.217), Chhattisgarh Swarnprabha (144.633) and Chhattisgarh Achar (156.33). Analyze the various mango genotypes' yield performance under the given conditions. Pedharasam had the highest number of flowers per panicle (1346.80), while Banganapalli had the lowest number (741.40), according to the experiment [13].

The percentage of male flower panicle1 in both research years (2019-20 and 2020-21) that are shown in (Table 4), recorded highest in Chhattisgarh Raj (92.763%) followed by Chhattisgarh Achar (87.984 %), Chhattisgarh Nandiraj (87.647%) and Chhattisgarh Pawan (84.314%) and Dashehari (60.474%) is the significantly lowest. The highest percentage of hermaphrodite flowers Langra (39.526%) recorded highest, followed by Dashehari (32.962 %) and Amarpali (31.912%). While, the lowest percentage of perfect flowers (7.237%) was recorded in Chhattisgarh Raj which was at par with Chhattisgarh Raj (12.016 %), Chhattisgarh Nandiraj (12.353%), and Chhattisgarh Pawan (15.686%). Some varieties of mango have different flowering and fruiting habits. The Pairi variety had the lowest flowering (47.50%) and the Kesar variety had the highest (74.0%). The variety "Sindhu" had the highest percentage of hermaphrodite flowers (28.53%), while the varieties



Table 4. Studies on male flower percent, hermaphrodite flower per cent and sex ratio of mango varieties during years 2019-20 to 2020-21

Varieties	Male flower percent			Hermaphrodite flower percent			Sex Ratio		
	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled
Chhattisgarh Swarnprabha	82.103	84.104	83.104	17.897	15.896	16.897	4.598	5.485	5.042
Chhattisgarh Pawan	83.633	84.994	84.314	16.367	15.006	15.686	5.187	5.967	5.577
Chhattisgarh Achar	87.732	88.236	87.984	12.268	11.764	12.016	7.200	7.740	7.470
Chhattisgarh Raj	91.957	93.569	92.763	8.043	6.431	7.237	12.628	15.792	14.210
Chhattisgarh Gaurav	81.609	80.650	81.129	18.391	19.350	18.871	4.527	4.471	4.499
Chhattisgarh Nandiraj	87.320	87.974	87.647	12.680	12.026	12.353	7.304	8.091	7.698
Dashehari	64.484	69.591	67.038	35.516	30.409	32.962	1.922	2.875	2.398
Langra	59.690	61.257	60.474	40.310	38.743	39.526	1.516	1.609	1.562
Mallika	73.346	73.229	73.287	26.654	26.771	26.713	2.767	2.777	2.772
Amrapali	66.645	69.451	68.048	33.355	30.549	31.952	2.139	2.291	2.215
SE(m)±	2.874	3.723	3.170	2.874	3.723	3.170	1.029	1.334	1.136
C.D. at 5%	8.605	11.146	9.491	8.604	11.146	9.491	3.080	3.996	3.402

"Alphonso" and "Kesar" had the least number of perfect flowers [14]. In the pooled data analysis (2019-20 and 2020-21) that is shown in (Table 4), the sex ratio was higher (14.210) with the variety of Chhattisgarh Raj. The sex ratio was markedly lower (1.562) in Langra as compared to other varieties which were at par is varieties Amarpali (2.215), Dashehari (2.398), and Mallika (2.77). The genotype PKM 1 was found to have a maximum sex ratio of 1:5.43, which is significantly higher than other genotypes [13].

Conclusion

The research done here has shown us which variety is producing more fruits keeping in mind the knowledge of floral biology because flowers indicate the number of fruit setting in mango. If a variety has more bisexual flowers, then that panicle will have more fruits. In this case, we found that Chhattisgarh Raj is the earliest flowering variety and Amrapali is the latest flowering variety. While Chhattisgarh Gaurav and Dashehari have the highest number of flowers, due to which the number of fruits was overestimated in the plains of Chhattisgarh.

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