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Research Article

Morphological characterization of different primary genotypes of mango (*Mangifera indica* L.) in Bihar

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Abstract

The morphological characterization of mango genotypes plays a significant role to understand their diversity, identifying distinct traits, and providing valuable insights into their classification and breeding. Hence, the experiment was conducted on 25 primary mango genotypes at Bihar Agricultural University, Sabour, Bihar during the years 2020–2021. The results showed that the genotypes G-06 and G-42 had the earliest bud break (4th February). While genotype G-23 had the maximum panicle length (36.75 cm). The genotype G-28 had the maximum canopy volume of 397.42 m^3 with the maximum plant spread in both directions (7.35m in north-south and 7.35 m in east-west direction). Based on the above findings, it can be concluded that genotypes G-11, G-12, G-30, G-23, G-28, and G-29 performed better in respect of floral attributes and more canopy volume, which are important factors for maximization of yield.

Keywords canopy volume, floral attributes, genotypes, mango, plant height

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Introduction

The mango (*Mangifera indica* L.), which has a pleasant flavour, high nutritional value, and commercial importance, is one of the most significant fruit crops grown all around the world. Being the national fruit of the country, mango contributes significantly to the Indian economy and occupies a substantial share of the country's horticultural industry. Bihar has emerged as a prominent region for mango cultivation, with a wide range of primary genotypes being grown. The morphological characterization of mango genotypes plays a crucial role in understanding their diversity, identifying distinct traits, and providing valuable insights into their classification and breeding. By assessing the morphological characteristics of different primary genotypes of mango in Bihar, researchers and horticulturists can gain a comprehensive understanding of their distinct attributes, which can aid in their conservation, utilization, and improvement. Morphological characterization plays an important part in understanding the diversity and variability of mango genotypes, aiding in their classification, identification, and management. It involves the study of morphological features, such as tree structure, inflorescence type, flower characteristics, fruit shape, size, color, and other key morphological attributes [1]. These traits provide valuable insights into the genetic makeup and adaptability of different mango genotypes, enabling breeders and researchers to develop improved cultivars and formulate effective conservation strategies [2]. Therefore, keeping the view of the

above facts, the experiment was conducted with the aim to bridge this gap by conducting a comprehensive morphological characterization of different primary genotypes of mango in Bihar. Through field surveys, data collection, and statistical analysis, we seek to identify and describe the key morphological traits exhibited by various mango genotypes in the region. The findings of this study will not only contribute to gathering knowledge on mango diversity but also provide valuable insights for breeders, researchers, and policymakers involved in mango cultivation and conservation in Bihar. The management and conservation of mango genetic resources will be able to provide knowledge on morphological traits of the genotypes in Bihar.

This research will also be instrumental in facilitating breeding programs aimed at developing improved varieties with desirable traits such as disease resistance, high yield, and enhanced fruit quality. Additionally, the results of this investigation will be very useful to farmers, horticulturists, and mango enthusiasts by providing valuable insights into the distinct attributes of the different mango genotypes and their potential applications. The findings of this research seek to shed light on the morphological characterization of different primary genotypes of mango in Bihar.

Methodology

The present investigation was conducted under the experimental area of the All India Coordinated Research Project on Fruits, Bihar Agricultural University, Sabour, Bhagalpur, Bihar. A total twenty-five genotypes were selected as treatments. All the plants were of similar age (8 years) and were planted at a spacing of 5 × 5 meters under Randomized Block Design. Two trees per genotype were used for data collection and further analysis. Inflorescence shape and inflorescence color was identified as per IPGRI descriptor -2006 [3]. Based on the date of panicle emergence in previously tagged branches in all directions, the average date of bud initiation, bud break, panicle emergence, duration of 50% flowering, and period of full bloom was observed. From the beginning of flowering to the date of full bloom, the number of days during the flowering period (days) was recorded. With the aid of a meter scale, panicle length was determined at the full bloom stage.

With the aid of a measuring stick and measuring tape, the height of experimental trees was determined from the base to the top of the top shoot. East-West and North-South measurements of the canopy spread were made, and the average was calculated. Canopy volume was calculated as per the following formula [4]:

$$\text{Canopy volume } (m^3) = 4/3\ \pi r^2 h$$

Where, r= radius of crown (m^3), h= Height of tree (m).

Results and Discussion

Floral characters

Among the genotypes, there was a significant difference in phenological characteristics (Table 1). Inflorescence shape of mango was found conical in genotypes G-01, G-02, G-06, G-19, G-20, G-28, G-29, G-50, G-51 and pyramidal in G-03, G-05, G-09, G-11, G-16, G-21, G-22, G-23, G-27, G-31, G-37, G-42 and G-44, while broadly pyramidal among the remaining genotypes. The color of mango inflorescences were light green in G-01, G-16, G-23, G-28, G-31; yellowish green in G-02, G-03, G-06, G-19, G-21, G-27, G-30, G-42, G-51; green with red patches in G-05, G-11, G-29, G-37, G-50; dark pink in G-12 and light red in remaining genotypes. A similar type of phonological variation in different mango genotypes was also observed earlier [24]. Bud initiation was noted earliest in G-11 and G-30 (3rd January) while late in G-28 (20th February), Earliest bud break was seen in G-06 and G-42 (4th February) while late in G-29 (3rd March), earliest panicle emergence was noted in G-11 and G-30 (15th January) while late in G-51 (22nd March), Duration of 50% flowering was recorded highest in

Table 1. Flowering attributes of distinct mango (*Mangifera indica* L.) genotypes under Bihar condition

Genotype	Inflorescence shape	Inflorescence color	Bud Initiation	Bud Break	Panicle emergence	50% Flowering	Full Bloom	Duration of flowering
G-01	Conical	Light green	16-Jan	19-Feb	25-Feb	11Days	09 Days	19 Days
G-02	Conical	Yellowish green	22-Jan	21-Feb	02-Mar	08 Days	09 Days	17 Days
G-03	Pyramidal	Yellowish green	13-Jan	04-Feb	14-Feb	13 Days	07 Days	23 Days
G-05	Pyramidal	Green with red patches	22-Jan	13-Feb	22-Feb	11 Days	07 Days	19 Days
G-06	Conical	Yellowish green	19-Jan	04-Feb	12-Feb	15 Days	10 Days	28 Days
G-09	Pyramidal	Red	04-Feb	22-Feb	26-Feb	13 Days	07 Days	13 Days
G-11	Pyramidal	Green with red patches	03-Jan	11-Jan	15-Jan	18 Days	10 Days	51 Days
G-12	Broadly pyramidal	Dark pink	08-Jan	12-Jan	24-Jan	18 Days	07 Days	48 Days
G-16	Pyramidal	Light green	19-Jan	22-Feb	27-Feb	10 Days	09 Days	15 Days
G-18	Broadly pyramidal	Light red	19-Jan	19-Feb	26-Feb	11 Days	09 Days	16 Days
G-19	Conical	Yellowish green	17-Jan	21-Feb	26-Feb	10 Days	07 Days	11 Days
G-20	Conical	Red	16-Feb	01-Mar	05-Mar	11 Days	08 Days	10 Days
G-21	Pyramidal	Yellowish green	16-Feb	21-Feb	25-Feb	13 Days	06 Days	14 Days
G-22	Pyramidal	Pink	08-Jan	22-Jan	14-Feb	16 Days	06 Days	8 Days
G-23	Pyramidal	Light green	17-Jan	16-Feb	23-Feb	13 Days	08 Days	17 Days
G-27	Pyramidal	Yellowish green	19-Jan	07-Feb	25-Feb	13 Days	09 Days	29 Days
G-28	Conical	Light green	20-Feb	25-Feb	04-Mar	10 Days	`06 Days	14 Days
G-29	Conical	Green with red patches	28-Jan	03-Mar	08-Mar	09 Days	08 Days	9 Days
G-30	Broadly pyramidal	Yellowish green	03-Jan	12-Jan	15-Jan	14 Days	08 Days	47 Days
G-31	Pyramidal	Light green	14-Jan	14-Feb	23-Feb	11 Days	08 Days	15 Days
G-37	Pyramidal	Green with red patches	20-Jan	16-Feb	24-Feb	13 Days	07 Days	20 Days
G-42	Pyramidal	Yellowish green	21-Jan	04-Feb	13-Feb	16 Days	08 Days	26 Days
G-44	Pyramidal	Light red	11-Jan	15-Jan	17-Feb	15 Days	07 Days	18 Days
G-50	Conical	Green with red patches	15-Feb	21-Feb	01-Mar	10 Days	06 Days	13 Days
G-51	Conical	Yellowish green	23-Jan	09-Feb	22-Mar	13 Days	09 Days	23 Days
SE.m (±)	-	-	**0.90**	**2.35**	**1.48**	**0.61**	**0.72**	**0.52**
C.D. (5%)	-	-	**2.57**	**6.69**	**4.21**	**1.74**	**3.21**	**3.55**

G-11 and G-12 genotypes (18 Days) with lowest duration in G-2 genotype (08 Days). Periods of full bloom are varied from 10 days in G-11 genotype to 06 days in G-21 and G-22 genotypes. Duration of flowering was observed maximum in genotype G-11 (51 Days) with lowest in G-22 (8 Days). Similar results have already been reported by Bose and Mitra [5]. The cultivars and growth circumstances influence the timing of flowering. Researchers conducted similar research under terai conditions [6], whereas Islam et al., [7] conducted research under the diverse climatic conditions of Nawabganj, Bangladesh. From the results on the panicle length of 25 mango genotypes, it was observed that there was significant variations in panicle length in mango genotypes with maximum length (36.75 cm) in G-23 whereas minimum (14.00 cm) in G-29. Out of 25 genotypes G-22 (35.00 cm) was at par with G-23 (36.75 cm). The evaluation of open-

pollinated mango progenies in Brazil based on vegetative and floral characters was also reported by researchers [8], and the outcomes of this investigation were consistent with them. According to Bose and Mitra [5], the regularity of mango flowers differed depending on genotype. Because each mango genotype has its own flowering time, it is usually linked to the current native environmental circumstances, genetics, nutritional state, and hormonal factors [9].

Growth characteristics

A notable variance in the growth traits was seen among the 25 mango genotypes tested for the current inquiry (Figure.1). The plant height of mango genotypes varied from 3.15 m (G-29) to 7.55 m (G-21). Despite the significant heterogeneity across genotypes, the parents' extremely heterozygous nature was established. Even sibling seedlings in hybrid progenies had different genotypes; varietal interactions with agro-climatic conditions could possibly explain the differences in tree height between genotypes [10-12].

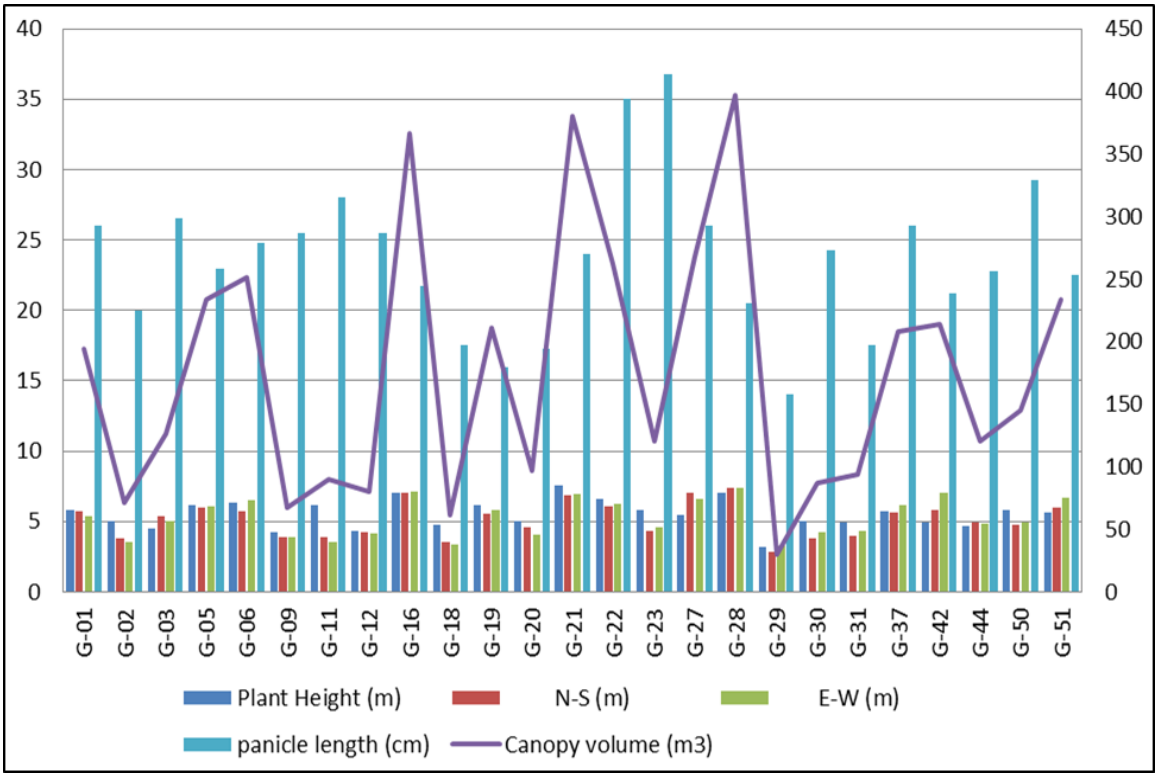

Figure 1. Variation in different growth characters of 25 primary genotypes of mango

The effect of plant spread (m) in the north-south direction of mango genotypes also varied significantly with the range from 2.80 m (G-29) to 7.35 m (G-28). The maximum plant spread in the north-south direction was found in G-16 (7.00 m) and minimum in G-29 (2.80 m), however, the maximum plant spread in the east-west direction (7.35 m) was found in G-28 and minimum (3.25 m) in G-29. Similar studies were conducted by researchers [6, 13-17] in different agro-climatic zones of India. Out of 25 genotypes, maximum canopy volume was found in G-28 (397.42 m^3) followed by G-21 (380.50 m^3) and G-16 (366.56 m^3), while minimum in G-29 (30.21 m^3) followed by G-18 (61.29 m^3) and G-09 (67.84 m^3). The canopy differences are influenced by different genotypes, propagation methods, plantation density, and prevailing agro-climatic conditions [18-21]. The growth and development of genotypes with a specific genetic character under a specific set of environmental conditions have a positive relationship. As a result, differences in vegetative growth characteristics among mango types could be attributed to genetic differences. Researchers have also observed significant diversity in vegetative growth among different

mango cultivars [22-23].

Conclusion

A total of 25 mango genotypes were assessed for their flowering and growth traits. According to the results of the experiment, G-11 and G-12 are the best genotypes for all floral characteristics under Bihar conditions. The genotype G-11 and G-30 are the earliest in bud break and takes the highest duration of flowering. Genotype G-23 has maximum panicle length. Genotypes in terms of plant height and spread, G-28 and G-29 were found most suitable. The findings revealed that the genotypes varied greatly for a number of morphological features, including the timing of bud break, the length, and commencement of panicles, plant height, and canopy volume. For mango breeding and enhancement programmers, these findings are highly significant. The identification and characterization of different primary genotypes of mango in Bihar will help to ensure the preservation of this valuable genetic resource.

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