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Studies on the Sex Ratio of Different Mango Varieties under the Northern Dry Zone of Karnataka

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

An investigation was carried out to evaluate different cultivars of mango for their performance, growth, and flowering under the northern dry zone of Karnataka. Tree height, canopy volume and trunk girth were maximum in Baneshan, while Kadar recorded maximum tree spread. Baneshan were the first to come into full bloom, and Dashehari were recorded maximum panicles per plant. The maximum number of fruits per panicle at harvest was found in Kesar. The maximum fruit set per cent was observed in Totapuri

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1. INTRODUCTION

Mango is a tropical fruit that belongs to the cashew family (*Anacardiaceae*) and has thousands of cultivars. It is native to southern Asia, especially Myanmar, Bangladesh, and northeastern India, and has been cultivated there since ancient times. Mango trees are evergreen and can grow up to 40 meters (131 feet) tall, with a crown radius of 15 meters (49 feet). The mango is a tropical fruit tree that usually flowers in spring and produces attractive fruits. Mango inflorescence is a branched terminal panicle, up to 0.6 m long and a hundred to several thousand flowers per panicle. Mango inflorescence is a flowering shoot called panicles and bears 2 types of flowers male and hermaphrodite flowers. Sex ratio is a variable component within a panicle, trees and among the cultivars. The initial fruit set is directly related to the proportion of perfect flowers [1]. A tree can have 200 to 3000 panicles with the potential to produce a tremendous number of flowers [2].

Mango fruit develops rapidly after fruit set and is ready for harvesting within 13 to 20 weeks, depending on variety and climate. Mango is essentially a tropical fruit. It generally does well within the temperature range of 24 to 27 °C but also can tolerate temperatures as high as 48 °C. The requirement for water depends on the type of soil and climate, planting distance, cultivars, age of the plants, developmental stages, NPK applications and weather conditions (Malik et al., [3], Reddy et al., [4], Gawanker et al., [5], Dhake et al., [6]. The productivity of mango is low due to several factors such as alternate bearing, fruit drop, disease and pests, most of the north Indian varieties viz. Dashehari, langra, Chousa and Bombay Green are alternate bearers while most of the south Indian varieties are regular bearers [7]. Low productivity is the resultant effect of alternate bearing, inadequate fruit set, followed by heavy fruit drop. In Mango, flowering is influenced by weather conditions and varietal genotypes.

Mango belongs to the group of plants, in which an antagonism between vegetative vigor and flowering intensity is observed. Therefore, any factor that reduces the vegetative vigour without altering the metabolic activity, favours flowering. Mango trees are generally induced to flower between October to December in the northern hemisphere and from June to August in the southern hemisphere. However, irregularity of flowering in mangoes, which varies in time and intensity of flowering from year to year almost completely biannual (alternate bearing habit), is not an uncommon phenomenon. Accordingly, the unravelling of the nature of flower triggering and signalling elements.

Even in the same region, different environmental conditions at different years can affect the maturity and quality of fruits [8]. Therefore, the evaluation of different promising mango cultivars for a given set of ecology is one of the prerequisites for successful mango cultivation.

2. MATERIALS AND METHODS

The investigation was carried out at the Main Horticultural Research and Extension Center (MHREC) UHS, Bagalkot (Karnataka) from August to June 2020. Bagalkot is situated in the north-eastern part of Karnataka at latitude 16° 10' 48.00" N longitude 75° 42' 0.00" E and altitude of 559 meters above the mean sea level. Bagalkot enjoys a subtropical climate, hot and dry summers and cold winters are the main characteristic features of this region. In general, the highest and lowest temperature goes above 45℃ and below 15℃, respectively. The annual rainfall varies from 550 to 700 mm which is received mainly from July to September. The experimental material consisted of eight varieties of mango viz., Langra, Malgoa, Khadar, Dashehari, Pairi, Kesar, Totapari and Alphonso and free from the attack of insect pests and diseases. Healthy and vigorous eight-year-old plants were selected for the present study. During the investigation, all the experimental plants received the same cultural practices and treatments. The observations recorded growth parameters like plant height, plant-bearing habit, canopy spread, plant canopy, trunk girth, number of primary and secondary branches, leaf area and reproductive parameters like number of panicles per plant, time of panicle emergence, panicle length, number of staminate and hermaphrodite flowers, number of fruits per panicle at harvest and fruit set percentage.

3. RESULTS AND DISCUSSION

The height of the plant is one of the most important morphological parameters that reflect the growth quality of the tree. Among the cultivars the maximum tree height was recorded

in Baneshan (3.82 m), however the minimum tree height was recorded in Pairi (2.50 m). The variation in plant height characters among the varieties might be due to variations in genetic makeup under the present set of environmental and edaphic conditions. The high variability in plant height among the mango varieties has also been determined by Majumdar et al., 2011 and Joshi et al., 2013. The maximum tree spread (north-south and east-west) was found in Khadar (4.40 m and 4.79 respectively) while the minimum was found in Dashehari (3.11 m and 3.0 m respectively). This variation concerning plant spread among the different cultivars may be due to the spreading and intermediate spreading habit of the cultivar. Similar results have also been reported by Reddy et al., 2001; Sharma and Sing, 1970. The maximum tree canopy was recorded in Baneshan (14.74 m3) while the minimum tree canopy was recorded in Malgoa (7.26 m3) Kobra et al., 2012 reported that the tree canopy ranged from 21.92 m3 (Lata Bombai) to 79.78 m3 (Khirsapat). The stem girth for different mango varieties indicated that Baneshan, Malgoa and Dashehari gave significantly higher stem girth as compared to other varieties. A greater number of primary and secondary branches were noticed in Dashehari followed by Kesar and Kadar similar observations were also noted by Vasanthrao 2009 and Mahesh 2018.

The variation in vegetative traits concerning stem girth among the varieties might be due to variation in genetic makeup more or less similar results have been reported by Reddy et al., [9], Dalal et al., [10]. Significant differences were observed among the mango cultivars concerning the date and time of panicle emergence. The date of panicle emergence is earliest in Baneshan(24th to 29th October) followed by Totapuri (14th to 19th November) and Alphonso (14th to 29th November). While late panicle emergence was noticed in varieties Dashehari (12th to 16th February) followed by Khadar (2nd to 8th December). The seasonal cyclic change of growth, flower, fruit and their development differ between cultivars and geographical location. The variation observed in terms of panicle initiation might be due to the difference in the genetic composition of parental mongo cultivars. The phenology pattern is strongly under environmental control in mangoes.

Kadar, Pairi and Totapuri were found to have regular bearing habits. Whereas the rest of the cultivars showed irregular bearing habits. A maximum number of panicles per tree was observed in Dashehari (329.67) followed by Kesar (321.44) and Pairi (229.44). The minimum number of panicles per tree was observed in Malgoa (156.44). Chandra et al., 2001, observed 1236 (Kesar) to 10,377 (Mallika) panicles per tree. Similar results were also reported by Dalal et al., [10], Bakshi et al., 2012 in mango.

The panicle length was observed highest in cultivar Totapuri (38.58 cm) followed by Khadar (35.45 cm) however minimum panicle length was found in Malgoa (27.69 cm). The variation in size and shape of the panicle in mango cultivars might be due to genetic composition and more specifically the physiological condition of the shoot on which the panicle arises. In the same line of work Chandra et al.,2001 reported that the panicle length has distinct variation in eight mango cultivars and hybrids under agroclimatic conditions of Odisha. In the experiment, the earliest fruit set in Baneshan (4th to 10th November) followed by Totapuri (29th November to 5th December). The difference in the time of appearance of flowers in different cultivars might be due to the genetic constitution of a particular cultivar [11,12].

Among the various factors that influence fruitfulness in mangoes is several hermaphrodite flowers per panicle is the most important as it decides fruit set per cent which in terms influences the productivity of the tree. Varieties differed significantly concerning the number of hermaphrodite flowers per panicle [13].

The maximum number of hermaphrodite flowers per panicle was found in Dashehari (554.89) followed by Kesar (440.33). The minimum number of hermaphrodite flowers per panicle was found in Pairi (233.67). Mango is known to exhibit diverse types of flowers. From this study, it is clear that the productivity of mango is influenced by the number of hermaphrodite flowers which normally decides the per cent of fruit set. Hong and hui, 2001; Chandra et al., 2001 and Dalal et al., 2005 in mango. The number of staminate flowers per panicle is considered to be one of the important factors towards the unfruitfulness of mango. Because enormous staminate flowers produced will drain out the nutrients from the tree, which are otherwise utilized for the growth and development of hermaphrodite flowers [14,15]. Varieties differ significantly among themselves for the number of staminate flowers per panicle. The maximum number of staminate flowers per

Table 1. Morphological parameters of mango varieties under the Northern dry zone of Karnataka

Sl. No.	Treatment	Tree height (m)	Tree spread (m)		Tree canopy (m^3)	Trunk girth (cm)	Number of primary branches	Number of secondary branches	Leaf area (cm^2)
			N-S	E-W					
1	Khadar	3.41	4.40	4.79	13.27	40.67	4.89	13.22	48.26
2	Baneshan	3.82	3.72	3.59	14.74	53.44	4.00	9.89	41.32
3	Alphonso	3.49	3.75	3.10	13.24	35.61	3.44	8.22	42.06
4	Kesar	2.69	3.40	3.43	8.71	37.67	5.11	10.89	42.64
5	Dashehari	2.78	3.11	3.23	10.33	43.44	5.22	11.00	48.91
6	Pairi	2.50	3.19	3.05	7.60	29.22	4.33	9.56	41.01
7	Totapuri	3.40	3.34	3.00	11.87	42.67	4.33	8.44	43.81
8	Malgoa	2.51	3.31	3.24	7.26	43.78	4.67	8.78	38.12
	S.Em±	0.21	0.25	0.28	0.95	1.25	0.26	0.31	1.48
	CD at 5%	0.63	0.77	0.85	2.89	3.81	0.80	0.93	4.50
	CV (%)	11.74	12.39	14.13	15.19	5.33	10.18	5.32	5.94

Table 2. Reproductive parameters of mango varieties under the Northern dry zone of Karnataka

Sl. No.	Treatment	Bearing habit	Date of panicle emergence	Date of fruit set	Number of panicles per tree	Panicle length (cm)	Number of hermaphrodite flowers per panicle	Number of staminate flowers per panicle	Number of fruits per panicle at harvest	Fruit set percentage (%)
1	Khadar	Regular	Dec 2 - Dec 8	Dec 19 - Dec 26	170.00	35.45	327.78	1050.33	1.18	0.05
2	Baneshan	Irregular	Oct 24 - Oct 29	Nov 4 - Nov 10	213.89	31.36	252.40	433.78	1.51	0.04
3	Alphonso	Irregular	Nov 14 - Nov 29	Dec 5- Dec 12	161.22	32.01	350.78	1316.89	1.29	0.04
4	Kesar	Irregular	Nov 15 - Nov 20	Nov 30 - Dec 6	321.44	29.95	440.33	1499.00	1.15	0.04
5	Dashehari	Irregular	Feb 12 - Feb 16	Feb 25 – March 2	329.67	31.56	554.89	3001.00	1.48	0.06
6	Pairi	Regular	Nov 21- Nov 26	Dec 2 - Dec 9	229.44	29.91	233.67	1825.44	1.18	0.03
7	Totapuri	Regular	Nov 14 - Nov 19	Nov 29 - Dec 5	225.67	38.58	435.56	1256.89	1.26	0.08
8	Malgoa	Irregular	Nov 24 – Nov 29	Dec 9 - Dec 16	156.44	27.69	335.33	1310.44	1.29	0.04
	S.Em±	-	-	-	14.95	1.02	139.21	7.43	0.06	0.01
	CD at 5%	-	-	-	45.35	3.09	422.18	22.54	0.19	0.02
	CV (%)	-	-	-	11.46	5.50	16.50	3.51	8.58	19.02

panicle was found in Dashehari (3001.00) followed by Pairi (1825.44) [16].This may be the reason for Pairi and Kesar being low-yielders due to a greater number of staminate flowers per panicle. The minimum number of staminate flowers per panicle was found in Baneshan (433.78). Similar results were reported by Kumar and Bramhachari et al. (2004) (Table 2).

The maximum number of fruits per panicle at harvest was found in Baneshan (1.51) followed by Dashehari (1.48). The minimum number of fruits per panicle at harvest was found in Kesar (1.15). Bakshi et al. (2012) reported number of fruits per panicle at harvest ranged from 0.81 to 1.67, these results were in agreement with the present investigation (Table 2) [17].

In fruit crops like mango fruit set per cent is the most relevant factor in deciding the fruitfulness of mango. Among the different cultivars, the maximum fruit set (%) was found in Totapuri (0.08 %) The minimum fruit set (%) was found in Pairi (0.3 %). From these facts, it is obvious that the cultivar, that had a high fruitset percentage proved to have more potential with a greater number of fruits per tree, which referred to the highest percentage These findings are in line with Vasantrao's (2009) observations of the study (Initial fruit set percentage ranged from 3.69 to 8.68%). The variation may be due to the different cultivars used in this study and the number of hermaphrodite flowers per panicle (Table 2) [18,19].

4. CONCLUSION

There were distinct variations for different vegetative and flowering characters among the mango cultivars under study. Based on the results obtained, it may be concluded that the varieties like Baneshan, Totapuri and Dashehari were superior in most of the characters. The information generated from this study will be useful for various breeders for the improvement of varieties by selecting suitable parental material. This research work can be further validated by evaluating these varieties with suitable molecular markers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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