

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.906.244>

Studies on the Growth and Flowering Behavior of Different Mango (*Mangifera indica* L.) Genotypes

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ABSTRACT

Growth and inflorescences characteristics of 30 mango genotypes were studied during the period of 2017 to 2018. The evaluation of new cultivars adaptation of mango (*Mangifera indica* L.) provides tools to assist and improve the mango production in different climatic conditions. The study was conducted to evaluate the phenological and reproductive development of different mango genotypes. The variables like total tree height, tree spread, tree girth, leaf length, leaf width, petiole length, Date of panicle emergence, panicle length, panicle width, number of male and perfect flowers, perfect flower percentage and sex ratio were recorded during the period of study. The average tree height (8.36 m), tree spread (8.99 m) and stem girth (103.97 cm) was found to be observed maximum in Sundar Langra. The maximum leaf length, leaf width and petiole length was observed significantly in Alphonso (32.85 cm), Sindhu (10.24 cm) and Arka Aruna (6.28 cm) respectively. Results pertaining to panicle emergence suggest that Malpacharisi, Sendhuram, Arka Aruna and Imam pasandhad very early emergence of panicle (before January). The maximum percentage of perfect flowers per inflorescence was recorded significantly in Sothuparaivadumangai (31.43 %). Among the genotypes PKM 1 exhibited significantly maximum sex ratio (hermaphrodite flowers to male flowers) (1:5.43). It is concluded that some genotypes like Sundar Langra, Arka Aruna, Sendhuram and Alphonso were superior in most of the traits.

Keywords

Mango,
Genotypes,
Growth,
Flowering

Article Info

Accepted:
18 May 2020
Available Online:
10 June 2020

Introduction

Mango (*Mangifera indica* L.) is the most popular fruit crop in the orient particularly in India, where it is considered as the best choice among all indigenous fruits. It is a tropical fruit originated from Indo-Burma region and grown almost all part of the world. It is a

major fruit crop of India and occupies an area of 2.263 million hectares with an annual production of 19.68 million tonnes and the productivity is 8.71 MT/hac. The export potential of India is 52761 MT of fresh and dried products of mango with the benefit cost of Rs.44,366 Lacs (APEDA, 2016-17). The area, production and productivity of mango in

TamilNadu is 160.49 thousand hac, 1.157 million tonnes and 7.19 MT/hac (India stat 2016-17). Different cultivars of mango varied in their performance and these differences are governed by various genetic, cultural and environmental factors. The growth of the mango trees is usually given by cycles with short repetitions throughout the year and it is depending on the cultivar, climate conditions and management. The knowledge about the growth pattern of the mango trees is essential for establishing effective methods to handle the culture and it allows the phenotypic characteristics expressions of each genetic material. Among the mango trees phenophases, the flowering is a complex phenomenon as long as its duration and it may be extended earlier by natural conditions or artificial inductions, it depends on climatic conditions and previous crop productivity. The mango trees have higher productions in regions with cold and/or dry period preceding flowering, humid soil and maximum air temperature between 30 °C and 33 °C during the fruit development. Temperatures above 35 °C cause injury in plants and temperatures from 8 °C to 10°C during the cold period of the year may be regarded as the lower limit for the successful mango production. A temperature regime of 25 °C during the day and 15 °C during the night as prevails during this period was found to be the optimum for flower induction. Prior to flowering, farmers do not irrigate in order to enhance drought stress to support flower induction. The knowledge of the phenology of mango cultivars can be used for genetic breeding or even for cultivation in new planting areas and on the range of processes linked to agronomic management of the supply chain. Looking to above fact, it was realized to ascertain the performance of different cultivars of mango growing under the agro-climatic conditions of Tamilnadu for different phenological and reproductive development among mango cultivars. The information generated from this

study will enable the effective utilization of mango genetic resources especially breeding programme for improvement of this crop.

Materials and Methods

The present investigation was conducted at Horticultural College and Research Institute (HC&RI) of TamilNadu Agricultural University, Periyakulam, TamilNadu, during the period of 2017 and 2018. The experiment was carried out on thirtymango genotypes namely, Alphonso, Amarapali, ArkaAruna, ArkaPuneet, Au Rumani, Banganapalli, Durai pandi, Iswarya, Imam pasand, Javari, Komangai, Kovankachi, Kundur Pacharisi, Kuruvi Neelum, Mallika, Malpacharisi, Mohandhas, Natham Palamani, Neelum, P.K.Patti, Pedharasam, PKM 1, PKM 2, Ratna, Samba Kooja, Shajahan, Sendhuram, Sindhu, Sothuparai Vadumangai and Sundar Langra available at the experimental orchard of the Horticultural College and Research Institute (HC&RI), Periyakulam. Plants of these mango genotypes were ten years old, healthy and free from diseases and pests. These plants were maintained under uniform cultural practices to ensure yield of quality fruits. Observations were made on vegetative and flowering characteristics like tree height, tree spread, Stem girth, Leaf length, Leaf width, panicle length and width, number of male and perfect flowers and Perfect flower per cent among the different mango genotypes. The collected data on different parameters were analyzed by using analysis of variance (ANOVA) based on randomized block design (RBD). The data's were recorded by following methods.

Tree height (m)

Tree height was measured with the help of bamboo and measuring tape from base as ground level to the apex of the tree and expressed in meters.

Stem girth (cm)

The trunk girth was measured at 30 cm height from the ground level with the help of a measuring tape and expressed in centimeters.

Tree spread (m)

The tree spread was measured by measuring the canopy spread in East-West (E-W) and North-South (N-S) directions with the help of measuring tape. Average it and it was expressed in meter.

Leaf length (cm)

Average length of randomly selected 15 leaves from five shoots excluding petiole was taken from third and fourth positions from the tip of bearing shoot was recorded as leaf length and measured in centimeter.

Leaf width (cm)

Average width of randomly selected 15 leaves from five shoots was taken from third and fourth positions from the tip of bearing shoot were recorded as leaf width. The leaf width was measured in the upper, middle and lower portion of the leaf, averaged and expressed in centimeter.

Petiole length (cm)

Average length of petiole of randomly selected 15 leaves taken from third and fourth position from tip of the each bearing shoot was measured and expressed in centimeter.

Percentage of perfect flowers per inflorescence

The percentage of perfect flowers was calculated by using the following formula.

Per cent of perfect flowers =

$$\frac{\text{Number of perfect flowers per panicle}}{\text{Total number of flowers per panicle}} \times 100$$

Sex ratio (Perfect to male flowers)

The ratio of male flowers to hermaphrodite flowers was calculated as follows. (keeping the perfect flowers as constant one).

$$\text{Sex ratio} = \frac{\text{Number of perfect flowers per panicle}}{\text{Number male flowers per panicle}}$$

Results and Discussion

Tree growth parameters

The height of tree is one of the most important quality parameters which reflect the growth and quality of mango tree. Among the genotypes, SundarLangra exhibited the maximum tree height (8.36 m), tree spread (8.99 m) and stem girth (103.97 cm). However, minimum tree height (3.57 m), tree spread (3.35 m) and stem girth (25.13 cm) were recorded in Samba Kooja, P.K. Patti and Javari respectively (Table 1). The variation in plant height among the different varieties could be due to the variation in genetic make-up under the present set of environmental and edaphic conditions. High variability in plant height amongst the mango varieties have also been determined by Chanana *et al.*, (2005). This variation with respect to plant spread among the different cultivars may be due to spreading and intermediate spreading habit of the cultivar. Similar results have also been reported by Rymbai (2012). The variation in vegetative growth characters with respect to stem girth among mango varieties might be due to variation in genetic make-up. The more or less similar result has been reported by Srivastava *et al.*, (1987).

Leaf growth parameters

The maximum leaf length (32.85 cm) leaf width (10.24 cm) and petiole length (6.28 cm) was observed significantly in Alphonso, Sindhu and ArkaAruna, respectively, while the minimum leaf length (15.88 cm) and leaf width (2.64 cm) was observed in Samba Kooja. The petiole length (2.55 cm) was found to be minimum in Duraipandi (Table 2). The significant variation among the genotypes for leaf length and leaf width could be due to the genetic constitution of particular variety and interaction with environmental factors. This was supported by the findings of Samanta *et al.*, (1999) who observed the broad range of variation for leaf length among the 25 types of mango grown in West Bengal. Majumder *et al.*, (2011) and Joshi *et al.*, (2013) also reported the significant variations in leaf width of mango.

Flowering characteristics

Significant differences were observed among the mango cultivars with respect to date and time of panicle emergence. The date of panicle emergence was found to be earliest in Malpacharisi (20 Nov-2 Jan) followed by Sendhuram (22 Nov -26 Dec), ArkaAruna (24 Nov-2 Jan) and Imam pasand (24 Nov-2 Jan), while late emergence was observed in Komangai (17 Feb -9 Mar), Mallika (16 Feb -4 Mar) and Kuruvi Neelum (16 Feb -2 Mar). The variation observed in terms of panicle initiation might be due to the differences in genetic composition of parental mango genotypes. Singh (2003) and Kanpure *et al.*, (2009) also observed variation in date of panicle emergence among the mango varieties. Phenology pattern is strongly under environmental control in mango. The vegetative cycle ceases with the advent of winter and maturation of the leaves takes place along with the dormancy of the apical and axillary buds. The plant remains visually

dormant for about three months during winter. The reproductive flushes are also usually asynchronous in tropics. Synchronized flowering flushes, throughout the canopy in sub tropics, are primarily due to lower night temperature (5-10 °C). In places of less night temperature (10-18 °C) as in tropics, asynchronous reproductive flushes are common. Such delayed vegetative growth can reduce the potential for new shoots to flower during the next flowering season. The panicle length (39.50 cm) and width (28.53 cm) was observed maximum in Ratna. However, minimum panicle length (17.52 cm) and width (11.49 cm) was recorded in Banganapalli and Iswarya respectively. The variation in size and shape of panicles in mango cultivars might be due to genetic composition and more specifically the physiological condition of the shoot on which panicle arise. These results are in agreement with the findings of Thimmappaiah and Suman (1987) in different mango cultivars and they found that panicle size varied from 11.00 cm to 42.00 cm. Uthaiiah *et al.*, (1988), Yadav *et al.*, (2010), Majumder *et al.*, (2011) and Pawan and Chatterjee (2011) also reported variation in inflorescence length of different mango varieties. Narayanaswamy (1982) reported that the length and width of inflorescence in five varieties of mango ranged from 21.33 cm to 34.36 cm and 18.11 cm to 32.83 cm, respectively (Table 3).

Flowers are also borne on the older flushes of more than two years. The flowers dominate the terminals and if fruit are set, the vegetative growth does not occur from these terminals until the crop is harvested. If the flowers fail to set the fruit or fruit drop occur prematurely, the terminals produce vegetative growth immediately. The maximum number of male flowers (1063.53) was observed significantly in Alphonso. However, minimum number of male flowers (528.47) was observed in Samba kooja.

Table.1 Mean performance of mango genotypes for tree characters

S.No.	Genotypes	Tree height (m)	Stem girth (cm)	Tree spread (m) (EW+NS/2)
1	Alphonso	6.09*	62.67*	6.88*
2	Amarapali	6.13*	50.87	6.88*
3	ArkaAruna	5.67	53.00	5.95
4	ArkaPuneet	4.62	42.27	6.50
5	Au Rumani	4.50	36.33	5.25
6	Banganapalli	5.46	34.13	5.74
7	Duraipandi	7.76	63.67*	6.58
8	Imam Pasand	4.78	46.97	5.34
9	Iswarya	5.31	61.10*	6.10
10	Javari	4.93	25.13	4.10
11	Komangai	4.35	37.23	4.05
12	Kovankachi	5.42	48.73	6.18
13	KundurPacharisi	4.19	29.07	4.56
14	KuruviNeelum	3.71	31.10	3.64
15	Mallika	5.58	57.00	6.53
16	Malpacharisi	4.90	36.33	5.46
17	Mohandhas	4.19	32.37	4.28
18	NathamPalamani	5.94	68.1*	7.76
19	Neelum	5.30	43.53	6.42
20	P.K.Patti	3.98	26.67	3.35
21	Pedharasam	4.36	47.00	5.58
22	PKM 1	6.71*	78.53*	6.55
23	PKM 2	5.23	57.23	6.48
24	Ratna	7.41	83.26*	8.44*
25	Samba Kooja	3.57	33.23	3.6
26	Sendhuram	6.28*	71*	7.67
27	Shajahan	4.28	37.33	3.73
28	Sindhu	5.33	49	6.12
29	Sothuparaivadumangai	5.27	52.7	5.65
30	SundarLangra	8.36*	103.97*	8.99*
	Mean	5.32	49.98	5.81
	CD at 5%	0.69	9.46	0.91
	SE.m	0.24	3.33	0.32
	SE.d	0.34	4.71	0.45
	CV (%)	7.91	11.55	9.56

*-Significant at 5%

Table.2 Mean performance of mango genotypes for leaf characters

S.No.	Genotypes	Leaf length (cm)	Leaf width (cm)	Petiole length (cm)
1	Alphonso	32.85*	7.01	5.82*
2	Amarapali	28.97*	6.76	3.85
3	ArkaAruna	30.51*	7.27	6.28*
4	ArkaPuneet	19.41	7.60	3.67
5	Au Rumani	17.47	4.90	3.00
6	Banganapalli	24.19	5.77	4.60
7	Duraipandi	18.65	4.80	2.55
8	Imam Pasand	22.69	8.11	4.16
9	Iswarya	28.87*	6.93	5.33*
10	Javari	19.58	4.91	2.70
11	Komangai	23.17	6.39	3.58
12	Kovankachi	20.28	4.80	2.89
13	KundurPacharisi	25.84*	6.12	4.97*
14	KuruviNeelum	21.89	4.09	3.23
15	Mallika	27.41*	6.97	4.92*
16	Malpacharisi	20.20	5.91	3.48
17	Mohandhas	23.34	4.49	3.93
18	NathamPalamani	25.87*	6.69	3.05
19	Neelum	22.89	6.14	3.92
20	P.K.Patti	18.10	5.74	3.06
21	Pedharasam	21.19	5.17	3.04
22	PKM 1	25.79*	6.34	3.75
23	PKM 2	24.33	5.70	4.23
24	Ratna	25.37*	6.33	4.67*
25	Samba Kooja	15.88	2.64	2.88
26	Sendhuram	22.65	6.05	2.64
27	Shajahan	16.52	5.32	3.96
28	Sindhu	26.40*	10.24*	5.55*
29	Sothuparaivadumangai	18.49	4.53	2.60
30	SundarLangra	22.79	5.77	3.64
	Mean	23.05	5.98	3.87
	CD at 5%	1.82	2.47	0.79
	SE.m	0.64	0.87	0.28
	SE.d	0.91	1.23	0.39
	CV (%)	4.77	14.89	13.19

*-Significant at 5%

Table.3 Mean performance of mango genotypes for inflorescence characters

S.No.	Genotypes	Date of flower opening	Panicle length (cm)	Panicle width (cm)	No. of male flowers/panicle	No. of perfect flowers/panicle	Perfect flower %	Sex ratio (perfect to male)
1	Alphonso	27.12.17	20.06	11.69	1063.53*	207	16.29	1:5.1*
2	Amarapali	13.2.18	31.36	21.25*	942.60*	242.87	20.49	1:3.9*
3	ArkaAruna	24.11.17	21.1	14.29	640	203.87	24.16*	01:03.1
4	ArkaPuneet	20.12.17	20.21	11.95	642.8	164.33	20.36	1:3.9*
5	Au Rumani	1.12.17	20.79	15.44	661.87	219.2	24.88*	01:03.0
6	Banganapalli	16.2.18	17.52	13.35	550.67	190.73	25.73*	01:02.9
7	Duraipandi	15.2.18	21.87	12.96	818.4	267.87	24.66*	01:03.1
8	Imam Pasand	24.11.17	20.35	12.85	704.8	167	19.16	1:4.2*
9	Iswarya	15.2.18	25.72	11.49	677.6	196.33	22.47	01:03.5
10	Javari	15.2.18	23.86	14.63	904.00*	249.4	21.62	01:03.6
11	Komangai	17.2.18	25.88	15.92	589.13	219.6	27.15*	01:02.7
12	Kovankachi	28.1.18	27.77	12.78	978.73*	281.53*	22.34	01:03.5
13	KundurPacharisi	25.12.17	26.44	20.85*	935.47*	340.67*	26.70*	01:02.8
14	KuruviNeelum	16.2.18	20.37	12.69	554.73	244.53	30.59*	01:02.3
15	Mallika	16.2.18	29.81	22.49*	782.33	335.07*	29.99*	01:02.3
16	Malpacharisi	20.11.17	22.85	17.19	815.67	283.20*	25.77*	01:02.9
17	Mohandhas	13.12.17	24.85	12.97	641	192.73	23.12	01:03.3
18	NathamPalamani	15.2.18	23.07	13.09	857.07	205.07	19.31	1:4.2*
19	Neelum	13.2.18	27.27	18.53	908.13*	192.47	17.49	1:4.7*
20	P.K.Patti	12.12.17	25.36	12.84	797.33	262.53	24.77*	01:03.0
21	Pedharasam	13.12.17	32.94	13.33	1021*	325.80*	24.19*	01:03.1
22	PKM 1	10.2.18	33.89	20.71*	964.47*	177.6	15.55	1:5.4*
23	PKM 2	6.12.17	28.08	20.74*	581.33	187.27	24.36*	01:03.1
24	Ratna	15.12.17	39.50*	28.53*	995.8	338.67*	25.38*	01:02.9
25	Samba Kooja	5.2.18	22.79	12.77	528.47	171.53	24.50*	01:03.1
26	Sendhuram	22.11.17	26.13	19.06*	820.8	214.07	20.69	01:03.8
27	Shajahan	15.2.18	25.73	13.81	644.93	150.73	18.94	1:4.3*
28	Sindhu	13.2.18	26.43	19.37*	1046.13*	285.60*	21.45	1:3.7*
29	Sothuparaivaduma ngai	11.2.18	21.9	16.15	617.27	282.93*	31.43*	01:02.2
30	SundarLangra	10.2.18	25.14	14.63	957.13*	230.27	19.39	1:4.2*
	Mean		25.3	15.94	788.11	234.35	23.1	01:03.5
	CD at 5%		8.77	2.92	82.33	36.8	0.97	0.15
	SE.m		3.09	1.03	29.01	12.97	0.34	0.05
	SE.d		4.37	1.46	41.02	18.34	0.48	0.08
	CV (%)		8.18	8.54	6.38	9.58	2.57	2.64

*-Significant at 5%

In conclusion, there were distinct variations for different vegetative and flowering characters among mango cultivars under study. On the basis of results obtained it may be concluded that the genotypes like SundarLangra, ArkaAruna, Sendhuram and Alphonso were superior in most of the characters. The information generated from this study will be useful for various stakeholders like breeders for improvement of varieties by selecting the suitable parental material, food processors by selecting the varieties with suitable nutritional value, etc. This research work can be further validated by evaluating these varieties with suitable molecular markers.

Acknowledgement

The authors thank the Department of Fruit Crops, Horticultural College and Research Institute for providing the technical and Management support.

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How to cite this article:

Indian, G., Eslavathkhamdar Naik, M. Deenavarman, K. Jagathesan and Janani, T. 2020. Studies on the Growth and Flowering Behavior of Different Mango (*Mangifera indica* L.) Genotypes. *Int.J.Curr.Microbiol.App.Sci.* 9(06): 1981-1989.
doi: <https://doi.org/10.20546/ijcmas.2020.906.244>