COMPARATIVE STUDIES OF FLOWERING BEHAVIOUR AND SEX RATIO IN DIFFERENT HYBRIDS AND SELECTIONS OF MANGO (*MANGIFERA INDICA* L.) UNDER TARAI REGION OF UTTARAKHAND

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Abstract: The different cultivars of mango were studied for panicle initiation time, date of start of flowering, full boom, duration of flowering, total number of flowers, proportion of male to hermaphrodite flowers and size of panicle. The present studies revealed that panicle emergence was found earlier in Arka Neelkiran (27th – 31th January) and late in Langra (22nd Feb – 4th March) and in case of other it was noticed within the month of February. The start of flowering was earlier in Amrapali, while, it was late in cultivar Langra. Maximum duration was observed with Arka Neelkiran (39 days) and minimum (18 days) in case of Pant Sinduri, Swarna Jahangir and Ambika. Length of panicle was found maximum in Cv. Pant Sindhuri.The maximum number of flowers per panicle was observed in Pusa Arunima (788.00). As regarding the number of hermaphrodite flowers it was observed maximum in Pusa Arunima (486.33) which was statically *at par* with Ambika (472.67), while, minimum number of hermaphrodite flowers was obtained in Arunika (199.00). The significant lower sex ratio has been shown in Ambika and Arka Neelkiran i.e. 0.59 which was statistically *at par* with Pant Sinduri (0.62) and Pusa Arunima (0.67), and higher sex ratio was noted in case of Dashehari (1.90) followed by Ratna (1.70).

Keywords: Hermaphrodite flowers, Mangifera indica, Panicle emergence, Sex ratio.

Introduction: Mango (*Mangifera indica* L.) is one of the important fruits of the tropical and subtropical region of the world. Mango grows on a wide range of climatic and soil conditions. There are many factors that influence yield, maturity and quality of fruits the, same cultivar can attains different characteristics in different growing conditions. Even in the same region, different environmental conditions at different years can affect maturity and quality of the fruit. Mango inflorescence is a pyramidal big flowering shoot called panicle, it's length varies from few inches to two - three feet. The inflorescence bears two types of nearly sessile flower, perfect (hermaphroditic) flowers and male (staminate) flowers. Number and percentage of distribution of both types of flowers per inflorescence vary according to many factors such as cultivar, year, and time of blooming, part of inflorescence, genetics and environment. The objective of the present study is comparing the flowering behaviour and sex ratio in different cultivars of mango.

Materials and methods: The present studies entitled "Comparative studies of flowering behavior and sex ratio of different cultivars of mango (*Mangifera indica* L.)" were carried out at Horticulture Research Center, Pattharchatta Govind Ballabh Pant University of Agriculture and Technology Pantnagar. Sixteen mango cultivars viz. Amrapali, mallika, Pusa Arunima, Ambika, Arunika, Neeleshan, Neeluddin, Neelgoa, Ratna, Swarna Jahangir, Arka Neelkiran, Mahmood Bahar, Pusa Surya, Pant sinduri, Dashehari and Langra grown at Horticultural Research Center, Patharchatta, were taken as experimental material. The selected hybrids and selections were of 5 years old. All the plants selected for experiments were almost uniform in growth and vigour and maintained under uniform cultural operations. A panicle was tagged on each side of plant. Panicle initiation data was noted with the emergence of first panicle on the tree. Male and Hermaphrodite flowers were counted on panicles tagged throughout the flowering season with forceps. Both male and hermaphrodite flowers were detached after counting. Then the percentage of male, hermaphrodite, sex ratio and total number of flowers was calculated. The statistical design of the experiment followed was randomized block design.

Result and discussion:

Date of panicle emergence: The data recorded on date of panicle emergence in different cultivars of mango are presented in Table 1. It is evident from the data that date of panicle emergence in different cultivars varied from 27th January to 4th March. It was found earlier in Arka Neelkiran (27th – 31th January) and late in Langra (22nd Feb – 4th March) and in case of other it was noticed within the month of February. Similar findings have also been reported [1].The variation in flowering behavior may be attributed to the genetic characters and the climatic conditions. Variation in panicle emergence and flowering behavior in mango hybrids were also reported [2]

Size of panicle: The data presented in fig 1 showed that all the mango cultivars varied significantly in their panicle length. The higher panicle length was recorded in Pant Sinduri (40.11 cm), while, the lower panicle length was recorded in Pusa Surya (22.12 cm). On the other hand width of panicle was found significantly higher in case of Arunika (19.83 cm) which was closely followed by Neelgoa (17.45 cm), whereas, lower panicle width was found in case of

Pusa Surya (18.16 cm). possible cause of difference in panicle length and width may be due to environmental conditions [3].

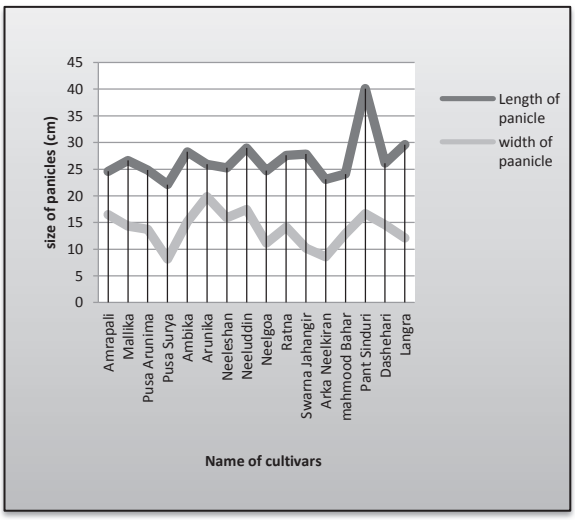

Fig 1: Size (length and width of panicle)

Number of panicle/ plants: The value presented in table 1 revealed that all the mango cultivars varied significantly with respect to number of panicle per plants. The maximum number of panicle was observed in Pusa Surya (123.00) followed by Neelgoa (74) and Arka Neelkiran (71). The minimum number of panicles was produced by Arunika (18.67) followed by Neeluddin (20.33), Pant Sinduri (30.00), Dashehari (32.00), Neeleshan (33.33) and Amrapali (33.67) which was statistically *at par* with each other. Such varietal differences were also observed by [4]

Time and duration of flowering: In different mango cultivars, flowering commenced from 15th February to 18th March (table 1). The start of flowering was earlier in Amrapali, while, it was late in cultivar Langra. In present study, the start of flowering in Langra was observed during 2nd week to 3rd week of March. The similar observations were also made [5] with respect to start of flowering in Langra. Full bloom in different mango cultivars was reported from 8th March to 3rd April. It was found earlier in Dashehari (8th -20th March) and late in Langra (29th – 3rd April). The duration of flowering varied from 18 days to 39 days in different mango cultivars. Maximum duration was observed with Arka Neelkiran (39 days) and minimum (18 days) in case of Pant Sinduri. Furthermore, the findings confirms with the results of Majumder [6] who observed duration of flowering ranged from 17.67 to 35.33 days. The variation in flowering behavior may attribute to the genetic characters and the climatic condition.

Total number of flowers per panicle: The perusal of data on Table 1 revealed that there were significant differences among all the cultivars in relation to total number of flowers per panicle. The maximum number of flowers per panicle was observed in Pusa Arunima (788.00) followed by Ambika (753.33). The minimum number of flowers was obtained in Arunika (474.00) and Langra (506.33). The result obtained in the present study coincide with the results of [7] who observed that the number of flowers per panicle ranged from 302 – 994 in 13 different cultivars. Similar results were also reported [3] and who have already observed that number of flowers ranges from 718.75 to 1609.

Table 1: Date of panicle emergence, start of flowering, full bloom, numbers of panicle/plant and duration of flowering in different cultivars of Mango.

S. No.	Name of cultivars	Date of panicle emergence	No. of panicle/ plant	Date of start of flowering	Date of full bloom	Duration of flowering (days)
1	Amrapali	Jan 28 - Feb 2	33.67	Feb. 15 – Feb. 22	March 13 – March 18	32
2	Mallika	Feb 6 - Feb 17	62.67	Feb. 22 – March 7	March 20 –March 23	30
3	Pusa Arunima	Feb 22 - Feb 29	62.00	March 6 – March 17	March 20 – March 26	21
4	Pusa Surya	Feb 10 - Feb 16	123.00	Feb. 25 – March 8	March 15 – March 19	23
5	Ambika	Feb 19 – Feb 23	58.33	March 9 – March 13	March 23 – March 26	18
6	Arunika	Feb 13 – Feb 23	18.67	March 3 – March 15	March 20 – March 25	23
7	Neeleshan	Feb 17 – Feb	33.33	March 12 – March 18	March 27 – April 3	23

		22				
8	Neeluddin	Feb 9 – Feb 10	20.33	March 1 – March 7	March 22 – March 24	24
9	Neelgoa	Feb 2 – Feb 27	74.00	March 2 – March 13	March 18 – March 25	24
10	Ratna	Feb 3 – Feb 11	60.33	March 5 – March 13	March 20 – March 26	22
11	Swarna Jahangir	Feb 8 – Feb 14	48.33	March 7 – March 13	March 22 – March 24	18
12	Arka Neelkiran	Jan 27 – Jan 31	71.33	Feb. 15 – Feb 25	March 23 – March 25	39
13	Mahmood Bahar	Feb 10 – Feb 18	50.33	March 7 – March 10	March 22 – March 25	19
14	Pant Sinduri	Feb 14 – Feb 24	30.00	March 6 – March 14	March 23 – March 25	18
15	Dashehari	Feb2 – Feb 3	32.00	March 1 – March 10	March 8 – March 20	20
16	Langra	Feb 22 – march 4	60.67	March 13 – March18	March 29 – April 3	22
S.Em.±		-	7.24			
C.D. at 5%		-	20.91			

Number of hermaphrodite flowers was obtained in Arunika (199.00) by Ratna (206.33) and Mallika (209.00). Almost similar findings were also reported [8] The perusal of data indicate that maximum number of male flowers was recorded in Dashehari (483.33.) which was statistically *at par* with Neeluddin (435.67) and minimum number of male flowers was found in case of Pant Sinduri (225.33). The results obtained on number of male flowers in the present study were also in conformity with the observations made [9] Similar findings have also been reported by [10] The significant difference between number of male and hermaphrodite flowers among the hybrids and selections studied may be due to their genetic makeup, time of flowering, response to prevailing climatic conditions and endogenous growth hormones and their concentrations.

Per cent male and hermaphrodite flowers: The significant differences with respect to percentage of male and hermaphrodite flowers were noticed among mango cultivars (Fig. 1). The lower percentage of male flower was recorded in mango Cv. Ambika (37.27 %) which was followed Arka Neelkiran (37.31 %) and Pusa Arunima (38.27 %). The higher percentage of male flowers per panicle was noted in Dashehari (65.55 %) followed by Ratna (63.05 %), Mallika (62.59 %) and Amrapali (61.23 %). As it is evident from the data presented in Fig. 1, the percentage of hermaphrodite flowers among the different mango cultivars varied from 34.72 to 62.72. Higher percentage of hermaphrodite flowers was noticed in Ambika (62.72 %) which was closely followed by Pusa Arunima (61.66). Minimum percentage of hermaphrodite flowers was obtained in Ratna (34.72 %) followed by Mallika and Amrapali i.e. 37.33 and 38.76 %, respectively. These results are in agreement with those found [11, 12, 13, 14, 15, 16, 17].

Sex ratio: It is apperant from the data presented in fig. 2 that all the mango cultivars significantly differed in relation to ratio between male and hermaphrodite flowers. The lower sex ratio has been shown in Ambika and Arka Neelkiran i.e. 0.59 which was statistically *at par* with Pant Sinduri (0.62) and Pusa Arunima (0.67), and higher sex ratio was noted in case of Dashehari (1.90) followed by Ratna (1.70). The differences in sex ratio among the various mango Cvs. were confirmed by the results [18, 19, 20] The variability in sex ratio of different cultivars seems to be governed by physiological and environmental conditions.

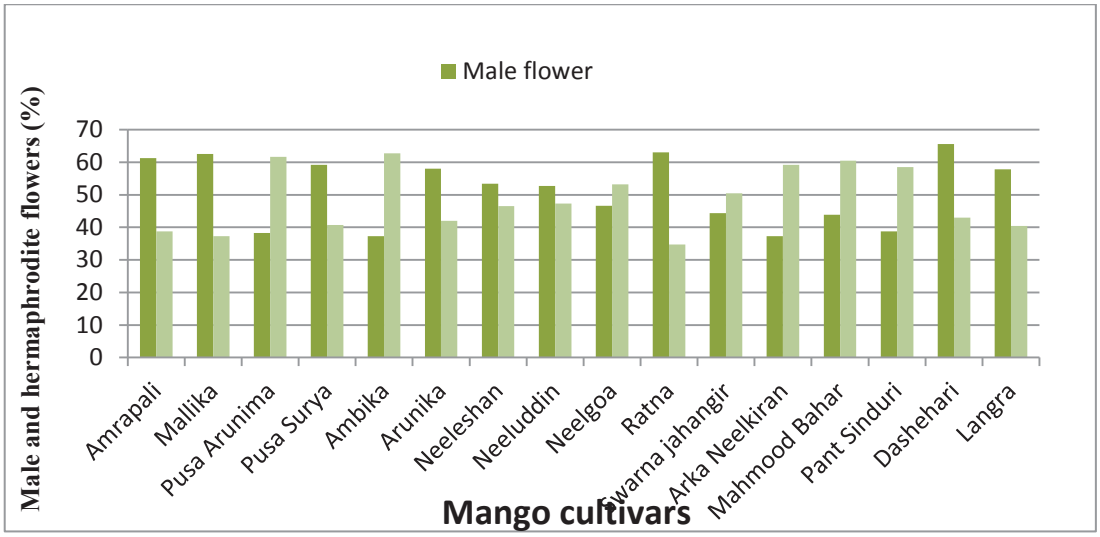

Fig 2: Per cent male and hermaphrodite flowers

Table 2: Number of different types of flowers, and sex ratio of different cultivars of mango.

S. No.	Name of cultivars	Total number of flowers	No. of male flowers	No. of hermaphrodite flowers	Sex ratio
1	Amrapali	632.00	386.67	245.33	1.57
2	Mallika	558.67	349.33	209.00	1.67
3	Pusa Arunima	788.00	301.67	486.33	0.67
4	Pusa Surya	544.00	321.67	222.33	1.46
5	Ambika	753.33	280.67	472.67	0.60
6	Arunika	474.00	275.00	199.00	1.38
7	Neeleshan	581.67	315.00	272.67	1.15
8	Neeluddin	721.00	435.67	411.67	1.11
9	Neelgoa	655.00	306.00	349.00	0.85
10	Ratna	556.33	350.00	206.33	1.70
11	Swarna Jahangir	559.33	248.67	310.67	0.80
12	Arka Neelkiran	699.00	260.65	438.33	0.59
13	Mahmood Bahar	632.67	276.33	356.33	0.88
14	Pant Sinduri	580.00	225.33	356.67	0.62
15	Dashehari	736.67	483.33	253.33	1.90
16	Langra	506.33	293.33	213.00	1.38
S.Em.±		45	30.93	26.93	0.63
C.D. at 5%		131	89.33	77.79	0.16

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