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Correlation of Climatic Parameters with Flowering Characters of Mango

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ABSTRACT

Nine different varieties of mango were selected at Fruit Research Station, Sakkarbaug, Junagadh Agricultural University, Junagadh falls under South Saurashtra Agro-climatic Zone during the year 2016-2017 for determining the correlation of dependent variables of flowering characters along with their weather parameters viz., maximum & minimum temperature, day & night temperature, rainfall, Relative humidity, wind speed and bright sunshine hours of independent characters through correlation coefficients analysis in mango as to estimate the contribution of most important characters towards yield. The results revealed that, the temperatures (max/min& day/night) and bright sunshine hours had highly significant and negative correlation with days to flower initiation, fruit set and male flower (%) while, it showed highly significant positive relation with width of panicle, no. of panicle/tree and hermaphrodite flower (%). Similarly, relative humidity had highly significant positive association with days to flower initiation, fruit set and male flower (%) while, it showed highly significant negative relation with no. of panicle/tree and hermaphrodite flowers (%).Post-monsoon rain was not significant correlation but it was positive i.e. later rain resulted to late flowering. All climatic parameters except relative humidity and wind speed showed significant positive correlation total no. of flowers/panicle and non-significant but positive with various panicle characters in mango.

Key words: *Mango, Correlation Study, Climatic Parameters, Flowering Characters*

INTRODUCTION

The mango (*Mangifera indica* L.) is the most popular among the tropical fruits and considered one of the oldest cultivated tree in the world. It is recognized as one of the best fruits in the world market and no one will have a difference of opinion about the status given to mango as "King of Fruits", owing to its captivating flavour, excellent taste, attractive fragrance, irresistible sweetness and beautiful shades of colour both inside and outside the fruit. India is the largest mango producing country in the world and it produce around 196.87 lakh tonne of mango from 22.63 lakh ha area with 8.71 t/ha productivity[1].

It is well documented that, flowering of any crop is very much affecting by various climatic parameters *viz.*, temperature, relative humidity, rainfall, sunshine, moisture availability in soil and other climatic factors.

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Mango is most vulnerable against climate change. However, various cultivars of mango showing different behaviour with weather parameters. Day and night temperatures during the flowering evocation period are emerging as the major environmental cue for floral differentiation. The cool temperature (18/10˚C day/night) rather than a short photoperiod caused floral induction, whereas warm temperatures (30/25˚C day/night) rather than a long photoperiod inhibited flowering[6].

The correlation studies of climatic parameters with flowering characters of mango give a better appreciation of cause and effect relationship between pairs of character. Knowledge of correlations, if accompanied by the understanding of the magnitude of contribution (direct and indirect) of each component character to the final make up of the fruit yield, the criteria formulated would be effective in selecting the genotypes and using themselves in the crop improvement programme. Therefore, the present study was undertaken to determine the nine mango cultivars correlations along with their climatic parameters of direct and indirect effects in mango to determine the contribution of most important characters towards yield.

MATERIAL AND METHODS

An investigation was carried out at Fruit Research Station, Sakkarbaug, Junagadh Agricultural University, Junagadh falls under South Saurashtra Agro-climatic Zone during the year 2016-2017. The experiment was laid out in Randomized Block Design consisting of nine mango varieties which were replicated three times. Nine mango varieties selected for this study are Kesar, Alphonso, Rajapuri, Dashehari, Amrapali, Khodi, Dudhpendo, Ratna and Bajrang. All climatic parameters for correlation were recorded at experimental site according to effective months of character from November to March except rainfall, was effective from August to October for days to flower initiation and fruit set. The climatic parameters were correlated with all the dependent variables using the statistical software SPSS[7].

RESULTS AND DISCUSSION

1. Days to flower initiation and fruit set

Correlation among various climatic variables and morphological characters is an important aspect for better planning of selection programs and is also helpful in determining the components of complex trait like yield in their prevailing climatic conditions especially in case of fruit crop like mango, where in quantity and quality both are important. According to Table 1, the results indicate that correlation for days to initiation of flower was found highly significant but negative with maximum/minimum temperature (33.1/14.1˚C), day/night temperature (28.3/18.9˚C) and bright sunshine hours (8.4 hr/day) and positive with relative humidity (50.8 %) and wind speed (2.3 km/hr) i.e. flowering was delayed in majority of varieties due to beyond range of day/night temperature and might be cloudy weather. Post-monsoon rain (11.6 mm) was not significant correlation but it was positive i.e. later rain resulted to late flowering. In case of days to fruit set, the similar trend of correlation for initiation of flowering was observed and might be due to the increase in temperatures and bright sunshine hours, hastened the anthesis, anther dehiscence, pollen tube growth and fertilization process[10].

The development fate of mango buds is strongly influenced by temperature prevails in that location. Cool night temperature < 19˚C in combination with day temperature < 30˚C typically induce flowering of mango tree. According to Naphrom *et al.*[5] the climactic factors affect to flower initiation might be due to major phytohormone levels in leaves and shoots of mango trees[5]. However, mango trees responded to temperature variations more critically than to photoperiods as evidenced by the different times of flowering at different places in India[2]. Considerable differences among mango cultivars and genotypes have also been observed in their flowering response to environmental factors. In Florida cv. Irwin initiate flowers at fairly low temperatures (30-20˚C day/night) when compared to cv. Kensington and many Indian cultivars[14].

2. Panicle characters

Among the panicle characters of mango; length of panicle, diameter of rachie and no. of spikelet/panicle had non-significant but positive correlation with temperatures (32.3/13.5˚C max/min and 27.6/18.2˚C day/night) and negative with relative humidity (50.5 %) and wind speed (2.8 km/hr) except for correlation of no. of spikelet/panicle with day temperature and bright sunshine hours (8.3 hr/day), which show significant positive association. Whereas, width of panicle had highly significant positive correlation with temperatures and significant negative and positive relation with relative humidity and bright sunshine hours, respectively. While, wind speed show non-significant but negative relation with width of panicle. Similarly, warm temperatures hastened growth rates of panicles and flowers. In contrast; cool temperatures retarded the growth of panicles and flowers[10].

The climatic parameter temperature (max/min & day/night) and relative humidity showed highly significant but positive and negative correlation with no. of panicle/tree, respectively. However, no. of panicle/tree noted significant positive association with wind speed and non-significant but positive with bright sunshine hours. Kumar *et al.*[4] was also reported the similar kind of results[4].

3. Per cent of male and hermaphrodite flowers

The temperatures (32.3/13.5˚C max/min and 27.6/18.2˚C day/night), wind speed (2.8 km/hr) and bright sunshine hours (8.3 hr/day) showed highly significant negative and positive correlation with percentage of male and hermaphrodite flowers, respectively. The hermaphrodite flowers were increased with increasing the temperature, wind speed and bright sunshine hours. However, relative humidity has negative effect to reduce the hermaphrodite flowers. Similarly, Shinde *et al.*[9] recorded that the low percentage of hermaphrodite flowers (4.98-8.19 %) during the 2nd phase of flowering was due to the low temperature (14.46-16.60˚C) from 10 December 2000 to 7 January 2001. During this period, the humidity was also low (64.99-69.61 %) [9] and Singh *et al.*[11] noted the maximum number of hermaphrodite flower was obtained in temperature 33.47˚C and 35.4˚C and minimum in 18.4˚C and 18.7˚C, respectively[11].

4. Total number of flowers and sex ratio

The correlation of total number of flowers per panicle show significant negative with all climatic parameters except relative humidity, which show significant positive association. The higher temperature generally increased inflorescence size while there was an inverse effect on the mean number of flowers per inflorescence with 619.6 at 20/10˚C decreasing to 431.3 at 30/20˚C[13]. The sex ratio (male/hermaphrodite flowers) in mango show non-significant but negative relation with al climatic parameters except relative humidity, which show significant positive association. According to Davenport[3] environmental and internal physiological factors have been claimed to influence sex ratio in mango[3]. Generally in mango, high temperature has been associated with an increased number of perfect flowers and low temperature increased number of male flowers[8, 12] so, temperatures have a direct relation to sex ratio in mango.

Table 1: Correlation of climatic parameters with days to flower initiation and fruit set in mango

Climatic parameters	Mean of climatic parameter for effective period	Days to initiation of flowering	Mean of climatic parameter for effective period	Days to fruit set
Maximum temperature (˚C)	33.1	-0.991**	32.3	-0.855**
Minimum temperature (˚C)	14.1	-0.979**	13.5	-0.822**
Day temperature (˚C)	28.3	-0.989**	27.6	-0.836**
Night temperature (˚C)	18.9	-0.984**	18.2	-0.821**
Rainfall (mm)	11.6	0.299	11.6	0.039
Relative humidity (%)	50.8	0.529**	50.5	0.804**
Wind speed (km/hr)	2.3	0.949**	2.8	-0.672**
Bright sunshine (hrs/day)	8.4	-0.778**	8.3	-0.672**

Table 2: Correlation of climatic parameters with various panicle characters of mango

Climatic parameters	Mean of climatic parameter for effective period	Length of panicle	Width of panicle	Diameters of primary rachie	No. of spikelet/panicle	No. of panicle/tree
Maximum temperature (˚C)	32.3	0.166	0.538**	0.102	0.352	0.632**
Minimum temperature (˚C)	13.5	0.133	0.516**	0.115	0.345	0.624**
Day temperature (˚C)	27.6	0.198	0.555**	0.147	0.382*	0.655**
Night temperature (˚C)	18.2	0.155	0.520**	0.133	0.349	0.620**
Relative humidity (%)	50.5	-0.157	-0.492*	-0.129	-0.367	-0.548**
Wind speed (km/hr)	2.8	-0.012	-0.295	-0.136	-0.246	0.437*
Bright sunshine (hrs/day)	8.3	0.171	0.423*	0.230	0.483*	0.304

Table 3: Correlation of climatic parameters with percentage of flowers (male & hermaphrodite)/panicle, total number of flowers/panicle and sex ratio in mango

Climatic parameters	Mean of climatic parameter for effective period	Male flowers (%)	Hermaphrodite flowers (%)	Total no. of flowers/panicle	Sex ratio (male/herma.)
Maximum temperature (˚C)	32.3	-0.656**	0.658**	-0.413*	-0.308
Minimum temperature (˚C)	13.5	-0.663**	0.665**	-0.403*	-0.313
Day temperature (˚C)	27.6	-0.669**	0.671**	-0.442*	-0.317
Night temperature (˚C)	18.2	-0.666**	0.668**	-0.405*	-0.315
Relative humidity (%)	50.5	0.733**	-0.738**	0.458*	0.402*
Wind speed (km/hr)	2.8	-0.619**	0.617**	-0.287	-0.283
Bright sunshine (hrs/day)	8.3	-0.615**	0.613**	-0.408*	-0.315

CONCLUSION

Mango is a much more climate sensitive crop and climatic parameters viz., temperatures (maximum/minimum and day/night), bright sunshine hours, rain, relative humidity, etc. had a profound influence on various flowering characters of mango specially flower initiation, fruit set, panicle growth, per cent of hermaphrodite flowers & male flower and sex ratio.

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