Int.J.Curr.Microbiol.App.Sci (2021) *10*(03): 2003-2007

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 10 Number 03 (2021)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2021.1003.255

Correlations among Flowering, Pollen Viability and Malformed Panicle in Mango (*Mangifera indica* L.) Cultivars

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Keywords

Flowering, correlations, Pollen viability and malformation

Article Info

Accepted:
18 February 2021
Available Online:
10 March 2021

A B S T R A C T

The present investigation was carried out during 2010-12 to establish the correlation among flowering, pollen viability and malformation in 15 mango cultivars namely Amrapali, Bhadauran, Dushehari, Erwin, Husnara, Janardan Pasand, Langra, Mallika, Neelum, Primor de Amoreira, Pusa Arunima, Sensation, Tommy Atkins, Totapuri Red Small and Zill at the Division of Fruits and Horticultural Technology, Indian Agricultural Research Institute, New Delhi. The flowering duration had significant positive correlation with days required for 50% bloom, per cent hermaphrodite flowers and had significant negative correlation with *in vitro* germination of fresh pollen. Per cent hermaphrodite flowers had negative correlation with total flowers and pollen viability. Total number of flowers showed significant positive correlation with per cent male flowers but negative correlation with hermaphrodite flowers percentage. The malformed panicle had positive correlation with day required for 50% bloom and had negative correlation with panicle length. Thus, on the basis of results it can be concluded that correlations among flowering, pollen viability, and malformed panicles are pre- requisite for any of the breeding programme. Direct selection may be followed for the improvement of mango for these characters.

Introduction

Mango is one of the commercially important fruit crops of tropical and sub-tropical worlds. At present more than 100 countries produces mangoes and still remains a prominent horticultural crop of India. The fruit occupies an important socio-economic position in India and south-east Asian countries where it is held in high esteem. India produces 22.40 million tonnes mango from 2.23 million hectare area (NHB, 2018-19). In India, there are hundreds of mango cultivars, of which only about 20-25 cultivars are being grown commercially

(Chadha and Pal, 1986). Majority of them posses narrow adoptability and show eco-geograhpical preferences for growth and yield (yadav and Ranjan1993). The success in mango improvement primarily depends on the nature and magnitude of variation present in the progeny population. Selection of mutilyear breeding programme in replacing the former method with which earlier hybrids were evolved, namely from chance seedling of planned and unplanned crosses.

Therefore, quantification of variation among population of many breeding programme has become importance. Correlation studies between flowering, fruit retention, pollen viability and malformed panicle would certainly provide an idea, which might be utilized for selection of desirable parameters for future breeding programmers.

The highly significant positive correlation between desirable characters is favorable to plant breeding, because it might help in simultaneously improvement of both the characters. On the other hand, the negative correlation would hinder the synchronized expression of both the characters. Significant correlation among different characters suggests the direct and indirect effective selections for further improvement

Materials and Methods

The present study was carried out on fifteen parental mango cultivars. These parental were characterized for flowering, pollen viability and malformed panicle (2011-2012) and available at the experimental orchard of the Division of Fruits and Horticulture Technology, IARI, New Delhi. The selection of mango cultivars was made on the basis of their importance in mango breeding programmes. Trees of these mango cultivars were fairly old (20-25 years), healthy and free from diseases and pests. The plants of these mango cultivars were maintained under uniform cultural practices.

To determine the degree of association of different parameter, the correlation coefficient of fifteen characters were calculated by using Pearson's correlation coefficient formula as suggested by Al –Jibouri *et al.*, (1958).

$$r = \frac{Cov\ (X,Y)}{\sqrt{V(x).\ V(y)}}$$

r = correlation coefficient

Cov (X, Y) = covariance of X and Y

V (x) and V (y) = variance of x and y.

Results and Discussion

Correlation among 15 flowering and fruiting parameters was studied and a correlation matrix was developed. The day required for 50% bloom had significant positive correlation with flowering duration, Ratio of panicle length and diameter, 0.44). However, it had significant negative correlation with panicle diameter (-0.42), and Total flowers(-0.35). The correlation of days required for 50% bloom with other parameters was found to be non-significant.

The flowering duration had significant positive correlation with days required for 50% bloom (0.44) and Normal panicle (0.47) but had significant negative correlation with *in vitro* germination of fresh pollen (-0.43). It was interesting to note that flowering duration had positive correlation with per cent hermaphrodite flowers but negative correlation with per cent male flowers.

Percent hermaphrodite flowers had highly significant negative correlation with male flowers percentage (-1.00) and sex ratio (-0.80) (Table 1).

Table.1 Correlation matrix of different flowering and fruiting parameters

Chrs	Days to 50% bloom	Flowering duration	Hermaphrodite flower	Male flower	Total flowers	Sex ratio	Panicle length	Panicle dia.	Ratio of panicle length and diameter	Normal panicle	Malformed panicle	Malformation %	In vitro germ. test	Acetocarmine test
Days to 50% bloom	**1.000**	**0.440***	**0.193**	**-0.193**	**-0.352**	**0.015**	**-0.296**	**-0.416**	**0.236**	**0.388**	**0.339**	**-0.288**	**0.012**	**-0.057**
Flowering duration		**1.000**	**0.315**	**-0.315**	**-0.115**	**-0.235**	**-0.167**	**-0.062**	**-0.200**	**0.466***	**0.559**	**-0.090**	**-0.427***	**0.173**
Hermaphrodite flower			**1.000**	**-1.000**	**-0.438***	**-0.799****	**-0.177**	**-0.370**	**0.335**	**0.288**	**0.191**	**-0.275**	**-0.071**	**-0.485***
sMale flower				**1.000**	**0.438***	**0.799****	**0.177**	**0.370**	**-0.335**	**-0.288**	**-0.191**	**0.275**	**0.071**	**0.485***
Total flowers					**1.000**	**0.198**	**0.400**	**0.377**	**-0.116**	**-0.359**	**-0.227**	**0.173**	**-0.021**	**0.403**
Sex ratio						**1.000**	**0.183**	**0.340**	**-0.291**	**-0.067**	**-0.083**	**-0.053**	**0.061**	**0.065**
Panicle length							**1.000**	**0.768****	**0.007**	**-0.337**	**-0.354**	**-0.152**	**-0.392**	**-0.028**
Panicle dia.								**1.000**	**-0.606***	**-0.257**	**-0.069**	**0.163**	**-0.310**	**0.092**
Ratio of PL and PD									**1.000**	**-0.040**	**-0.334**	**-0.353**	**-0.018**	**-0.206**
Normal Panicle										**1.000**	**0.813**	**-0.398**	**-0.006**	**0.085**
Malformed panicle											**1.000**	**0.150**	**-0.148**	**0.334**
Malform. (%)												**1.000**	**-0.150**	**0.402**
***In vitro* germ. test**													**1.000**	**-0.075**
Acetocarmine Test														**1.000**

However, it had significant negative correlation with total flowers (-0.44) and pollen viability as examined by acetocarmine test (-0.49) but had positive correlation with Ratio of panicle length and diameter(0.34). Similarly, the percentage of male flower had highly significant negative correlation with per cent hermaphrodite flowers (-1.00) and Ratio of panicle length and diameter(-0.34), but had highly positive correlation with sex ratio (0.80), total number of flowers (0.44), panicle diameter (0.37) and pollen viability as examined by acetocarmine test (0.49). With other parameters it had non-significant correlation.

Total number of flowers showed significant positive correlation with per cent male flowers (0.44) but negative correlation with hermaphrodite flowers percentage (-0.44). Other parameters had non-significant correlation with number of total flowers. The sex ratio showed highly negative correlation with pre cent hermaphrodite flowers (-0.80) and highly positive correlation with per cent male flowers (0.80). Sex ratio had non-significant correlation with other flowering and fruiting parameters.

The flowering parameter like inflorescence size, flowering duration and flower number showed significant positive correlation among them. They also had significant positive impact on yield. It might be due to better fruit set and retention which, ultimately result in more yield per tree. However, number of male flowers and total number of flowers did not have any significant correlate on with yield. These findings were in accordance with those of Iyer *et al.*, (1989) in mango.

The panicle length had highly significant positive correlation (0.77) with the panicle diameter and showed non-significant correlation with other traits. Similarly, panicle diameter had significant positive correlation with panicle length and significant negative correlation with ratio of panicle length and diameter (-0.61). Other parameters did not have significant correlation with panicle diameter. The number of normal healthy panicles on plants of different mango cultivars showed highly negative correlation with number of malformed panicle (-0.81) and had significant positive correlation with flowering duration (0.47). The *in vitro* germination test of fresh pollen viability had significant negative correlation with flowering duration (-0.43). However, *in vitro* germination test to examine viability of fresh pollen had non-significant correlation with other flowering and fruiting traits. Other combination of parameters pertaining to flowering and fruiting in parental mango cultivars had non-significant correlation.

Correlation coefficients are measure of the degree of closeness of the linear relationship between pairs of variable. Therefore, based on present study it can be concluded that selection of trait with 50% bloom, flowering duration and Normal panicle positive correlation with improved yield. As the *in vitro* germination test of fresh pollen viability had negative correlation with flowering duration so there is possibility of increasing the breeding efficiency by *in vitro* pollen storage.

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How to cite this article:

Ankit Singh, Manish Srivastav, S. K. Verma and Patel, Y. C. 2021. Correlations among Flowering, Pollen Viability and Malformed Panicle in Mango (*Mangifera indica* L.) Cultivars. *Int.J.Curr.Microbiol.App.Sci.* 10(03): 2003-2007.
doi: https://doi.org/10.20546/ijcmas.2021.1003.255