



P-ISSN: 2349-8528

E-ISSN: 2321-4902

www.chemijournal.com

IJCS 2020; 8(3): 1215-1217

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Received: 15-03-2020

Accepted: 17-04-2020

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Study on compatibility of different coloured mango pollinizer among commercial cultivars

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DOI: <https://doi.org/10.22271/chemi.2020.v8.i3p.9368>

Abstract

Mango has enormous varietal diversity and there are about 1600 varieties in the world. It has a rich intra-specific diversity, with about 1600 and 1000 cultivars of mango present globally and India, respectively. The major mango growing states in India are Maharashtra, Andhra Pradesh, Uttar Pradesh, Bihar, Karnataka and Gujarat. Several studies have been made on characterization of intra-varietal variability of many different cultivars of mango. However, hybrid development of varieties with attractive traits like colour, size, taste, etc. in mango is limited. The maximum number of initial fruit set in cross combination of Amrapali x Vanraj (40) was recorded which was at par with Amrapali x Hussan-e-ara (39). The maximum number of matured fruit was observed in cross combination of Zardalu x Vanraj (15). Such studies in commercial cultivars of mango will certainly be helpful in understanding its floral biology and compatibility of different coloured mango cultivars.

Keywords: Matured fruits, Cross-compatibility, Fruit set, Hybridized flower.

Introduction

Mango (*Mangifera indica* L.) is one of the most important tropical fruit tree in the world which has around 73 genera, belongs to family anacardiaceae in order sapindales originated in the Indo-Burma region. Mango is an andromonocious plant and its inflorescence has two types of flowers i.e. staminate and hermaphrodite. The flowering period of mango is usually of short duration of 2 to 3 weeks; low temperature may extend it, whereas higher temperature may shorten it. Mango is called as king of the fruits (Purseglove, 1972) [5]. Mango has been cultivated for thousands of years in India (Mukherjee, 1953; Kostermans and Bompard, 1993) [6, 4] and its cultivation is as old as Indian civilisation.

Mukherjee (1953a) [7] found that the percentage of perfect flowers in some Indian mango cultivars ranged from 25% to 36.6%. The initial fruit setting depends upon the ratio of the number of perfect to male flowers. Proportion of perfect flowers needed for optimum fruit set must not be less than 1 percent. Flowering time and type of flower has a dramatic influence on the mango production and its quality. Gulabkhas, Vanraj, Hussan-e-ara, Langra, Zardalu and Amrapali are categorized as early flowering mango cultivars under Indian condition. Avilan *et al.* (1998) [1] studied flower diversity in twenty one mango cultivars of Venezuela and reported that flower number per panicle varies from 601 (cv. Haden) to 4,859 (cv. Irwin).

Like flowering time, fruit colour is also an important parameter, which significantly influences the mango trading among consumers. So far, inheritance pattern of fruits colour has not been studied well but available research reports revealed that it has been governed by polygenes and different colour fruit was observed due to different gene combinations. Mango pollination commences with the contact of pollen with the stigmatic surface of the style. The style of the hermaphrodite flower has a small stigmatic surface grooved as a receptive surface for pollen grains (Ding and Darduri, 2013) [2].

In order to hybridise these early colourless commercial cultivars Langra, Zardalu and Amrapali with colour cultivar Gulabkhas, Vanraj and Hussan-e-ara, flowering period more or less overlap to some extent. Such selection form the hybrids between these cultivars might retain brilliant colour and having better market qualities.

Any breeding programme has some pre-requisites, such as collection of germplasm, knowledge of floral biology, pollen morphology and viability, inter-varietal, inter-specific and

inter-generic compatibility along with a standardised technique for hybridisation. Its knowledge will be useful in understanding the problems involved in the poor fruit-set in many of our cultivars. It is particularly important in the mango where male and hermaphrodite flowers are born in large numbers on panicle.

Besides, it is quite helpful to a cultivator or breeder in selecting cultivars having a good fruit set and little tendency for the fruit to drop, and in adjusting cultural practices in relation to flower emergence, fruit development and fruit drop, so as eventually to overcome the erratic cropping habit of certain mango cultivars.

Materials and methods

The present study was carried out on six mango cultivars namely, Amrapali, Zardalu, Hussan-e-ara, Langra, Gulabkhas and Vanraj available at the experimental orchard of the Department of Horticulture (Fruit and Fruit Technology), BAU, Sabour, Bhagalpur in the year 2017-18. 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.

Experimental site and climate

Bihar Agricultural College, Sabour is situated between 25°15'40" North longitude 87 °2'55" East Latitude with an elevation of 45.72 meters above the mean sea level in the heart of the vast alluvial Gangetic plains of North India, South of River Ganga. The climate of the region is semi-arid, subtropical with hot desiccating summer, cold but frost less winter with an average annual rainfall of about 1150 mm precipitating mainly in between middle of June to middle of October.

Treatment Details

The present study was carried out with six mango cultivars namely, Amrapali, Zardalu, Hussan-e-ara, Langra, Gulabkhas and Vanraj considered each as a treatment.

S. No.	Treatments	Cultivars	Male / Female
1	T ₁	Langra	Female parents (T ₁ to T ₃)
2	T ₂	Zardalu	
3	T ₃	Amrapali	
4	T ₄	Gulabkhas	Male parents (T ₄ to T ₆)
5	T ₅	Vanraj	
6	T ₆	Hussan-e-ara	

Number of hybridized flower

Two hundred panicles were selected from each cultivar viz. Langra, Zardalu, Amrapali, Gulabkhas, Vanraj, Hussan-e-ara contributing in from all four direction south, east, west, north direction. The pollens were taken from pollinizer cultivars Gulabkhas, Vanraj, Hussan-e-ara and pollinate the panicle flower of Langra, Zardalu, Amrapali and counting the number of flowers bagged and mark the bag for further analysis.

Number of fruit set

After bagging of hybridized panicle, number of fruit set per panicle in different cultivar of mango was counted and average was taken.

Fruit set per cent

Fruit set per cent was calculated on the basis of number of hybridized flowers per panicle and number of initial fruit set per panicle.

$$\text{Fruit set per cent} = \frac{\text{Number of initial fruit set}}{\text{Number of hybridized flowers}} \times 100$$

Statistical analysis

The experiment was conducted in a Randomised Block Design. There were six treatment with three replication of each cultivar planted at a distance of 10m x 10m. Significance among mean was analysed using analysis of variance at $p > 0.05$.

Results and discussion

No. of initial fruit set and matured fruits per panicle

A persual of analysis of variance indicated that the number of initial fruit set and matured fruits harvested per panicle of hybridized flowers were highly significant (table no-1). The maximum number of initial fruit set in cross combination of Amrapali x Vanraj (40) was recorded which was at par with Amrapali x Hussan-e-ara (39) whereas minimum was noted in Langra x Vanraj (16).

The maximum number of matured fruit was observed in cross combination of Zardalu x Vanraj (15) which was at par with Langra x Hussan-e-ara and Zardalu x Hussan-e-ara (14) whereas minimum was observed in Amrapali x Vanraj (06) which were at par with cross combination of Zardalu x Gulabkhas (08), Langra x Vanraj (09) and Amrapali x Hussan-e-ara (09). It was found that greater number of perfect flowers resulted in more number of fruit set and ultimately increased yield. But in present investigation it was not true with all the varieties. Singh (1990) [8] also supported the fact that fruit set is a varietal character depending upon several factors such as time of flowering, sex ratio, efficient cross pollination and intensity of fruit drop. He further added that varieties differed from one another in these respects and this lead to varying fruit set in different varieties.

Fruit set percentage in some mango cultivars

With reference from the data reported in table no. – 1 demonstrate that the maximum fruit set per cent (20.00%) was recorded in Amrapali x Vanraj which was at par with Amrapali x Hussan-e-ara (19.50%) followed by Amrapali x Gulabkhas (16.00%), Zardalu x Vanraj (14.50%), Langra x Gulabkhas (12.50%) whereas minimum (8.00%) in Langra x Vanraj which was followed by Langra x Hussan-e-ara (10.00%) and Zardalu x Gulabkhas (11.50%). It is believed that cross compatibility was maximum found in Amrapali x Vanraj in respect of other combination due to genetic make-up, environmental condition. This finding goes in line with Issarakraisila *et al.* (1992) [3].

Table 1: Number of hybridized flowers, no. of initial fruit set, no. of matured fruit and fruit set per cent in some mango cultivars

Variety	Number of hybridized flowers	Number of initial fruit set	Number of matured fruit set	Fruit set (%)
Langra x Gulabkhas	200	25	12	12.50
Langra x Vanraj	200	16	09	08.00
Langra x Hussan-e-ara	200	20	14	10.00
Zardalu x Gulabkhas	200	23	08	11.50
Zardalu x Vanraj	200	29	15	14.50
Zardalu x Hussan-e-ara	200	21	14	10.50
Amrapali x Gulabkhas	200	32	10	16.00
Amrapali x Vanraj	200	40	06	20.00
Amrapali x Hussan-e-ara	200	39	09	19.50
C.D.(p=0.05)		3.14	0.71	1.07

Conclusion

On the basis of above findings, all six cultivars showed variation in respect of flowering behaviours and fruiting behaviour. Number of flowers per panicle was highest in Langra. On the basis of pollen viability and pollen germination percentage Hussan-e-ara may act as best pollinizer to the female flowers. In respect of cross compatibility Amrapali x Vanraj combination was the best followed by Amrapali x Hussan-e-ara.

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