

COMPATIBILITY STUDIES IN SOME MANGO, *Mangifera indica* L. CULTIVARS

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Abstract

This study was initiated with a view to find out cross compatibility, self-sterility and pollen viability in six mango, *Mangifera indica* cultivars namely, Anwar Rataul (V1), Dusehri (V2), Malda (V3), Neelum (V4) and Samar Bahisht (V5) by using Langra (V6) as male parent. The results obtained indicated that maximum (51.40%) fruit set was noted in V1 and this was followed by V2, V4, V5 and V3 with 41.80, 41.40, 10.40 and 9.40 %, respectively. There was statistically non-significant difference in respect of fruit drop at pea stage. The varieties regarding fruit set by selfing portrayed a sequence of V4, V6, V3, V5, V2, and V1 in descending order giving 2.25, 2.05, 0.60, 0.50, 0.37 and 0.22 %, respectively. Pollen viability by staining with acetocarmine showed that V6 had the highest number of viable pollens followed by V4 with 95 and 91.30 percent. Similarly pollen viability with iodine gave almost the identical results as that of acetocarmine. Pollen viability on the basis of pollen germination in various concentrations of sucrose solution showed that Langra and Neelum gave the highest pollen germination in 7.5 % sucrose.

Key words: Mango, *Mangifera indica*, Cross compatibility, Self sterility, Pollen viability

Introduction

Cross compatibility has been extensively studied in field crop as compared to horticultural crops. It has been reported that cultivars of mango, *M. indica* like Dusehri, Langra, Chausa and Bombay Green are self incompatible (Sharma and Singh, 1970). However, observations in Pakistan do not substantiate these findings. Blocks of these cultivars in certain orchards give adequate crop. The reason for that may be cross pollination because it has been observed that plants grown at two sites, very little self pollination occurred and most fruit set resulted from cross pollination. Pollination studies with Rumani mango cultivar as female parent and Himayuddin as the pollinator resulted in 50 percent fruit set. (Mukherjee and Banerjee, 1976; Reddy and Ramaya, 1976) The reason for increased fruit set might be due to compatible pollinator. Dusehri was found incompatible with Chausa and Safeda Malihabad while Chausa was incompatible with Bombay Green and Rataul. Langra, Rataul and Bombay Green were compatible

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pollinator for Dusehri. No self-incompatibility was observed in Alphanso but fruit retention was increased by cross pollination (Gunjate *et al.*, 1983).

The low fruit set and more fruit drop may be attributed to self-sterility of certain cultivars. When flowers of Dusehri were selfed, fruit developed to the pea stage, then fruitlets turned yellow and dropped while cross pollinated flowers produced fruits which ripened normally (Singh *et al.*, 1962). Generally most of the cultivars have high pollen viability percentage. In Chausa, Dusehri and Krishanbhog above 90 percent pollens were viable but germination on an artificial medium was much lower i.e. 28.20 percent in Chausa. Pollen viability was 93.37, 85.44, and 73.75 percent in cultivars Kesar, Alphanso and Goamankur, respectively. (Randhawa and Damodaran, 1961; Desai *et al.*, 1985).

It is therefore, worthwhile to study cross compatibility, self sterility and pollen viability in some elite cultivars like Langra, Dusehri, Samar Bahisht, Neelum, Anwar Rataul and Malda growing in Pakistan. If it is determined that certain varieties are self-sterile, hybridization work which is considered difficult, will become more easy. Likewise, if some combinations are found cross compatible, it would be possible to utilize this for enhanced productivity of mango orchards.

Materials and methods

Present research work was carried out in Experimental Fruit Garden and Tissue Culture Laboratory, Department of Horticulture, University of Agriculture, Faisalabad, Pakistan. Materials for these studies were consisted of six mango cultivars viz. Anwar Rataul (V1), Dusehri (V2), Malda (V3), Neelum (V4), Samar Bahisht (V5) and Langra (V6). Investigations were made for cross compatibility, self-sterility and pollen viability.

For cross compatibility studies, six mature, well bearing trees of mango cultivars were selected. One hundred flowers were crossed along each side viz. East (S1), South (S2), West (S3), North (S4) at more than 10 feet from ground level (S5) on each variety by using Langra as male parent. For this purpose ten inflorescence of medium size were selected along each of the five sides. Ten flowers were emasculated on each selected inflorescence and enclosed in butter paper bags. The inflorescence of Langra was brought to the laboratory and collected pollens for crossing purpose. Anthers from opened flowers were got in petridish and let them stayed over night to achieve dehiscence. Pollens thus collected were applied to the stigma of emasculated flowers next day during 8-10 am and bagged. Five hundred straight crosses were made and thus total of 2500 crosses for five combinations.

Self-Sterility

Ten inflorescences were selected on each of the six cultivars. Four thousand fully developed flowers were kept and bagged after clipping off the rest.

Pollen Viability

Freshly opened flowers were collected from bagged inflorescence. Anthers were collected in petridish and left for 12 hours to dehisce. Anthers were then dipped for two to three times in 1-2 drops of 0.5 percent acetocarmine and iodine stain for observation under microscope. Viability of pollen was also tested by germinating the pollen grains in various sucrose concentrations namely, T1=simple aqua, T2= 1.00, T3=2.5, T4= 5.00, T5=7.50 and T6=10.00 percent sucrose solutions at room temperature. The percentage viability was calculated on the basis of germinated pollens. The statistical analysis was carried out applying two-way analysis of variance having one replication per unit. The non-additivity was tested to get information about the interaction. Individual comparisons were made by using DMR test.

Results

Data obtained on different parameters are presented hereunder.

Cross compatibility, fruit set percentage and fruit drop at pea stage

Information procured on fruit set percentage is presented in table 1. It is evident from the data that differences in relation to the sides of the tree, treatments (crosses) and interaction between these two parameters of study turned out to be significant. Perusal of the data indicated that Neelum x Langra enjoyed statistically best position with 51.40 percent fruit set. Anwar Rataul x Langra and Samar Bahisht x Langra stood at par with each other with 41.80 and 41.40 percent fruit set but they have ousted Dusehri x Langra and Malda x Langra where fruit set was 10.40 and 9.40, respectively. Mean values for sides spelt out significant superiority of S4, S1, S5 and S2 over S3, which occupied the lowest position. Aforesaid four tree sides behaved statistically alike with 32.60, 31.60, 31.40 and 31.20 percent fruit set, respectively while S3 occupied the lowest position with 27.60 percent fruit set.

Self-sterility

Four thousand flowers of each variety were enclosed in butter paper bags in order to see the fruit set which amounted to selfing. Data collected showed that (Table-1) maximum fruit set was offered by Neelum with 2.25 percent and followed by Langra with 2.05 percent. The other varieties showed abrupt fall indicating 0.60, 0.50, 0.37 and 0.22 percent fruit set for Malda, Samar Bahisht, Dusehri and Anwar Rataul. Data on fruit drop indicated that 100 percent fruit drop was experienced by all cultivars till the pea stage.

Pollen viability

Data regarding pollen viability by staining with acetocarmine and iodine are presented in table 1. Perusal of the data indicated that maximum pollen viability i.e. 95 percent on the basis of stained pollens in acetocarmine was noted in case of Langra and followed by Neelum with 91.30 percent. These two cultivars expressed superiority over the others. Data on pollen viability by staining with iodine gave almost identical results as that of acetocarmine. Pollen viability on the basis of pollen germinated in various sucrose solutions is given in table 2. Results indicated that Langra and Neelum gave highest pollen germination i.e. 85.71 and 81.67 percent in 7.50 percent sucrose (T5).

Discussion

Data on fruit set percentage revealed significant results for sides, treatments (crosses) and interaction between these two parameters of study. Mean values for treatments indicated significant superiority of Neelum x Langra, Anwar Rataul x Langra and Samar Bahisht x Langra those stood at par with each other but superseded Dusehri x Langra and Malda x Langra which in turn expressed statistically identical position. These results are in corroboration with Reddy and Ramaya (1976). Genetically it can be postulated that in general the compatibility rate decreases with the degree of distantly related varieties. Under this pretext Neelum appears to be closely related with Langra as compared with Malda and Dusehri those gave the poorest results. Anwar Rataul and Samar Bahisht occupied the intermediate range. It has also been noticed that some varieties of mango were more compatible as compared to others. It was noticed that Langra was compatible pollinator for Dusehri but our findings differed from that. The reason might be difference in climatic conditions those always play an important role to determine the cross compatibility of different varieties. Difference in the degree of compatibility was also observed by Narayana *et al.* (1989), they found that Bombay Green was best pollinator for Malika, Dusehri, Langra and Alphanso but Pairi was the

worst in respect of fruit set. Mean values for tree sides displayed that all the sides expecting S3 (West) turned out to be statistically identical. The latter side presented the worst picture in respect of fruit set. The present results contrasted to the reports made by Mukunda *et al.* (1989), they recorded significantly higher fruit set on the West side. The fact that West side presented the poorest results can be gauged from the fact that time of flower opening could be affecting the receptivity of stigma. It has been generally noticed that best time for crossing of flower extends from 8 to 10 am. In present case it appears that onset of light on the East side of the tree including parts of South and North would help rendering the flowers fit for crossing purposes during the said times while shadow on the West side does not provide the required conditions. From this it looks logical to believe that flowers on the West side might be accessible at some times latter. Robbertse *et al.* (1994) also noted that pollination success in mango varieties Isis and Keith was higher in the after noon than in the morning. Data concerning fruit drop presented 100 percent drop at pea stage in case of Dusehri and Malda when Langra was used as pollinator. It is important to note that minimum fruit set was also recorded in these two cultivars. This means that these varieties show signs of cross incompatibility with Langra.

Fruit set percentage by selfing indicated that only Langra and Neelum have more than 2 percent this means that these two cultivars might have some degree of self compatibility while other varieties appear self sterile but 100 percent drop was noted in all the cultivars at pea stage. It has also been reported by Free and Williams (1976) that bagging of inflorescence diminished the fruit set in mango. Azzouni *et al.* (1976) suggested that poor fruit set might be a sign of self incompatibility. Other researchers such as Sharma and Singh (1970) were also of view that majority of the fruits from selfing in mango were smaller and dropped at very early stage and none of them reaching even half of the full size. The major cause for this was degeneration of endosperms and nucleus in fruits resulting from self pollination.

Data on pollen viability by staining with acetocarmine and iodine gave similar results for the both tests. Langra and Neelum presented above 90 percent pollen viability. This would reflect upon that besides Langra, Neelum can also be used as male parent. These two cultivars also gave similar results when pollens of all six varieties were subjected to different sucrose concentrations and this testified their superiority over the other cultivars under study. Among the various sucrose concentrations, 5 and 7.5 percent presented best results with regards to highest number of germinated pollens

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Table 1. Fruit set and pollen viability percentage of different mango varieties

Varieties/sides	Fruit set	Fruit set (sides)	Fruit set (selfing)	Pollen viability (iodine)	Pollen viability (acetocarmine)
A. Rataul	41.80 b	S ¹ = 31.6 a	0.225	67.59	69.90
Decehri	10.40 c	S ² = 31.2 a	0.375	40.44	44.88
Neelum	51.40 b	S ³ = 27.6 b	2.25	92.70	91.30
S. Bahisht	41.40 b	S ⁴ = 32.8 a	0.50	60.00	63.39
Malda	9.4 c	S ⁵ = 31.4 a	0.60	72.50	70.83
Langra	-	-	2.05	94.74	95.00

Table 2. Pollen viability percentage of six mango varieties in different sucrose concentrations

Treat-ments	A.Rataul V ₁	Dusehri V ₂	Langra V ₃	Malda V ₄	Neelum V ₅	S.Bahisht V ₆	Total	Mean
T ₁	-	-	-	-	-	-	-	-
T ₂	50.00	11.11	46.15	20.00	23.61	15.00	165.87	27.65 cd
T ₃	55.56	27.50	60.00	22.50	36.67	50.00	252.23	42.04bc
T ₄	66.67	38.50	71.42	57.14	77.78	60.00	371.51	61.92a
T ₅	40.00	15.00	85.71	60.00	81.67	40.16	296.54	49.42ad
T ₆	28.57	10.00	22.22	37.50	12.50	6.60	117.39	90.57d
Total	240.78	102.06	285.48	197.10	232.20	145.74	-	-
Mean	40.13ab	17.01c	47.58a	32.85abc	38.70ab	24.29bc	-	-