

Studies on Flowering Behaviour, Fruit Setting and Extent of Floral Malformation in Different Cultivars of Mango (*Mangifera indica* L.)

MUHAMMAD AKBAR ANJUM, GHULAM ABBAS CHATTHA†, MUHAMMAD SULTAN AND SHAFQAT ABBAS

Department of Horticulture, University College of Agriculture, Bahauddin Zakariya University, Multan

†Horticultural Research Station, Pakpattan Road, Sahiwal

ABSTRACT

Flowering behaviour, fruit setting and extent of floral malformation was studied in five recommended cultivars of mango viz. Aman Dusehri, Anwar Ratual, Langra, Malda and Samar Behisht. The appearance of panicles was earliest in cv. Aman Dusehri followed by Malda, Anwar Ratual and Langra. In cv. Samar Behisht, flowering started at the latest. The cultivars differed significantly in number of flowers per panicle, percentage of hermaphrodite flowers, fruit set and extent of floral malformation. The percentage of hermaphrodite flowers was higher in cv. Samar Behisht and Langra resulting in better fruit set. The percentage of malformed panicles recorded was higher in cvs. Malda and Samar Behisht as compared to other cultivars during both the years.

Key Words: Flowering; Fruit set; Malformation; *Mangifera indica*; Mango

INTRODUCTION

Mango (*Mangifera indica* L.) is one of the most important fruits of the tropical and subtropical regions of the world. It is a valuable source of foreign exchange for many countries including Pakistan. Unfortunately, mango production in Pakistan has been badly influenced by a number of diseases and other problems like low fruit set, high fruit drop and floral malformation etc.

The sex ratio varies among mango cultivars and is also influenced by environmental conditions. Mango is a highly cross-pollinated crop and pollination takes place mostly through insects (Ram, 1992). In nature, more than 50% of the flowers do not receive any pollen and number of pollen grains per pollinated flower is also very low i.e. three per flower (Majumder & Sharma, 1990). Malformation is a serious threat to mango cultivation in the country. It affects both vegetative parts and inflorescence. Malformed inflorescence grow unabatedly beyond the blooming season and sometimes continue growing even until November. Most of the flowers on a malformed inflorescence are male and fruit is hardly ever obtained from them (Majumder & Diware, 1989). The problem is present in almost every orchard in the country but incidence varies from year to year and cultivar to cultivar. The malformation is considered as a disease of unknown etiology and so far no control of the disease is known. The problems associated with low productivity of mango can be overcome by developing full understanding of the plant. Mango is one of the least studied fruit among

major fruits of the country. Floral biology in mango is very important because sex ratio has a direct correlation with production. Therefore, the present work was envisaged to study the flowering behaviour, fruit setting and extent of floral malformation in five cultivars recommended for the area i.e. Aman Dusehri, Anwar Ratual, Langra, Malda and Samar Behisht.

MATERIALS AND METHODS

The present studies were conducted at the mango orchard, University College of Agriculture, Bahauddin Zakariya University Multan during 1997-98. Ten trees of each mango cultivar viz. Aman Dusehri, Anwar Ratual, Langra, Malda and Samar Behisht were randomly selected among vigorous and healthy trees growing under the uniform conditions of soil fertility, irrigation, interculture and other cultural operations. The experiment was arranged in a randomized complete block design with ten replications. The cultivars were considered as a factor and each tree under study as a replication. The data on following aspects were recorded.

Time of flowering. The plants under study were regularly visited at alternate days during the months of February and March to record the appearance of first panicle. On each tree a limb was selected and dates of all the appearing panicles were recorded. The date on which almost half of the total panicles were appeared was assigned as the date of 50% flowering.

Total number of flowers/panicle. Ten fully opened panicles (one on each experimental tree) were randomly selected and tagged. The total numbers of flowers in each panicle were counted in a non-sacrificing method and average was calculated.

Sex ratio. One fully opened normal panicle was cut off from each experimental tree and 100 flowers were randomly taken on a paper. The number of hermaphrodite and staminate flowers were separated and counted which is also the percentage of hermaphrodite and staminate flowers.

Fruit set. On the formerly tagged panicles, the number of fruits set were counted from last week of March to 2nd week of April depending upon the flowering time of each cultivar. The fruit set (%) was calculated using the total number of flowers in the panicle.

Percentage of malformed panicles. Ten panicles were selected randomly from each tree and out of these malformed were counted. The percentage was estimated using the total number of panicle studied.

The data collected were analyzed statistically using Fisher's analysis of variance technique and Duncan's multiple range (DMR) test at 5% probability was applied to compare the cultivar means for the parameter studied (Petersen, 1994).

RESULTS AND DISCUSSION

The panicle appearance was the earliest in cv. Aman Dusehri i.e. in the first week of February during

1997 and third week of February during 1998. This was followed by Anwar Ratual and Malda. In cvs. Langra and Samar Behisht it was the latest (Table I). Ali and Mazhar (1960) and Jawanda and Singh (1961) in separate studies have already reported that the onset of flowering in different mango cultivars varies from February to March under natural conditions, being the earliest in cv. Aman Dusehri. Baghel *et al.* (1988) also found that the panicle emergence was earliest in cv. Aman Dusehri among the ten cultivars studied. Hence the results obtained in the present study are in conformity with the previous workers. The appearance of 50% panicles was completed about 2-3 weeks of appearance of first panicle (Table I). The differences in time of flowering during the years were possibly due to variation in weather conditions. Total number of flowers/panicle ranged from 664–1675. The cultivars differed significantly for the factor during both the years. During 1997, maximum flower number per panicle was recorded in Langra, which differed significantly from all other cultivars. During 1998, maximum flowers were counted in cv. Malda followed by Aman Dusehri and Anwar Ratual and these cultivars behaved statistically alike. Minimum flower number was recorded in Langra indicating the behaviour of biennial bearing (Table II). The results obtained in present study coincide with the results of Thimmappaiah and Suman (1987) who observed that the number of flowers per panicle ranged from 302–994 in 13 different cultivars.

Table I. Time of flowering in different cultivars of mango under Multan conditions

Mango cultivar	Date of appearance of 1st panicle		Date of appearance of 50% panicles	
	1997	1998	1997	1998
Aman Dusehri	05-02-97	21-02-98	27-02-97	08-03-98
Anwar Ratual	15-02-97	25-02-98	07-03-97	10-03-98
Langra	18-02-97	03-03-98	08-03-97	14-03-98
Malda	15-02-97	01-03-98	05-03-97	13-03-98
Samar Behisht	04-03-97	08-03-98	21-03-97	20-03-98

Table II. Flower number, fruit set and extent of malformation in different cultivars of mango

Mango cultivar	No. of flowers		%age of hermaphrodite flowers		Fruit set (%)		%age of malformed panicles	
	1997	1998	1997	1998	1997	1998	1997	1998
Aman Dusehri	695.9b*	859.0ab	21.1e	43.7c	1.81b	2.39a	19.25c	41.45b
Anwar Ratual	664.9b	853.8ab	78.0c	24.2d	2.24b	0.66b	14.57c	33.60b
Langra	1674.5a	644.0c	84.0b	79.9a	3.02a	2.74a	12.31c	39.23b
Malda	807.3b	1037.7a	72.5d	56.2bc	2.26b	0.82b	43.26b	45.15b
Samar Behisht	663.1b	667.3bc	90.6a	65.9ab	3.18a	3.71a	53.14a	71.80a

*Means sharing similar letters in a column are statistically non-significant at 5% probability (DMR test)

In sex ratio, the percentage of hermaphrodite flowers is important which ultimately decides the fruit set. The percentage of hermaphrodite flowers among the cultivars also varied significantly and ranged from 21.1–90.6%. Significantly more number of hermaphrodite flowers were borne in cvs. Samar Behisht and Langra during both the years. During the first year of study minimum number of hermaphrodite flowers (21.1%) were borne in cv. Aman Dusehri which was improved next year (43.7%). While during the next year, minimum number of hermaphrodite flowers (24.2%) were borne in cv. Anwar Ratual (Table II). The environmental conditions prevailing at the time of panicle development determine the sex ratio in mango (Majumder & Sharma, 1990). The increased percentage of hermaphrodite flowers in cvs. Samar Behisht and Langra could be due to late flowering i.e. high temperature at the time of panicle development. Samson (1989) observed variation in the percentage of hermaphrodite flowers, ranging from 1–100% under different environmental conditions. Thimmappaiah and Suman (1987) working on 13 different cultivars also found maximum percentage of hermaphrodite flowers in cv. Langra. The significant differences in sex ratio among the cultivars studied may be due to their genetic make up, time of flowering, response to prevailing climatic conditions and endogenous growth hormones and their concentrations.

Fruit set (%) also varied significantly among the cultivars and ranged from 0.66 to 3.71%. Maximum fruit was set in Samar Behisht followed by Langra, which statistically stood at par with Samar Behisht. The minimum fruit was set in cvs. Malda and Anwar Ratual and these both behaved statistically alike (Table II). The variation in fruit set could be due to genotypic differences. Furthermore, fruit set also depends upon the availability of pollen, its viability, populations of pollinating insects and self and cross compatibility of a cultivar and with other cultivars, respectively. Scholefield and Oag (1986) have already reported large differences in final fruit set (0.33–1.39%) among mango cvs. Bangalora, Batavi, Common, Glenn, Irwin and Kensington.

The extent of floral malformation varied significantly among the cultivars studied. Highest percentage of malformed panicles was recorded in cv. Samar Behisht followed by Malda during both the years while all other cultivars behaved alike with lowest percentage of malformed panicles (Table II). Mango cultivars vary in their susceptibility to floral malformation. These results also coincide with the results of Majumder and Diware (1989) and Ram *et al.* (1990) who also observed maximum percentage of malformed panicles in cvs. Samar Behisht and Malda.

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