Genetical studies in mango (*Mangifera indica* L.)

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Abstract

Mango is highly heterozygous crop and results of genetical studies can be used for selection of parents in hybridization programme. A study in this direction was taken up at Indian Institute of Horticultural Research, Bangalore by carrying out half sib analysis. The study shows that non-additive variance controls the characters studied in mango. Heritability is low and the chances of hybrid vigour manifesting for the characters in the F_1 generation are bright. Selection of progenies can be made based on fruit size *i.e.*, medium sized fruits will have good TSS and selecting big sized fruits will bring down the TSS. It was also noticed that for the traits studied, phenotypic coefficient of variation was more than the genotypic coefficient emphasizing the greater manifestation of characters and lesser influence of environment.

Key words: *Mangifera indica*, heterozygous, phenotypic correlation, genotypic correlation, additive, non-additive, heritability.

Introduction

Mango (*Mangifera indica* L.) is one of the most important fruits and occupies a premier place among the fruit crops in India and other countries. In India more than thousand varieties are in cultivation. These varieties have mainly arisen as chance seedlings and most of the commercial varieties suffer from one or the other draw back (Singh and Singh, 1958). Mango is highly heterozygous and the genetics of the crop is also not completely understood. Although some literature is available on the genetical studies on this crop but no systematic work has been done so far. Lack of information on the genetics of the crop and the perennial nature makes the breeding difficult and time consuming. Hence, a genetical study was taken up especially to find out the presence of reciprocal effects and to assess the parents best suited for the transfer of desirable characters in the commercial varieties of mango.

Materials and methods

This study was taken up at experimental farm of Indian Institute of Horticultural Research, Bangalore. The varieties Alphonso, Banganapalli, Neelum, Kalapadi and Janardhan Pasand were utilized for crossing, including reciprocals. F_1 inter varietal progenies of the combinations, Alphonso x Banganapalli, Alphonso x Neelum, Alphonso x Kalapadi and Alphonso x Janardhan Pasand were evaluated for different characters. CRD with unequal number of replications was resorted for calculating variances. Hybridization was carried out by utilizing the method suggested by Singh *et al.* (1980). Half sib analysis was carried out on the data obtained on six characters as per the method given by Liyanage and Sakai (1961) and Bavappa and Ramachander (1967). The coefficients of phenotypic variability (PCV) and genotypic variability (GCV) were calculated as per (Singh and Chaudhury, 1977). Heritability (in narrow sense) was calculated by following formula:

$$h^2 = 4\sigma b^2 / (\sigma^2 b + \sigma^2 w)$$

Where, $\sigma^2 b$ = between progeny variance
$\sigma^2 w$ = within progeny variance

Results and discussion

The data (Table 1) indicates that for fruit weight maximum variability was recorded in the cross Alphonso x Banganapalli and Alphonso x Janardhan Pasand which has maximum values of 9269.5 and 8312.8, respectively. This shows that these two crosses produce more variability for fruit weight in the progenies so that selection is easy whereas in the crosses, Alphonso x Neelum and Alphonso x Kalapadi the scope for selection is limited because of less segregation and less variability. This shows that Banganapalli as one of the parents which imparts larger fruit size in the progenies. The same observations were noticed by Bhujanga Rao *et al.* (1963) in the F_1 progenies. Iyer (1991) also observed large number of big sized fruits in the progenies of the cross Banganapalli x Alphonso. Sharma and Majumder (1985) observed that irrespective of fruit size in the parents, progenies may have better size. With regard to fruit volume the variability in the progeny was seen to a greater extent in the cross Alphonso x Banganapalli and Alphonso x Janardhan Pasand. Mean values of TSS and variances do not follow the same pattern as in case of fruit weight and volume as factors other than genetic are involved. However, Sharma and Majumder (1988) indicated additive inheritance as they noticed higher TSS in progenies of Neelum and Dashehari crosses. There was little variation in the progenies of the cross Alphonso x Banganapalli and Alphonso x Kalapadi. Maximum variability was seen in the progenies of the cross Alphonso x Neelum and Alphonso x Janardhan Pasand. The varieties Neelum and Janardhan Pasand contributed towards TSS than Banganapalli and Kalapadi. In the case of the characters like skin weight and stone weight the means and variances were different for different crosses. Maximum variability for these characters was seen in the cross Alphonso x Banganapalli and Alphonso x Janardhan Pasand. The variety Banganapalli has contributed for stone weight and skin weight. Greater variability is also seen in the cross Alphonso x Kalapadi for skin weight. Scope for selection will be more when Banganapalli is used as one of the parents in crossing. With regard to pulp percentage maximum variability is seen in the cross Alphonso x Kalapadi. Based on the study of genetic variance, Lavi *et al.* (1998) opined that parents should not be chosen entirely on the basis of

Table 1. Mean values for different characters

Parents/ crosses	Fruit weight	Fruit volume	TSS (ºBrix)	Skin weight	Stone weight	Pulp (%)
Parents	212.3	187.0	19.1	53.5	31.6	58.6
Alphonso x Neelum	169.3	146.8	18.1	34.6	26.9	62.9
Alphonso x Banganapalli	254.4	231.4	17.2	64.6	45.6	54.2
Alphonso x Janardhan Pasand	283.3	266.9	16.7	64.3	41.9	61.5
Alphonso x Kalapadi	169.4	145.9	22.6	43.7	31.8	53.1
Janardhan Pasand x Alphonso	247.5	234.2	18.0	50.8	36.2	70.4
Neelum x Alphonso	193.3	163.3	17.2	43.7	29.6	56.4
F-value	2.95**	3.47**	7.01**	3.28**	6.83**	2.4**

** significant at *p*=0.01

Table 2. Heritability (narrow sense) and other variability parameters

Sl.No	σ_g	σ_p	Heritability(ns) (%)	PCV (%)	GCV
FW	233.08	6565.23	3.45	37.53	0.05
FV	233.18	6182.14	3.66	40.93	0.06
TSS	0.13	8.86	1.46	15.95	0.01
PW	20.06	442.47	4.38	39.46	0.06
SW	13.64	148.33	8.6	35.8	0.08

FW=fruit weight, FV= fruit volume, TSS= total soluble solids, PW=peel weight, SW= stone weight

phenotype since offspring performance is quite unpredictable. However, the progeny mean values do not differ from each other to a great extent indicating that other extraneous factors are acting apart from the genetic factors. The varieties Kalapadi and Banganapalli are the main contributors for pulp in the fruits of the progenies. The data in Table 1 show that for all the characters studied, reciprocal effects were absent and selection of female parents will not affect the progenies in any way. However, Iyer (1991) found that whenever Banganapalli was used as a female parent 66% of the progenies had big sized fruits. For the character fruit weight, Alphonso and Neelum when used as parents in crossing, maximum variability was seen in the progenies, hence, scope for selection is more. In case of fruit volume, TSS, skin weight and stone weight, also the same trend was seen. In case of pulp percentage, variability was more in the progenies of Alphonso and Janardhan Pasand, hence scope for selection of progenies with fruits having better pulp recovery is more when these are used. A study was conducted using the progenies of the crosses *viz.*, Alphonso x Banganapalli, Alphonso x Neelum, Alphonso x Janardhan Pasand and Alphonso x Kalapadi and its reciprocals. Large variation was noticed in the progenies when the variety Banganapalli was used as one of the parents with Alphonso for crossing. Greater variability is also seen in the cross Alphonso x Kalapadi for skin weight. The varieties Janardhan Pasand and Neelum contributed more for the character TSS in their progenies. Reciprocal effects were found to be absent for the characters studied.

The genotypic variance and coefficient of variance were lower than the phenotypic variance and coefficient of variance respectively, implying the role of environment in the manifestation of the characters (Table 2). The heritability in narrow sense was noticed to be comparatively high in stone weight. For the character pulp percentage these parameters were not studied, as it depends on the skin weight and stone weight. Since, the heritability is comparatively low for the all the parameters studied, it can be concluded that non-additive inheritance is predominant and there is every chance that heterosis can be exploited in the F_1 generation.

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