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R Janarthanan
Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Serumavilangai, Nedungadu (PO), Karaikal, U.T. of Puducherry, Tamil Nadu, India

V Sundaram
Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Serumavilangai, Nedungadu (PO), Karaikal, U.T. of Puducherry, Tamil Nadu, India

Corresponding Author:
R Janarthanan
Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Serumavilangai, Nedungadu (PO), Karaikal, U.T. of Puducherry, Tamil Nadu, India

Studies on correlation coefficient in F_2 generation of Bhendi [*Abelmoschus esculentus* (L.) Moench]

R Janarthanan and V Sundaram

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Abstract
In the present study involving segregants from 2 cross combinations *viz*., Cross 1 [SKY/DR/RS/107 (P 1) X Tiruchi Local (P 2)] and Cross 2 [IC69257 (P 3) X 770 (P 4)], observation were recorded on twelve bio metric traits from 250 randomly tagged plants in F_2. The work was carried out in the Department of Horticulture, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal, U.T. of Puducherry during Kharif 2018. Correlation coefficient analysis revealed the importance of number of fruits plant^{-1}, plant height at final harvest, number of primary branches at final harvest and internodal length in exercising selection from segregating population of bhendi as they were found to exert positive and significant association with yield.

Keywords: Bhendi, F_2 segregants, association analysis, correlation and intercorrelation

Introduction
Bhendi *[Abelmoschus esculentus* (L) Moench.] commonly known as lady's finger is an important Malvaceous vegetable crop cultivated in tropical and sub-tropical regions of the world. The fruit of bhendi is valued for its ability to suppress the urogenital infection and its mucilage content finds various medicinal and industrial applications (Akinyele and Temikotan, 2007) [1]. The tender and delicious green fruits are valued for export, besides its use for canning, dehydration and freezing. Yield being the end product of interaction among many complex component characters, which either alone or jointly influences the yield. Selection of genotypes based on yield alone is not likely to be effective as the efficiency of selection for yield mainly depends on the direction and magnitude of association between yield and yield component traits as well as among component traits themselves (Breese and Haywards, 1972) [3]. As the correlation study provides a way to understand these associations, the present investigation on bhendi was taken up with the specific objective of understanding the magnitude and direction of association between yield and other character through.

Materials and Methods
The association study was undertaken at the Pandit Jawaharlal Nehru College of Agriculture and Research Institute in Karaikal region of U.T. of Puducherry. The trial plot was laid out in an unreplicated design using 1000 seeds generated from each cross combination from the hybrids [Cross 1 - SKY/DR/RS/107 (P 1) X Tiruchi Local (P 2)] and [Cross 2 - IC 69257 (P 3) X 770 (P 4)] were raised during Kharif 2018, at a spacing of 45 cm X 30 cm. The observations recorded on twelve characters were days to first flowering, node number of first flowering, plant height at flowering, days to first harvest, fruit length, fruit girth, fruit weight, internodal length, plant height at final harvest, number of primary branches at final harvest, number of fruits plant^{-1} and fruit yield plant^{-1} from 250 randomly tagged plants of F_2 population in both the crosses.

The degree of association of the yield components towards yield and yield components *inter se* was calculated as simple phenotypic correlation coefficients (r)

$$r_{1.2} = \frac{\text{Covariance between characters 1 and 2}}{\sqrt{(\text{variance of character 1}) \times (\text{variance character 2})}}$$

The significance of correlation coefficient was tested using the procedure of Snedecor and Cochran (1967) [12].

Results and Discussion

An effort to formulate suitable selection indices in the F_2 population of bhendi association analysis was performed and the study revealed a very strong positive association of number of fruits plant^{-1} (0.9080 in Cross 1 and 0.9220 in Cross 2), followed by plant height at final harvest (0.6110 in Cross 1 and 0.5380 in Cross 2) and number primary branches at final harvest (0.1790 in Cross 1 and 0.2030 in Cross 2) with yield plant^{-1} (Table 1 and 2). A significant positive association of number of fruits plant^{-1} (Kumar and Reddy, 2016) [4], plant height at final harvest (Yadav *et al*., 2017) [14] and number of primary branches at final harvest (Rashwan, 2011) [11] had already been reported in bhendi. Fruit weight (0.1330) was found to exhibit a significant positive association with yield only in Cross 1 and such a finding has also been reported earlier in bhendi by Kumar and Reddy (2016) [4].

The association of days to first flowering, days to first harvest as well as internodal length were found to be negative with yield of Bhendi among segregants of both the crosses and this was in conformity to the earlier findings of Thulasiram *et al.* (2017) [13]. The presence of positive association among major yield contributing traits render selection easier and effective, while negative correlation among the traits affect selection for simultaneous improvement of characters.

The highest positive inter correlation among the F_2 population was observed between days to first flowering and days to first harvest (0.9070 in Cross 1 and 0.8840 in Cross 2) in both the crosses (Table 1 and 2) as reported earlier by Thulasiram *et al.* (2017) [13]. This was followed by the association of fruit weight with fruit length and fruit girth. Fruit weight had shown highly significant positive association with fruit length (0.7810 in Cross 1 and 0.7420 in Cross 2) as well as fruit girth (0.6190 in Cross 1 and 0.7050 in Cross 2) as shown in Table 1 and 2 and such a report has already been published by Archana *et al.* (2015) [2]. The significant positive association of plant height at flowering and node number of first flowering with days to first flowering, days to first harvest and plant height at flowering with node number of first flowering as well as fruit length and fruit girth with fruit weight had been observed in the present study in both crosses (Table 1 and 2) and this is in conformity to the earlier findings of Kumar *et al.* (2009) [5] and Rajkumar (2014) [9].

A positive inter correlation between fruit length and fruit girth, number of fruits plant^{-1} and plant height at final harvest as well as number of primary branches at final harvest were also observed and such a finding had already been published by Patel *et al.* (2015) for fruit length and fruit girth and by Ramya and Senthilkumar (2009) [10] for plant height at final harvest and number of fruits plant^{-1}.

A perusal of correlation coefficient recorded in the present study revealed highly significant negative association of plant height at final harvest with days to first flowering as well as days to first harvest in Cross 1 (Table 1). Such a negative association in bhendi has been reported earlier by Rajkumar (2014) [9] for plant height at final harvest and days to first flowering. However, the negative association between days to first harvest and plant height at final harvest observed in the present study is contrary to the earlier findings of Magar and Madrap (2009) [6].

Thus, the association analysis of the present study revealed the importance of number of fruits plant^{-1}, plant height at final harvest, number of primary branches at final harvest, fruit length, fruit girth and fruit weight in excersing selection for yield enhancement in Bhendi as reported by Pachiyappan and Saravannan (2016) [7].

Table 1: Correlation coefficient among various yield traits in F_2 population of Cross 1 [SKY/DR/RS/107 (P 1) X Tiruchi Local (P 2)]

	DFF	NFF	PHF	DFH	FL	FG	FW	IL	PHFH	NPBH	NFP	FYP
DFF	1	0.5680**	0.6200**	0.9070**	-0.0380	-0.0020	-0.0610	0.0250	-0.2190**	0.0410	-0.0130	-0.1330*
NFF		1	0.4610**	0.5190**	-0.0690	0.0330	-0.0590	0.0250	-0.0780	0.0200	-0.0280	-0.1030
PHF			1	0.5610**	0.1000	0.0770	0.0720	0.0950	0.1500*	-0.0700	0.0580	0.1000
DFH				1	-0.0330	0.0140	-0.0260	0.0110	-0.1800**	0.0910	0.0110	-0.0910
FL					1	0.4810**	0.7810**	0.0280	0.1400*	0.0240	0.0470	0.1030
FG						1	0 .6190**	0.0010	0.1370*	-0.0620	0.0220	0.1190
FW							1	0.0280	0.1900**	0.0450	0.0470	0.1330*
IL								1	0.0960	-0.0940	-0.1610*	-0.0870
PHFH									1	-0.0440	0.4660**	0.6110**
NPBH										1	0.2740**	0.1790**
NFP											1	0.9080**
FYP												1

DFF	- Days to first flowering	NFF	- Node number of first flowering	PHF	- Plant height at flowering (cm)
DFH	- Days to first harvest	FL	- Fruit length (cm)	FG	- Fruit girth (cm)
FW	- Fruit weight (g)	IL	- Internodal length (cm)	PHFH	- Plant height at final harvest (cm)
NPBH	- Number of primary branches at final harvest	NFP	- Number of fruits plant^{-1}	FYP	- Fruit yield plant^{-1} (g)

* Significant at 5 per cent level ** Significant at 1 per cent level

Table 2: Correlation coefficient among various yield traits in F_2 population of Cross 2 [IC69257 (P 3) X 770 (P 4)]

	DFF	NFF	PHF	DFH	FL	FG	FW	IL	PHFH	NPBH	NFP	FYP
DFF	1	0.5430**	0.6780**	0.8840**	0.0970	0.0600	0.0760	0.1960**	0.0760	-0.0840	-0.0830	-0.1080
NFF		1	0.4390**	0.4750**	0.0920	0.0520	0.0780	0.1250*	0.1980**	0.0090	0.0370	0.0350
PHF			1	0.6580**	-0.0110	0.0530	0.0670	0.3560**	0.3370**	-0.0200	-0.0090	0.0710
DFH				1	0.0830	0.0690	0.0830	0.2090**	0.1010	-0.0380	-0.0930	-0.0960
FL					1	0.5440**	0.7420**	-0.0730	0.0390	0.0560	0.0130	0.0540
FG						1	0.7050**	0.0630	0.1110	0.0120	-0.0050	0.0770
FW							1	-0.0310	0.0680	-0.0060	-0.0500	0.0370
IL								1	0.2140**	-0.2010**	-0.0850	-0.0130
PHFH									1	-0.1300*	0.4010**	0.5380**

NPBH										1	0.2370**	0.2030**
NFP											1	0.9220**
FYP												1

* Significant at 5 per cent level ** Significant at 1 per cent level

DFF	- Days to first flowering	NFF	- Node number of first flowering	PHF	- Plant height at flowering (cm)
DFH	- Days to first harvest	FL	- Fruit length (cm)	FG	- Fruit girth (cm)
FW	- Fruit weight (g)	IL	- Internodal length (cm)	PHFH	- Plant height at final harvest (cm)
NPBH	- Number of primary branches at final harvest	NFP	- Number of fruits plant^{-1}	FYP	- Fruit yield plant^{-1} (g)

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